The economic and social impact of the University of Southampton

Final Report for the University of Southampton

LE London Economics

October 2022

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Foreword

It is a pleasure to introduce this report on the Economic and Social Impact of the University of Southampton. We have commissioned this independent report, undertaken by London Economics, as we have launched our '**Triple Helix Strategy**', to allow us to understand how we affect our cities (Southampton and Winchester), our region and beyond. As we set out to strengthen our knowledge exchange and enterprise (KEE) and civic university activities as part of our strategy, it is important to appreciate the scale and range of positive impacts that we create. This report also serves as a benchmark against which we will be able to monitor our progress towards our strategic ambitions.

The headline figure of an overall **annual economic impact of £4.14 billion** is undoubtedly impressive, as is the multiplier of **7.4 times** the University's direct expenditure. The diversity of sources of this economic impact are equally impressive, with significant contributions from all strands of the 'triple helix': Education, Research and KEE. It is also clear that these strands are deeply interrelated and mutually supporting. Our people, students, graduates, and staff are at the heart of their delivery and interconnection.

*Our **Triple Helix strategy** – achieving greater impact through increasing the links between education, research and knowledge exchange and enterprise*

While our economic impact merits attention, it only tells part of the story. The social impact of the University is equally significant. This is harder to measure directly or to convey in numbers, so the report includes case studies which give vivid examples of the nature of the societal benefits we generate beyond our economic contribution. As we implement our KEE and civic university strategic plans, we look forward to further growing our societal value to our city, our region and the wider world.

I hope that you enjoy reading this report as much as I have and find it interesting and informative. Please do not hesitate to provide your reflections and feedback.

Yours

Professor Mark E. Smith CBE

President and Vice Chancellor
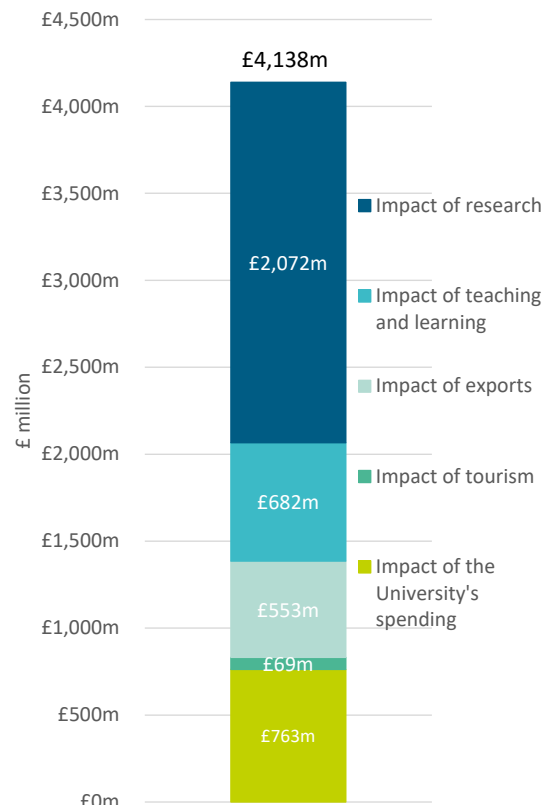
University of Southampton

> ## The total economic impact on the UK associated with the University of Southampton's activities in 2020-21 was estimated at £4.14 billion

London Economics were commissioned by the University of Southampton to undertake an analysis of the **economic and social impact** associated with the University's activities in the 2020-21 academic year. In addition to identifying the direct, indirect and induced impacts associated with the University of Southampton's **physical and digital footprint**, this analysis incorporates the economic impact associated with the University's **teaching and learning activities**, **research and knowledge exchange activities**, the contribution of the University's **international students** to the UK economy and the impact the University has on **tourism** in Southampton.

There are a multitude of non-economic or **societal benefits** resulting from the activities of the University. For graduates, these wider benefits include improvements in employability; health and wellbeing outcomes; improved social mobility; the acquisition of further learning and qualifications; and improved communication and autonomy. Similarly, as a civic university and central to Southampton's identity, the University actively supports economic and social wellbeing, prosperity and community cohesion in the region through the thousands of jobs generated, the unparalleled expenditure of the institution, its staff and its students, as well as the training delivered that is critical to the functioning of both the public and private sector employers.

Although it is clear that these outcomes have significant societal value, it is impossible to assign a monetary value in any robust way. Within the report these impacts are discussed further with the inclusion of a number of case studies that outline just some of the wider social benefits.

- **Research and knowledge exchange** activities account for **£2.07 billion** (**50%** of the total) - generated by the world-class research, spin-out companies and the variety of knowledge exchange activities.

- The value of teaching and learning activities stood at **£682 million** (**16%**), resulting from the enhanced skills, productivity and earnings of the **4,995** UK-domiciled students commencing their studies in 2020-21.

- The impact of educational exports stood at **£553 million** (**13%**), resulting from the tuition fee income and other non-tuition-fee spending of the **4,190** international students commencing their studies in 2020-21.

- The impact of the tourism associated with the University stands at **£69 million** (**2%**), resulting from approximately **23,000** study trips, business meetings and visits to see friends and family linked to the University.

- The impact generated by the operating and capital expenditure of the University was estimated to be **£763 million** (**18%**), generated through the direct, indirect and induced impacts resulting from the spending of the University, its suppliers and its employees.

Compared to the University of Southampton's total operational costs of **£561 million** in 2020-21, this corresponds to a **benefit to cost ratio** of approximately **7.4:1**.

The University of Southampton supports economic activity across the entire United Kingdom

Of the five strands of impact, a number can be further disaggregated to illustrate the regional impact across the UK economy. This regional breakdown indicates that of the **£2.5 billion** identifiable regional-based impacts, approximately **£1.6 billion** (**64%**) of the impact occurs in the **South East**, of which a very significant proportion occurs within Southampton itself. Importantly, the analysis indicates that every region and sector of the UK benefits from the activities of the University of Southampton. The economic impact of the University on the **East of England** was estimated to be approximately **£100 million**, while the economic impact on the **North West** and **Yorkshire and the Humber** were **£83 million** and **£69 million** respectively.

Further illustration of the regional effect of the University can be seen in the location of the University's direct expenditure.
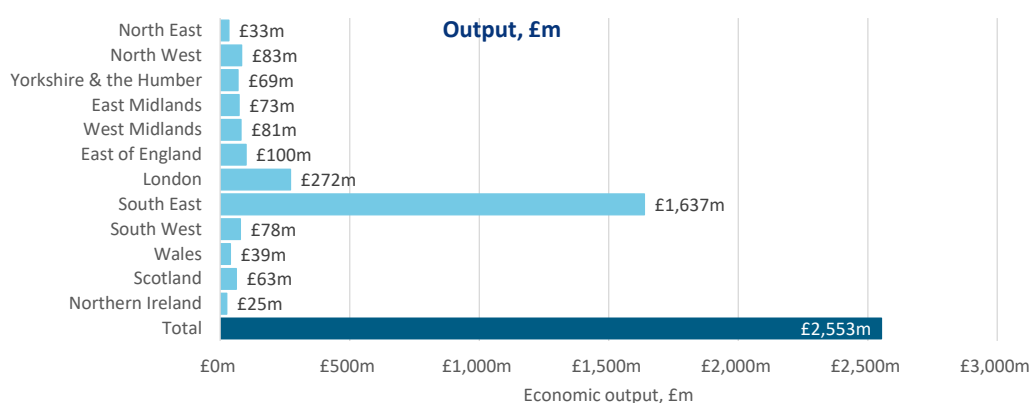
Looking at approximately **£126 million** of non-staff expenditure with postcode data undertaken by the University in 2020-21 (approximately **65%** of the University's total non-staffing expenditure), the map illustrates the spread of procurement spending by the University incorporating almost every Local Authority in the country.

There is a clear concentration of non-staffing expenditure in the **South East** (approximately **45%** of total non-staffing expenditure), with a particular concentration in and around Southampton itself (i.e. **£14.5 million** in Southampton, **£4 million** in Eastleigh and **£3 million** in Winchester). In addition, approximately **17%** of non-staffing expenditure occurs in **London**. However, although these two regions account for approximately three-fifths of the University of Southampton's procurement expenditure, the University of Southampton also procures an extensive range of goods and services from suppliers in other regions, including the **South West** (**10%**), the **East of England** (**9%**), and the **East Midlands** (**5%**).
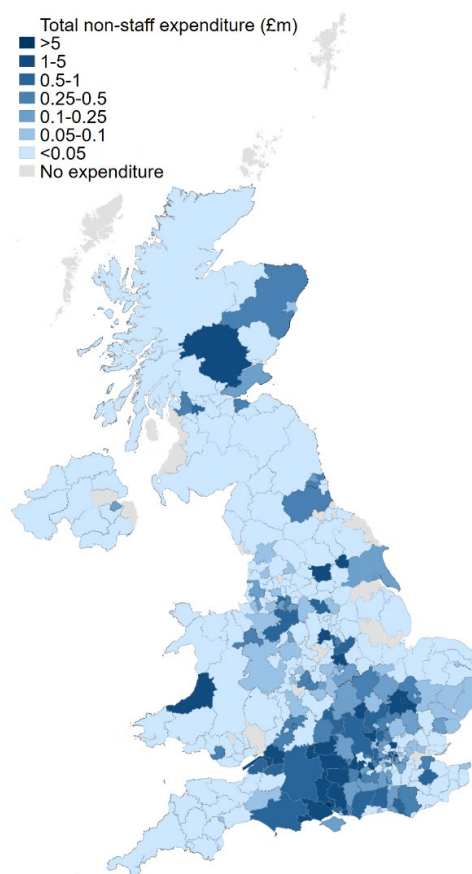
1   Introduction

London Economics were commissioned to assess the **economic and social impact of the University of Southampton in the United Kingdom**, focusing on the 2020-21 academic year. The University of Southampton contributes to the UK's national prosperity through a range of activities and channels, and the analysis is split into:

- The impact of the University of Southampton's **research and knowledge exchange activities**;
- The economic contribution of the University of Southampton's provision of **teaching and learning**;
- The impact of the University of Southampton's contribution to **educational exports**;
- The impact of the University of Southampton's **operating and capital expenditures**; and
- The impact of the University of Southampton's **contribution to tourism**.

Reflecting these channels of impact, the remainder of this report is structured as follows.

In **Section 2**, we outline our estimates of the impact of the University of Southampton's research and knowledge exchange activities. To estimate the impact of the world-leading research undertaken at the University of Southampton, we combine information on the research-related income accrued by the University of Southampton in 2020-21 with estimates from the wider economic literature on the extent to which public investment in research activity results in additional private sector productivity (i.e. positive 'productivity spillovers').

In **Section 3**, we assess the improved labour market earnings and employment outcomes associated with higher education attainment at the University of Southampton. Through an assessment of the lifetime benefits and costs associated with educational attainment, we estimate the net economic benefits of the University of Southampton's teaching and learning activity to the University of Southampton's students and the public purse (through enhanced taxation receipts), focusing on the cohort of **4,995** UK domiciled students who started higher education qualifications at the University of Southampton in 2020-21.

In addition to these UK domiciled students, there were a further **4,190** international students in the 2020-21 cohort of the University of Southampton students, contributing to the value of UK educational exports through their tuition fees as well as their non-fee (i.e. living cost) expenditures during their studies. **Section 4** assesses the direct, indirect, and induced economic impacts generated by this fee and non-fee income associated with the University of Southampton's 2020-21 cohort of international students.

Given that the University of Southampton is a major employer and supports its core activities through significant expenditures, the University of Southampton's substantial physical footprint also supports jobs and promotes economic growth throughout the UK economy. **Section 5** presents our estimates of the direct, indirect, and induced economic impacts associated with the operating and capital expenditures incurred by the University of Southampton in 2020-21.

In addition to domestic and international students and staff, the University of Southampton attracts a range of visitors to the Southampton region, including business visitors, friends and family visiting the University's staff and students, or participants in study trips to the University of Southampton.

In **Section 6**, we estimate the number of (overseas overnight[1]) visitors to Southampton in 2020-21 that resulted from the University of Southampton's activities, and assess the direct, indirect, and induced economic impacts generated by the associated tourism expenditure.

Finally, **Section 7** of this report **summarises** our main findings.

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[1] The analysis of the University of Southampton's contribution to tourism only focuses on visits to Southampton that involved overnight stays by visitors from overseas, as it is assumed that any domestic (day or overnight) visits to Southampton would have displaced activity from other regions of the UK (and should not be considered 'additional' to the UK economy).

2 The impact of the University of Southampton's research and knowledge exchange activities

2.1 Economic impact of the University of Southampton's research

In this section, we outline our analysis of the **economic impact of the University of Southampton's research**. We estimate both the **direct effects** of this research (captured by the research income accrued by the University of Southampton, net of any public funding), as well as the **productivity spillover effects** from the University of Southampton's research activities, on the whole of the UK economy.

2.1.1 Direct research impact

To estimate the **direct impact** generated by the University of Southampton's research activities, we used information on the total research-related income accrued by the University of Southampton in the 2020-21 academic year, including:

- Income from **research grants and contracts** provided by:
  - **UK sources**, including the UK Research Councils; UK-based charities; central government bodies, Local Authorities, and health and hospital authorities; industry and commerce; and other UK sources;
  - **EU sources**, including government bodies, charities, industry and commerce, and other sources; and
  - **Non-EU sources**, including charities, industry and commerce, and other sources; and
- **Recurrent research funding** allocated to the University of Southampton by Research England.

Aggregating across these sources, the total research-related income accrued by the University of Southampton in the 2020-21 academic year stood at **£173 million** (see Figure 1). Approximately **30%** of this income was received from the UK Research Councils (**£52 million**), UK charities (**£14 million**, **8%**), and through recurrent research grant funding from Research England (**£53 million**, **31%**), respectively. In addition to the **£30 million** (**17%**) accrued from other UK sources[2], the University of Southampton also received substantial amounts of research income from both EU (**£16 million**, **9%**) and non-EU sources (**£8 million**, **5%**).

To arrive at the net direct impact of the University of Southampton's research activities on the UK economy, we deducted the **costs to the public purse** of funding the University of Southampton's research activities from the above total research income in 2020-21. These public costs include the funding provided by the UK Research Councils (**£52 million**), recurrent research grants provided by Research England (**£53 million**), and other research income from UK central government bodies, Local Authorities, and health and hospital authorities (**£23 million**). Deducting these total public purse costs (**£127 million**) from the above total research-related income (**£173 million**), we thus estimated that the **net direct impact** associated with the University of Southampton's research activity in the 2020-21 academic year stands at **£46 million**.

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[2] This includes **£23 million** in other research income from UK central government bodies, Local Authorities, and health and hospital authorities. As discussed in further detail below, to arrive at the net direct impact of the University of Southampton's research activities, this funding is deducted from the University of Southampton's total research income, as it represents a cost to the public purse.

Figure 1   Research income received by the University of Southampton in 2020-21, £m by source of income
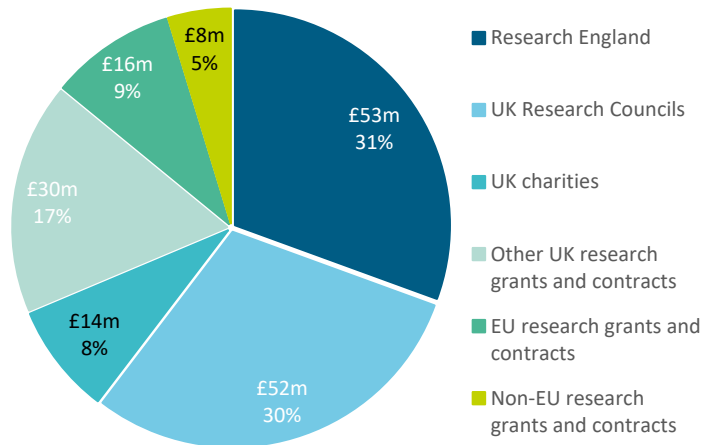
Note: All values are presented in 2020-21 prices and rounded to the nearest £1 million.
Source: London Economics' analysis based on data from the University of Southampton's 2020-21 Financial Statement

Transforming care and improving the lives of cancer survivors

The University of Southampton is involving cancer patients in research to understand the problems they face before, during, and after their treatment, to transform their care and improve their quality of life.

Half the UK population will develop cancer in their lifetime. Of these, half will live for more than 10 years after diagnosis. The School of Health Sciences' **Centre for Psychosocial Research in Cancer** (**CentRIC**) is addressing the challenges faced by cancer survivors.

Understanding how cancer and its treatment impact people's daily lives

The **ColoREctal Well-Being** (**CREW**) Study (2009-2018), was the first UK cohort study to collect information on the well-being of people from their cancer diagnosis through to five years after curative treatment. Led by Professor Claire Foster and funded by Macmillan Cancer Support, the study mapped the path of recovery of a thousand people who had colorectal cancer. The data collected showed that a third of participants still reported poor health and well-being up to five years after diagnosis. It also found that patients' mental health and confidence to manage their symptoms before treatment were as important as disease stage for predicting how well they recovered.

Introducing prehabilitation to patient pathways

The findings of the CREW study suggested that **"Prehabilitation"** - improving the physical and mental wellbeing of people with a cancer diagnosis before starting their treatment - could help their recovery.

As a result, in 2019 Macmillan, the National Institute for Health Research and the Royal College of Anaesthetists made a recommendation in joint guidance to healthcare professionals that patients undergo prehabilitation before cancer surgery.

CentRIC have since been involved in further studies, such as the Wessex Fit-4 Cancer Surgery Trial, to test models of prehabilitation that could be rolled out across the NHS. Research at University Hospital Southampton NHS Foundation Trust (UHS) found that despite illness, patients can maintain or improve their fitness before surgery by taking part in an exercise programme in hospital. The team, led by Professor Sandy Jack and supported by Dr Chloe Grimmett, a behavioural scientist from CentRIC, are testing whether patients taking part in such an exercise programme in the community (gyms and charity centres) reap the same benefits. They will also find out whether giving patients more psychological support to prepare for surgery (improving mental fitness) helps recovery.

The team will launch a pilot prehabilitation service (**PeriopFit**) at UHS later in 2022.

Helping patients self-manage symptoms

CREW showed that at least a third of patients struggled to manage cancer-related fatigue, affecting their ability to do and enjoy everyday activities. This led Professor Claire Foster to co-produce an online tool - **RESTORE digital support** - with patients, clinicians, academics and Macmillan Cancer

Support. It helps patients with any cancer to build confidence and set goals to help them manage fatigue.

Macmillan launched RESTORE in October 2019. It is the first free, evidence-based, digital resource for managing cancer-related fatigue.

Developing personalised follow-up care

After completing treatment, cancer survivors can feel their needs are not always met by a traditional system of routine hospital-based follow-up. This model also places an unsustainable burden on NHS resources.

CentRIC designed and tested new models of follow-up care with patients based on principles of supported self-management and remote monitoring through a web-based patient portal and self-management support workshops.

The **Patient Triggered Follow-up** (**PTFU**) (2011-2014) study, led by Professor Jessica Corner, and funding from Macmillan Cancer Support, showed it was feasible and acceptable for patients (and their health care teams) who completed treatment for breast, colorectal or testicular cancer to receive follow-up care in this way.

TrueNTH UK (2014-2019), led by Professor Alison Richardson, adapted, evaluated, and scaled this model of self-management support for men with prostate cancer. With funding from the Movember Foundation in partnership with Prostate Cancer UK, the model was trialled with over 2,500 men at five NHS hospitals. It included a workshop for patients on managing symptoms, support from cancer support workers, and access to an online patient portal that linked men to their care team and supplied real-time access to test results.

The model improved both the well-being of men with prostate cancer and their satisfaction with after-care. Reducing unnecessary appointments saved the NHS £39 per patient (a potential saving of over £1.8m a year if it were delivered nationally). By the end of 2020, one-quarter of NHS Trusts in England had adopted the TrueNTH UK model in its entirety and many more have adopted principles taken from the model and applied them as part of follow up care protocols.

There are 2.5 million cancer survivors in the UK (Macmillan Cancer Support). Researchers at the University of Southampton continue to work to provide the evidence needed to deliver patient-centred care.

2.1.2   Productivity spillovers

In addition to the direct impact of research, the wider academic literature indicates that investments in Research & Development (R&D) and other intangible assets may induce positive **externalities**. Economists refer to the term 'externality' to describe situations in which the activities of one 'agent' in the market induces (positive or negative) external effects on other agents in that market (which are not reflected in the price mechanism). In the context of the economic impact of research activities, existing academic literature assesses the existence and size of **positive productivity and knowledge spillovers**, where knowledge generated through the research activities of one agent enhances the productivity of other organisations.

There are many ways in which research generated at universities can induce such positive spillover effects to the private sector[3]. For example, spillovers are enabled through direct R&D collaborations between universities and firms (such as Knowledge Exchange Partnerships), the publication and dissemination of research findings, or through university graduates entering the labour market and passing on their knowledge to their employers. In a box insertion below, we examine just two exemplar channels through which these positive spillover effects occur through: the licensing of the University of Southampton's IP to other organisations and the activities of the University of Southampton's existing spinout companies.

Of particular interest in the context of research conducted by universities, a study by Haskel and Wallis (2010)[4] investigates evidence of **spillovers from publicly funded Research & Development activities**. The authors analyse productivity spillovers to the private sector from public spending on R&D by the UK Research Councils and public spending on civil and defence-related R&D[5, 6], and the relative effectiveness of these channels of public spending in terms of their impact on the 'market sector'. They find strong evidence of the existence of market sector productivity spillovers from public R&D expenditure originating from the UK Research Councils[7]. Their findings imply that, while there is no spillover effect associated with publicly funded civil and defence R&D, the marginal spillover effect of public spending on research through the Research Councils stands at **12.7 (i.e. every £1 spent on research through the Research Councils results in an additional annual output of £12.70 within the UK private sector)**.

Another study by Haskel et al. (2014) provides additional insight into the size of potential productivity spillovers from university research. Rather than estimating effects on the UK economy as a whole, the authors analyse the size of spillover effects from public research across different UK industries[8]. The authors investigate the correlation between the combined research conducted by the Research Councils, the higher education sector, and central government itself (e.g. through public research laboratories)[9], interacted with measures of industry research activity, and total

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[3] Note that there are also clearly significant economic and social spillovers to the public sector associated with university research. However, despite their obvious importance, these have been much more difficult to estimate robustly, and are not included in this analysis.

[4] Also, see Imperial College London (2010) for a summary of Haskel and Wallis's findings.

[5] The authors use data on government expenditure published by the (former) Department for Business, Innovation and Skills for the financial years between 1986-87 and 2005-06.

[6] This is undertaken by regressing total factor productivity growth in the UK on various measures of public sector R&D spending.

[7] Note that the authors' regressions only test for correlation, so their results could be subject to the problem of reverse causation (i.e. it might be the case that increased market sector productivity induced the government to raise public sector spending on R&D). To address this issue, the authors not only test for 1-year lags, but for lags of 2 and 3 years respectively, and produce similar estimates. These time lags imply that if there was a reverse causation issue, it would have to be the government's *anticipation* of increased total factor productivity growth in 2 or 3 years which would induce the government to raise its spending on research; as this seems an unlikely relationship, Haskel and Wallis argue that their results appear robust in relation to reverse causation.

[8] Haskel et al. (2014) use data on 7 industries in the United Kingdom for the years 1995 to 2007.

[9] A key difference to the multiplier for Research Council spending provided by Haskel and Wallis (2010) lies in the distinction between *performed* and *funded* research, as outlined by Haskel et al. (2014). In particular, whereas Haskel and Wallis (2010) estimated the impact

factor productivity within the different market sectors[10]. Their findings imply a total rate of return on public sector research of **0.2 (i.e. every £1 spent on public R&D results in an additional annual output of £0.20 within the UK private sector)**.

It should be noted that much of the existing literature does not assume a rate of depreciation on publicly-funded R&D investments. A standard assumption of the depreciation rate from the literature is around 20-25% per year, which still implies a significant estimate of the productivity spillover.

How do these estimates compare to the wider literature?

Whilst these research spillovers are quantitatively large; they are in line with related findings from the (relatively limited) economic literature. A report for the (former) Department for Business, Innovation and Skills (2014a) replicates the Haskel and Wallis (2010) approach, using a different (publicly-available) dataset and a slightly different methodology to explore variation in types of research council R&D investments in terms of their impact on private sector productivity. Despite the difference in data and approach, they find qualitatively similar findings: research council R&D investments yield large returns through their impact on private sector productivity.[11] The comparable research multiplier is estimated at 10.71. Moreover, the report finds much higher returns, depending on the precise approach and sample used. Additionally, research from Australia finds a similar research spillover to Haskel and Wallis (2010), albeit with a slightly lower research multiplier of 9.76, which may be expected given the different country studied (Elnasri and Fox, 2017)[12].

There is more limited research associated with general R&D multipliers (for other research income) although a report published for the Department for Business, Innovation and Skills, looking into the international benchmarking of the UK science and innovation system, notes a rate of return in the range of 20 to 50% (Department for Business, Innovation and Skills, 2014b).[13]

This demonstrates that researchers using different methods and datasets find similar results with regards to estimates of research spillovers.

What are the estimates of the productivity spillovers?

In order to estimate the productivity spillovers associated with the University of Southampton's research activities, we apply these productivity spillover multipliers from the existing literature to the different types of research-related income received by the University of Southampton in 2020-21 (again see Figure 1). Specifically, assigning the multiplier of **12.7** to the research funding that the

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of research *funding* by the Research Councils on private sector productivity, Haskel et al. (2014) instead focus on the *performance* of R&D. Hence, they use measures of the research undertaken by the Research Councils and the government, rather than the research funding which they provide for external research, (e.g. by higher education institutions). The distinction is less relevant in the higher education sector. To measure the research performed in higher education, the authors use Higher Education Funding Council funding where research is both funded by and performed in higher education.

[10] In particular, the authors regress the three-year natural log difference of total factor productivity on the three-year and six-year lagged ratio of total research performed by the Research Councils, government, and the Higher Education Funding Councils over real gross output per industry. To arrive at the relevant multiplier, this ratio is then interacted with a measure of co-operation of private sector firms with universities and public research institutes, capturing the fraction of firms in each industry co-operating with government or universities. The lagged independent variables are adjusted to ensure that the resulting coefficients can be interpreted as annual elasticities and rates of return.

[11] The coefficient on research council spending is 10.71 in the sample up to 2008, although this is not statistically significant given the limited number of observations employed in their sample.

[12] See London Economics (2018a), *The economic impact of the Group of Eight in Australia* (Section 2.2.1). The authors find an elasticity of 0.175, which converted to a research spillover, equals 9.76.

[13] See also Salter and Martin (2001).

University of Southampton received from **UK Research Councils and UK charities**[14] in 2020-21 (amounting to **£66 million**), and assigning the multiplier of **0.2** to **all other research funding** received by the University of Southampton in that academic year (amounting to **£107 million**)[15], we estimate that the research conducted by the University of Southampton in 2020-21 resulted in **total market sector productivity spillovers of £858 million**.

In other words, we infer a weighted average spillover multiplier associated with the University of Southampton's research activities of approximately **5.0** – i.e. **every £1 invested in the University of Southampton's research activities generates a total annual economic output of £5.0 across the UK economy**.

2.1.3   Aggregate impact of the University's research

Combining the direct economic impact of the University of Southampton's research (**£46 million**)

> **The impact of the University of Southampton's research and knowledge exchange activities in 2020-21 stood at £904 million.**

with the estimated productivity spillovers associated with this research (**£858 million**), we estimate that the total economic impact associated with the University of Southampton's research and knowledge exchange activities in 2020-21 stands at approximately **£904 million** (see Figure 2).

Comparing the **£127 million** of publicly funded research income received by the University of Southampton in 2020-21 to the **£904 million** impact from research and knowledge exchange activities, this suggests that **for each £1 million of publicly funded research income, the University of Southampton's research and knowledge exchange activities generated a total of £7.1 million in economic impact across the UK.**

Figure 2   Total impact of the University of Southampton's research in 2020-21, £m
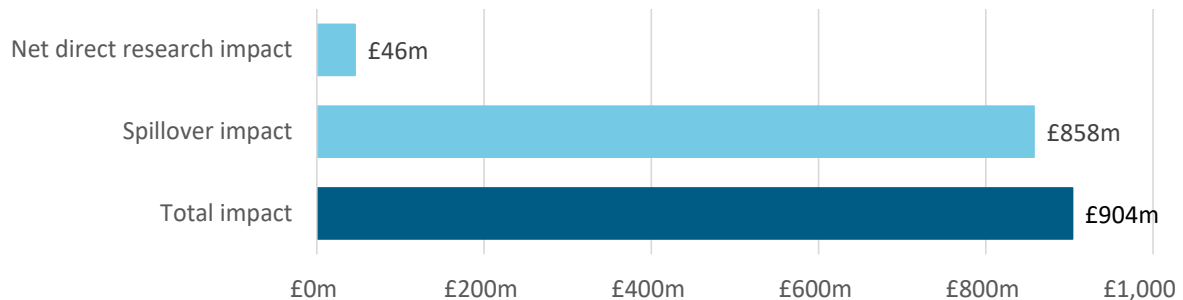
Note: All values are presented in 2020-21 prices, rounded to the nearest £1 million, and may not add up precisely to the totals indicated.
Source: London Economics' analysis

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[14] Where the vast majority of funding provided by UK charities relates to projects commissioned through an open competitive process.
[15] In terms of the large difference in magnitude between these multipliers, explaining the size of the 12.7 multiplier in particular, Haskel and Wallis (2010) argue that they would expect the productivity spillovers from Research Council funding to be large, 'given that the support provided by Research Councils is freely available and likely to be basic science'. To the best knowledge of the authors, there exists no further and recent empirical evidence to support this. As a result, we apply the separate multipliers to the different income strands.

2.2   Economic impact of the University of Southampton's knowledge exchange activities

In addition to its research activities, the University generates significant economic impacts through a range of knowledge exchange activities. Here, we assess the impacts associated with the operations of the University's **spinout** companies; **licensing of its IP** to other organisations; and the **business and community engagement services** that the University provides (e.g. consultancy services, contract research, facility and equipment services, and business and community courses).

Specifically, the analysis captures the direct, indirect, and induced economic impacts associated with each of these knowledge exchange activities, defined as follows:

- **Direct effect:** This measures the direct economic activity generated by each of these activities, captured by the turnover of the University of Southampton's spinout companies, IP income received by the University of Southampton, as well as the contract values of business and community activities the University undertakes.

- **Indirect effect ('supply chain impacts'):** the University of Southampton and its spinout companies spend their income on purchases of goods and services from their suppliers, which in turn spend this revenue to purchase inputs to meet the University of Southampton's or companies' demands. This results in a chain reaction of subsequent rounds of spending across industries, often referred to as a 'ripple effect'.

- **Induced effect ('wage spending impacts'):** The employees of the University of Southampton (supported by its income from knowledge exchange activities) and its spinouts use their wages to buy consumer goods and services within the economy. This in turn generates wage income for employees within the industries producing these goods and services, again leading to subsequent rounds of spending, i.e. a 'ripple effect' throughout the economy as a whole.

The total of the direct, indirect, and induced effects constitutes the *gross* economic impact of the University of Southampton's knowledge exchange activities. An analysis of the *net* economic impact ideally needs to account for two additional factors potentially reducing the size of any of the above effects:

- **Leakage** into other geographical areas, by taking account of how much of the additional economic activity actually occurs in the area of consideration; and

- **Displacement** of economic activity within the region of analysis, i.e. taking account of the possibility that the economic activity generated might result in the reduction of activity elsewhere within the region[16].

The direct, indirect, and induced impacts are measured in terms of monetary economic output[17], gross value added (GVA)[18], and full-time equivalent (FTE) employment supported. In addition to

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[16] It is important to note that, while the analysis takes account of *leakage* (e.g. adjusting for the extent to which any additional income for supplying industries might be spent on imports of goods and services from outside the UK), the estimated impacts here are *not* adjusted for *displacement* or additionality (e.g. the extent to which the IP income received by the University of Southampton might otherwise have been used for other purposes by the organisations from which the income is received). Hence, our analysis effectively estimates the direct, indirect, and induced impacts associated with the University of Southampton's knowledge exchange activities in *gross* terms.

[17] Here, economic output is equivalent to income/turnover (e.g. the direct economic output associated with the University's spinout companies is captured by the turnover of these firms in 2020-21).

[18] Gross value added is used in National Accounting to measure the economic contribution of different industries or sectors and is defined as economic output minus intermediate consumption (i.e. the cost of goods and services used in the production process).
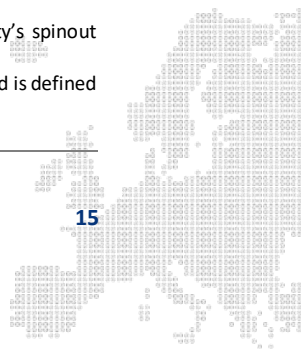
measuring these impacts on the UK economy as a whole, the analysis is broken down by geographic region and sector.

These impacts of the University of Southampton's knowledge exchange activities were estimated using **economic multipliers** derived from Input-Output tables, which measure the total production output of each industry in the UK economy, and the inter-industry (and intra-industry) flows of goods and services consumed and produced by each sector[19]. In other words, these tables capture the degree to which different sectors within the UK economy are connected, i.e. the extent to which changes in the demand for the output of any one sector impact on all other sectors of the economy. To be able to achieve a breakdown of the analysis by region, we developed a **multi-regional Input-Output model**, combining UK-level Input-Output tables (for 2016[20]) with a range of regional-level data[21] to achieve a granular breakdown by sector[22] *and* region[23].

In addition to the impacts associated with the University of Southampton's knowledge exchange activities described in the following sections, a similar methodology is applied to estimate the direct, indirect, and induced economic effects associated with the University's export income (see Section 4) and the operational and capital expenditures of the University of Southampton (see Section 5).

2.2.1   Economic impact of the University of Southampton's spinout companies

To assess the direct impact associated with the University of Southampton's spinout companies, we made use of information on the **turnover** (as a measure of economic output) and **FTE employment** associated with a total of **72** UK-based University of Southampton spinout companies that were active in 2020-21 (and for which data was available)[24, 25]. The **direct gross value added** generated was estimated by multiplying the **turnover** of the firm by the **average ratio** of GVA to **output** among organisations within the company's industry sector and region[26, 27]. Based on this approach, the

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[19] Specifically, the analysis makes use of *Type II* multipliers, defined as [Direct + indirect + induced impact]/[Direct impact].

[20] See Office for National Statistics (2020a).

[21] The fundamental idea of the multi-regional Input-Output analysis is that region *i*'s demand for region *j*'s output is related to the friction involved in shipments from one region to another (which we proxy by the distance between the two regions), and that cross-regional trade can be explained by the relative gross value added of the sector in all regions. The multi-regional Input-Output model was derived by combining UK-level Input-Output tables with data on geographical distances between regions; GVA and compensation of employees by sector and region (Office for National Statistics, 2019); employment by sector and region (Office for National Statistics, 2020b); gross disposable household income by region (Office for National Statistics, 2020c); population by region (Office for National Statistics, 2020d); and UK imports into each region and exports by each region, by commodity (Office for National Statistics, 2018).

[22] In terms of sector breakdown, the original UK Input-Output tables are broken down into 64 (relatively granular) sectors. However, the (wide range of) regional-level data required to generate the multi-regional Input-Output model is not available for such a granular sector breakdown. Instead, the multi-regional Input-Output model is broken down into 10 more high-level sector groups (see Table 20 in Annex A2.1 for more information).

[23] While Input-Output analyses are a useful tool to assess the total economic impacts generated by a wide range of activities, it is important to note several key limitations associated with this type of analysis. Input-Output analyses assume that inputs are complements, and that there are constant returns to scale in the production function (i.e. that there are no economies of scale). The interpretation of these assumptions is that the prevailing breakdown of inputs from all sectors (employees, and imports) in 2016 is a good approximation of the breakdown that would prevail if total demand (and therefore output) were marginally different. In addition, Input-Output analyses do not account for any price effects resulting from a change in demand for a given industry/output.

[24] The analysis excludes companies that were dissolved prior to 2020-21, or those that are primarily non-UK based. Further note that the information is based on the 2020-21 financial year, which does not necessarily coincide with the 2020-21 academic year. Information on the turnover and employment of the spinout companies was provided by the University of Southampton and supplemented by data from Bureau van Dijk's FAME database (based on Companies House information).

[25] Note that, in spite of using FAME data to fill gaps, it is likely that the combined University of Southampton/FAME data still provide an incomplete estimate of the total turnover, GVA, or employment of the University of Southampton's spinout companies. This particularly applies to relatively small companies falling below the reporting thresholds required by Companies House (implying that their financials would not be included in the FAME data).

[26] These ratios were derived based on the multi-regional Input-Output model. Each firm's main industry classification was based on information provided by the FAME database. Each firm's main regional location was based on the region of the main registered address of the company recorded in FAME.

[27] The analysis made use of any resulting turnover, employment, or GVA information available for a given company, irrespective of whether complete data (i.e. in terms of turnover, GVA and employment) was available for that firm. The direct impact is therefore based

direct impact associated with the activities of the University of Southampton's spinout activities in 2020-21 was thus estimated at **£370 million** in economic output (i.e. turnover)[28], supporting **1,140 FTE staff**, and contributing **£126 million** of gross value added.

We then applied relevant **economic multipliers** (derived from our Input-Output analysis) to estimate the **total direct**, **indirect**, and **induced** economic impacts associated with the University of Southampton's spinout companies. Specifically, we assigned relevant economic multipliers to each active spinout company in 2020-21, based on each firm's industry classification and the region of its main registered office address. Table 1 presents the resulting average multipliers across all spinout companies (weighted by the underlying (direct) turnover, employment, and GVA associated with each firm). Based on these estimates, in terms of economic output, we assume that every **£1 million** of turnover directly accrued by the University of Southampton's spinout companies generates an *additional* **£1.51 million** of impact throughout the UK economy, of which **£0.64 million** is generated in the South East. In terms of employment, we assume that, for every **1,000** (FTE) staff employed by these spinout companies, an *additional* of **1,740** staff are supported throughout the UK, of which **510** are supported within the South East.

Table 1   Economic multipliers associated with the activities of the University of Southampton's spinout companies

Location of impact	Output	GVA	FTE employment
South East	1.64	1.87	1.51
Total UK	2.51	3.19	2.74

Note: All multipliers constitute Type II multipliers, defined as [Direct + indirect + induced impact]/[Direct impact].
Source: London Economics' analysis

Applying these multipliers to the above direct impacts (**£370 million**), the total economic impact associated with the activities of the University of Southampton's spinout companies in the 2020-21 academic year was estimated to be **£928 million** across the UK economy, of which **£606 million** (**65%**) was generated in the South East (see Table 2). The estimated total number of FTE jobs supported stood at **3,120** (of which **1,720** or **55%** were located in the South East). The corresponding estimate in terms of GVA stood at **£402 million** (of which **£236 million** or **59%** occurred in the South East).

Table 2   Economic impact associated with the University of Southampton's spinouts in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£606m	£236m	1,720
Total UK	£928m	£402m	3,120

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5.
Source: London Economics' analysis

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on a total of 10 firms (out of the 72 active UK-based companies) for which turnover information was available, and 53 firms for which employment information was available.

[28] The turnover is driven largely by two spin-out companies accounting for around 90% of the total revenue associated with spin-out companies.
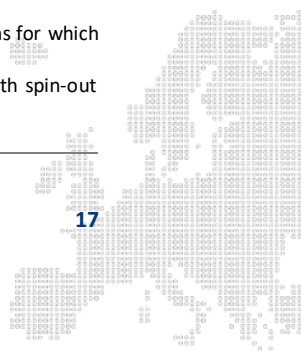
A home for south coast business and innovation

Home to over 100 businesses, the University of Southampton Science Park is a powerhouse of south coast innovation. It delivers an estimated £350 million in gross value added (GVA) to the local economy each year and attracts talent and investment to the region.

It is a distinctive place to work for science and technology companies, accommodating both start-ups and multinational organisations at every stage of business development.

A thriving regional hub

Southampton Science Park comprises a wide range of high-quality commercial offices, meeting spaces, laboratories, and conferencing facilities across 75 acres of landscaped grounds, and includes facilities such as cafes, a health club, early years childcare and communal transport. More than 1,000 people are part of the Park's community, brought together through social and formal networking, and educational events open to all resident businesses.

The Science Park supports efforts to build the profile of south coast entrepreneurship. It is a Hampshire Ambassador, and a sponsor of the South Coast Tech Awards, the Central South Business Awards, and the Test Valley Business Awards.

It responds to evolving commercial needs. Occupancy is rising steadily, starting from a healthy 82 per cent before COVID-19, despite the pressures that new ways of working have put on the commercial property industry. New co-working spaces have been created in the Incubation Centre, designed for entrepreneurs, start-ups, and small businesses that need a base to grow.

A healthy ecosystem for innovation

The Science Park provides structured business support programmes and facilitates commercial growth.

The Catalyst business accelerator for early-stage businesses runs annually. Successful applicants receive six months of world-class mentoring and workshops. This programme is free, without any equity share, and is supported by Hampshire County Council. Since it was established nine years ago, it has accelerated progress for 73 companies and helped secure over £28 million in early-stage funding, creating more than 160 jobs. Eighty per cent of these businesses were still trading after five years (double the national average).

Companies often face challenges when they have matured beyond the start-up phase and need to secure growth finance, put executive board and governance structures in place, and strengthen their sales and marketing. The University of Southampton is part of the SETsquared Partnership, which is regarded as the most successful university-linked business growth incubator globally, and is now celebrating its 20th year. The Science Park is home to the Southampton SETsquared centre, which helps businesses to the next phase of their journey.

University spin-out AccelerComm, which specialises in patented 5G algorithms to double network capacity, halve power and slash latency, is one such success story. In 2015, founders Professor Rob Maunder and Dr Taihai Chen took part in SETsquared's Innovation to Commercialisation of University Research (ICURe) programme, which supports teams led by early career researchers to explore potential markets and commercialise their work. Through the programme, they designed a business plan which led to an Innovate UK Aid for Start-Ups grant — a key step towards securing further funding and investment. Five years later, in 2020, AccelerComm secured £5.8 million in Series A funding to drive expansion and develop the technology further, as demand for their digital signal processing IP grew.

Technology companies must act when opportunities strike, and restrictive leases can throttle company growth. The Science Park offers flexible leases allowing for quick expansion. AccelerComm has upgraded its space several times to accommodate its rapidly growing team, now 55 people. In 2022, it took residency across 6,600 sq. ft of the Park's newest multi-occupancy property, Benham 5. This includes communal working and social areas essential to building the environment necessary to deliver their collaborative systems.

Championing responsible business for the future

Southampton Science Park is championing responsible ways of working that benefit both resident businesses and the community.

Absolar Solutions — University of Southampton spin-out company, Catalyst alumni and resident business — helps organisations to assess the solar potential of their buildings. Building on extensive academic research and emerging artificial intelligence, the company's state-of-the-art software can be used to carry out a remote solar survey. The team then carries out a solar audit and advises on the optimal plan for installing solar panels, helping businesses to reduce their carbon footprint.

The Science Park commissioned Absolar Solutions to conduct a remote solar survey of the whole Park. The findings were used to make a data-led decision to install a solar power system for the multiple-occupancy Kenneth Dibben House. This 235kWp installation will enable the Science Park to save 50 tonnes of carbon per year.

The Science Park continues to support responsible innovation and will soon host a new Engineering Centre. The University of Southampton Future Towns Innovation Hub (partly funded by Research England and the Enterprise M3 Local Enterprise Partnership) aims to enhance the prosperity, health and wellbeing of the people living in the Enterprise M3 area by delivering solutions for future mobility, Net Zero, healthy living and sustainable growth through integrated resource management, and engineering skills.

2.2.2 Productivity spillovers

In addition to the direct impact of research, the wider academic literature indicates that investments in Research & Development (R&D) and other intangible assets may induce positive **externalities**. Economists refer to the term 'externality' to describe situations in which the activities of one 'agent' in the market induces (positive or negative) external effects on other agents in that market (which are not reflected in the price mechanism). In the context of the economic impact of research activities, existing academic literature assesses the existence and size of **positive productivity and knowledge spillovers**, where knowledge generated through the research activities of one agent enhances the productivity of other organisations.

2.2.3 Economic impact of the University of Southampton's other knowledge exchange activities

In this section we estimate the economic impact of the University of Southampton's knowledge exchange activities that are separate from the spinout activities. These activities include IP licensing, consultancy services, contract research, facilities and equipment hire and business and community courses.

IP Revenues

To measure the direct impact associated with the University's other IP licensing activities, we made use of data from the Higher Education Business and Community Interaction Survey (HE-BCI)[29] on the total IP related revenues received by the University of Southampton in the 2020-21 academic year. This stood at **£3.9 million**. While this provides an estimate of the direct impact in economic output terms, to arrive at comparable estimates in GVA and employment terms, we multiplied this direct output by the average ratios of GVA to output and of FTE employees to output among organisations within the government, health, and education sector located in the South East[30]. Applying these assumptions, we estimate that the University's IP income in 2020-21 *directly* generates **£2.3 million** in GVA and supports **45** full-time equivalent jobs[31].

To estimate the total direct, indirect, and induced impacts associated with the University of Southampton's IP related revenues, we then multiplied these direct impacts by the estimated average economic multipliers associated with organisations in the government, health, and education sector in the South East[32]. These multipliers (for the impact on the South East and the UK economy as a whole) are presented in Table 3. Based on these estimates, in terms of economic output, we assume that every **£1 million** of IP income accrued by the University of Southampton generates an *additional* **£1.71 million** of impact throughout the UK economy, of which **£0.71 million** is generated in the South East. In terms of employment, we assume that, for every **1,000** (FTE) staff employed directly by the University of Southampton (supported by its IP income), an additional **1,060** staff are supported throughout the UK, of which **400** are supported within the South East.

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[29] See Higher Education Statistics Agency (2020b).

[30] This approach is based on the fact that the IP income is generated by the University of Southampton itself. In other words, we assume that the income accrued by the University of Southampton supports the same levels of GVA and employment (in relative/proportionate terms) as the income accrued by other institutions operating in the South East's government, health, and education sector. The ratios of GVA to output and employment to output were derived from the above-described multi-regional Input-Output model.

[31] All employment estimates have been rounded to the nearest 5.

[32] i.e. we assume that the expenditure patterns of the University of Southampton are the same as for other institutions operating in London's government, health and education sector.

Table 3   Economic multipliers associated with the University of Southampton's other knowledge exchange activities

Location of impact	Output	GVA	FTE employment
South East	1.71	1.61	1.40
Total UK	2.71	2.51	2.06

Note: All multipliers constitute Type II multipliers, defined as [Direct + indirect + induced impact]/[Direct impact].
Source: London Economics' analysis

Applying these multipliers to the above direct impacts, the analysis indicates that the estimated total economic impact associated with the University of Southampton's IP licensing activities in the 2020-21 academic year stood at approximately **£10.5 million** across the UK economy, of which **£6.6 million** (**63%**) was generated in the South East (see Table 4). The estimated total number of jobs supported (in FTE) stood at **100** (of which **65** or **65%** were located in the South East), while the corresponding estimate in terms of GVA stood at **£5.8 million** (of which **£3.7 million** or **64%** occurred in the South East).

Table 4   Economic impact associated with the University of Southampton's IP related revenues in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£6.6m	£3.7m	65
Total UK	£10.5m	£5.8m	100

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5.
Source: London Economics' analysis

Consultancy services

In 2020-21, the University of Southampton received approximately **£32.6 million** in revenues associated with consultancy services, of which approximately **£1.9 million** was received for services provided to SMEs, **£1.7 million** from other (non-SME) commercial businesses and **£29.0 million** from non-commercial organisations.

Adopting the same approach as presented previously to estimate the total direct, indirect and induced effect throughout the South East and UK economies associated with the contract consultancy income (using the same multipliers presented in Table 3), the analysis indicates that the estimated total economic impact associated with the University of Southampton's provision of consultancy services in the 2020-21 academic year stood at approximately **£88.4 million** across the UK economy, of which **£55.8 million** (**63%**) was generated in the South East (see Table 5). The estimated total number of jobs supported (in FTE) stood at **815** (of which **550** or **67%** were located in the South East), while the corresponding estimate in terms of GVA stood at **£48.8 million** (of which **£31.3 million** or **64%** occurred in the South East).

Table 5   Economic impact associated with the University of Southampton's consultancy income in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£55.8m	£31.3m	550
Total UK	£88.4m	£48.8m	815

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5. *Source: London Economics' analysis*
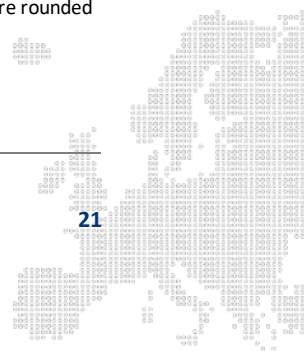
Contract research

Reflecting the depth, breadth and impact of the research routinely undertaken by the University, in addition to the research income identified in Figure 1, the University of Southampton received approximately **£31.5 million** in research contract income in 2020-21, of which approximately **£2.2 million** related to income generated from research contracts delivered to SMEs, **£6.9 million** related to income generated from research contracts delivered to other (non-SME) commercial businesses and **£22.3 million** of income was associated with research contracts delivered to non-commercial organisations.

Adopting the same approach as presented above to estimate the total direct, indirect and induced effect throughout the South East and UK economies associated with the contract consultancy income (and again using the same multipliers presented in Table 3), the analysis indicates that the estimated total economic impact associated with the University of Southampton's provision of research contract services in the 2020-21 academic year stood at approximately **£85.2 million** across the UK economy, of which **£53.8 million** (**63%**) was generated in the South East (see Table 6). The estimated total number of jobs supported (in FTE) stood at **780** (of which **530** or **68%** were located in the South East), while the corresponding estimate in terms of GVA stood at **£47.0 million** (of which **£30.2 million** or **64%** occurred in the South East).

Table 6   Economic impact associated with the University of Southampton's contract research income in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£53.8m	£30.2m	530
Total UK	£85.2m	£47.0m	780

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5. *Source: London Economics' analysis*

Facilities and equipment

In addition to delivering research, the University of Southampton received approximately **£12.3 million** in income in 2020-21 associated with the hire of its research facilities (often relating to the hire or lease of laboratory space or computing power and capacity etc). Of this total, approximately **£7.3 million** related to income generated from facilities and equipment provided to SMEs. This is a much larger proportion of total income received compared to the other categories (such as contract research income) and illustrates the commercial need (especially amongst SMEs) to be able to access established research infrastructure. Approximately **£4.3 million** related to income generated from facilities and equipment hire to other (non-SME) commercial businesses and **£0.7 million** was associated with facilities and equipment hire delivered to non-commercial organisations.

Adopting the same approach as presented previously (and again using the same multipliers presented in Table 3), the analysis indicates that the estimated total economic impact associated with the University of Southampton's facilities and equipment hire in the 2020-21 academic year stood at approximately **£33.3 million** across the UK economy, of which **£21.0 million** (**63%**) was generated in the South East (see Table 7). The estimated total number of jobs supported (in FTE) stood at **310** (of which **210** or **68%** were located in the South East), while the corresponding estimate in terms of GVA stood at **£18.4 million** (of which **£11.8 million** or **64%** occurred in the South East).

Table 7   Economic impact associated with the University of Southampton's facilities and equipment hire income in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£21.0m	£11.8m	210
Total UK	£33.3m	£18.4m	310

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5. *Source: London Economics' analysis*

Business and Community courses

Finally, in this section we consider the income generated from business and community courses. The University of Southampton received approximately **£8.5 million** in income in 2020-21 associated with business and community courses. Of this total, approximately **£0.2 million** related to income generated from business and community courses delivered to SMEs. Approximately **£0.1 million** related to business and community courses provided to other (non-SME) commercial businesses and **£0.2 million** was associated with business and community courses provided to non-commercial organisations. In contrast to the other research income sources, approximately **£8.1 million** related to business and community courses provided to individuals.

Using the same multipliers presented in Table 3, the analysis indicates that the estimated total economic impact associated with the University of Southampton's business and community courses in the 2020-21 academic year stood at approximately **£23.2 million** across the UK economy, of which **£14.6 million** (**63%**) was generated in the South East (see Table 8). The estimated total number of jobs supported (in FTE) stood at **210** (of which **145** or **69%** were located in the South East), while the corresponding estimate in terms of GVA stood at **£12.8 million** (of which **£8.2 million** or **64%** occurred in the South East).

Table 8   Economic impact associated with the University of Southampton's business and community course income in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£14.6m	£8.2m	145
Total UK	£23.2m	£12.8m	210

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5. *Source: London Economics' analysis*

2.2.4   Total impact of the University of Southampton's other knowledge exchange activities

In the 2020-21 academic year, the University of Southampton's knowledge exchange activities generated an estimated **£240.5 million** across the UK economy, of which **£151.9 million** (**63%**) was generated in the South East (see Table 9). The estimated total number of jobs supported (in FTE) stood at **2,200** (of which **1,500** or **68%** were located in the South East), while the corresponding estimate in terms of GVA stood at **£132.7 million** (of which **£85.3 million** or **64%** occurred in the South East).

Table 9 Total economic impact associated with the University of Southampton's knowledge exchange activities in 2020-21

Location of impact	Output, £m	GVA, £m	# of FTE employees
South East	£151.9m	£85.3m	1,500
Total UK	£240.5m	£132.7m	2,200

Note: All monetary values are presented in 2020-21 prices and rounded to the nearest £1 million. The employment figures are rounded to the nearest 5. *Source: London Economics' analysis*

2.3 Total impact of the University of Southampton's research and knowledge exchange activities

> **The impact of the University of Southampton's research and knowledge exchange activities in 2020-21 stood at £2.1 billion.**

Combining the impact of the University of Southampton's research activities (**£904 million**) with the estimated impact associated with the University's knowledge exchange activities (**£1,168 million**), we estimate that the total economic impact associated with the University of Southampton's research and knowledge exchange activities in 2020-21 stands at approximately **£2,072 million** (see Figure 3).

Comparing the **£173 million** of publicly funded research income received by the University of Southampton in 2020-21 to the **£2,072 million** impact from research and knowledge exchange activities, this suggests that **for each £1 million of publicly funded research income, the University of Southampton's research and knowledge exchange activities generated a total of £12.0 million in economic impact across the UK.**

Figure 3 Total impact of the University of Southampton's research and knowledge exchange activities in 2020-21, £m
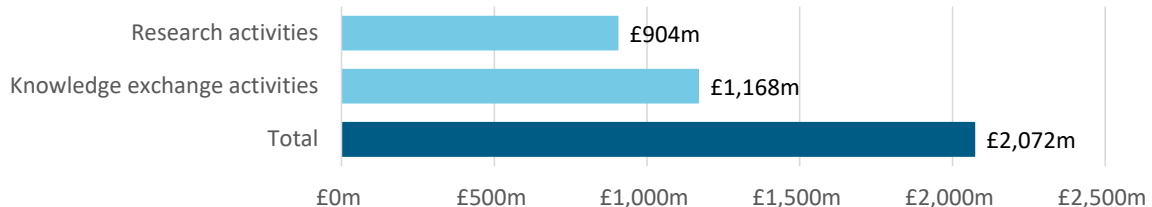
Note: All values are presented in 2020-21 prices, rounded to the nearest £1 million, and may not add up precisely to the totals indicated.
Source: London Economics' analysis

Empowering children and young people to make positive lifestyle choices

Launched in 2008, LifeLab is a unique research-based educational project created by the University of Southampton in collaboration with the University Hospital Southampton (UHS), where it is hosted.

LifeLab is not simply a school trip; it is a structured education programme. It comprises a professional development day for science teachers; pre-visit lessons at school; an immersive visit to the purpose-built LifeLab facility at UHS; follow-up lessons at school; and a celebration event for all LifeLab students, parents, and local health professionals and public officials.

LifeLab's scientists and educators create experiences that empower children and young people to understand the science behind the health messages they see and hear. Participants learn how their actions affect their health and the health of any children they may have in the future. LifeLab's mission is captured by the message: 'Change the beginning and you change the whole story.'

A research-based education programme

Chronic health issues like obesity, diabetes, and mental health disorders are socio-scientific issues (SSIs). Research led by the University of Southampton's School of Education demonstrated that young people should learn about SSIs during their formal science education and be equipped with decision-making skills to make informed choices. A 'bridging pedagogy' with eight components supporting a 'science for health' literacy was identified, laying the foundations of LifeLab's approach. LifeLab continues to refine and adapt its methods through current research projects: EACH-B Engaging Adolescents in Changing Behaviour, focusing on teenagers (funded by the National Institute for Health Excellence in 2017); and Early LifeLab, which focuses on young children.

Inspiring positive change

Since the launch of its hospital-based facility in 2014, LifeLab has engaged over 12,500 students and 300 teachers across 70 schools in the Wessex region. Rigorous evaluations have demonstrated that students have a more positive attitude to health and science learning and improved health literacy after participating in the programme. It is endorsed by professional bodies such as the Royal Society for Public Health (RSPH) and the Royal College for Paediatric and Child's Health (RCPCH).

The LifeLab facility can accommodate 32 students daily and has state-of-the-art equipment including an ultrasound machine to image blood flow, gel electrophoresis for DNA analysis, lung function equipment and a Tanita machine to analyse body composition. Students also have an opportunity to meet and talk to scientists, both from academic and clinical backgrounds, in a session called ''Meet the Scientist'. Feedback from students shows that these sessions help them to see a wide variety of career options in science which are open to people like themselves. The opportunity to step outside the classroom into a busy clinical environment creates a buzz among the students. For many, it is their first visit to a hospital, and the experience can allay fears by showing hospitals to be vibrant places where active scientific research takes place.

An agile response to the COVID-19 crisis

LifeLab responded to the rapidly changing circumstances of students and teachers during the COVID-19 crisis, continuing to deliver innovative education programmes tailored to their needs. The team mobilised young people through connections with local schools, exploring how to support them during the lockdowns. The Teenagers' Experience of COVID-19 (TeC-19) study, led by Professor Mary Barker in the Faculty of Medicine and funded through the Institute for Life Sciences, involved online focus group discussions running from March 2020 through to March 2021. Following these, the participants were asked to keep social media diaries and complete assessments of their diet, physical activity, mental health, and wellbeing.

Combining insights from Tec-19 and the principles underpinning LifeLab, the research team secured funding from the Department of Health and Social Care to develop a 'science for health' literacy programme to help reduce COVID-19 transmission by engaging young people in testing and other measures. This formed part of the Hampshire and Isle of Wight's population-level saliva testing programme to extend testing into educational settings.

A novel COVID-19-focused curriculum and materials for four- to 16-year-olds were co-created with schools. These included an 'Escape from Coronavirus' escape-room-themed lesson for primary schools and a teacher professional development unit to support the delivery of these lessons. During the testing phase, the education materials reached an estimated 10,000 education staff and 55,000 students.

Alongside making its resources available on the LifeLab Online educational platform, LifeLab partnered with the RSPH to develop a new qualification – COVID-19 Young Health Champions. Teachers could register and deliver this independently, with the assessment being quality assured by LifeLab as an RSPH Centre. From July 2021, it also became available as a self-directed student course, so that young people could register and take it by themselves.

As students returned to the classroom LifeLab adapted its modules to account for the fact that they could not yet be delivered back at the UHS – first for the school classroom and then so that activity days could be hosted in an alternative location at the University of Southampton. LifeLab intends to return to its unique facilities for the academic year 2022-23.

3 The impact of the University of Southampton's teaching and learning activities

Economic impact analyses of higher education institutions typically only consider the direct, indirect, and induced economic effects of a university's expenditures (through the institution's extensive supply chains, and the expenditures on its staff), as well as the economic impacts associated with the expenditures of students attending the institution. However, given that one of universities' primary activities is to provide teaching and learning, a simple study of this nature would significantly underestimate the impact of any higher education institution's activities on the UK economy.

In terms of measuring the impact of universities' teaching and learning activities, Atkinson's (2005) report to the Office for National Statistics asserted that the economic value of education and training is essentially the **value placed on that qualification as determined by the labour market**. Based on this approach, in this section of the report, we detail our estimates of the economic impact of the teaching and learning activities undertaken at the University of Southampton, by considering the labour market benefits associated with enhanced qualification attainment and skills acquisition – to **both the individual and the public purse**.

3.1 The 2020-21 cohort of UK domiciled University of Southampton students

The analysis of the economic impact of the University of Southampton's teaching and learning activities is based on the **2020-21 cohort of UK domiciled students**. In other words, instead of the University of Southampton's entire student body of **21,400** students in 2020-21 (*irrespective* of when these individuals may have started their studies), the analysis in this section focuses on the **4,995** UK domiciled[33] students **starting higher education qualifications (or standalone modules/credits) in the 2020-21 academic year**[34].

In terms of **level of study** (Figure 4), **69%** (**3,470** students) in this cohort of UK-domiciled students were undertaking **first degrees**, with a further **685** students (**14%**) undertaking **postgraduate taught degrees**, and **330** students (**7%**) enrolled in **postgraduate research degrees**. An additional **10** students were enrolled in **other undergraduate qualifications**, and the remaining **500** (**10%**) were undertaking **other postgraduate qualifications**[35].

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[33] It is likely that a proportion of EU and non-EU domiciled students undertaking their studies at the University of Southampton will remain in the UK to work following completion of their studies; similarly, UK domiciled students might decide to leave the UK to pursue their careers in other countries. Given the uncertainty in predicting the extent to which this is the case, and the difficulty in assessing the net labour market returns for students not resident in the UK post-graduation, the analysis of teaching and learning focuses on UK domiciled students only. In other words, we assume that all UK domiciled students will enter the UK labour market upon graduation, and that non-UK students will leave the UK upon completing their qualifications at the University of Southampton.

[34] We received HESA data on a total of **9,190** first-year students from the University of Southampton. Of these, we excluded **2** students whose gender was recorded as 'Other' and **4,190** non-UK domiciled students (who are instead considered as part of the analysis of **educational exports** (Section 4)).

[35] 'Other undergraduate' learning includes Certificates of Higher Education and other undergraduate-level diplomas and certificates. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, taught work for credit at postgraduate level, and other certificates, diplomas, and qualifications at postgraduate level.

Figure 4   UK domiciled students in the 2020-21 cohort of University of Southampton students, by level of study

Note: All numbers are rounded to the nearest 5, and the total values may not add up due to this rounding. 'Other undergraduate' learning includes Certificates of Higher Education and other undergraduate-level diplomas and certificates. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, taught work for credit at postgraduate level, and other certificates, diplomas, and qualifications at postgraduate level.
Source: London Economics' analysis based on University of Southampton HESA data

In relation to **mode of study** (Figure 5), **4,585** (**92%**) students in the cohort were undertaking their studies with the University of Southampton on a full-time basis, while the remaining **405** (**8%**) were enrolled on a part-time basis. As shown in Table 10, the majority of full-time students were undertaking first degrees (**76%**) or postgraduate taught degrees (**11%**). The majority of part-time students in the cohort were enrolled in postgraduate degrees with **44%** undertaking postgraduate taught degrees, **42%** undertaking other postgraduate degrees and **12%** undertaking other postgraduate learning.

Figure 5   UK domiciled students in the 2020-21 cohort of University of Southampton students, by mode of study
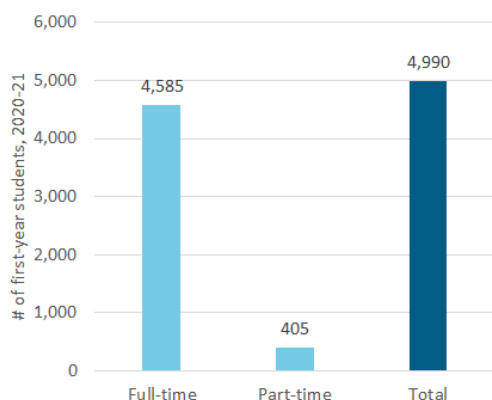
Note: All numbers are rounded to the nearest 5, and the total values may not add up due to this rounding.
Source: London Economics' analysis based on University of Southampton HESA data

Figure 6   UK domiciled students in the 2020-21 cohort of University of Southampton students, by domicile
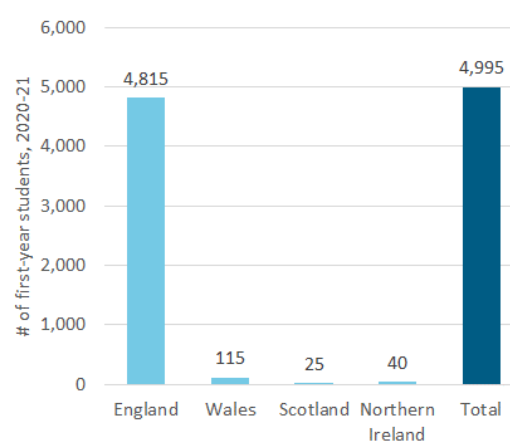
Note: All numbers are rounded to the nearest 5, and the total values may not add up due to this rounding.
Source: London Economics' analysis based on University of Southampton HESA data

In terms of **domicile** (Figure 6), the majority (**4,815, 97%**) of UK domiciled students in the cohort were from England, with the remaining **180** (**3%**) students domiciled outside of England (including **115** students from Wales, **25** from Scotland, and **40** from Northern Ireland).

Table 10 **UK domiciled students in the 2020-21 cohort of University of Southampton students, by level of study, mode, and domicile**

| Level and mode of study	Domicile				
	England	**Wales**	**Scotland**	**Northern Ireland**	**Total**
Full-time					
Other undergraduate	0	0	0	0	**0**
First degree	3,350	85	5	25	**3,470**
Other postgraduate	325	5	0	0	**330**
Higher degree (taught)	490	10	5	0	**505**
Higher degree (research)	265	10	5	0	**280**
Total	**4,430**	**110**	**20**	**30**	**4,585**
Part-time					
Other undergraduate	10	0	0	0	**10**
First degree	5	0	0	0	**5**
Other postgraduate	165	0	0	0	**170**
Higher degree (taught)	160	5	5	5	**180**
Higher degree (research)	50	0	0	0	**50**
Total	**385**	**5**	**10**	**5**	**405**
Total					
Other undergraduate	10	0	0	0	**10**
First degree	3,355	85	5	25	**3,470**
Other postgraduate	490	5	5	5	**500**
Higher degree (taught)	650	15	10	10	**685**
Higher degree (research)	310	10	5	0	**330**
Total	**4,815**	**115**	**25**	**40**	**4,995**

Note: All numbers are rounded to the nearest 5, and the total values may not add up due to this rounding. 'Other undergraduate' learning includes Certificates of Higher Education and other undergraduate-level diplomas and certificates. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, taught work for credit at postgraduate level, and other certificates, diplomas, and qualifications at postgraduate level.
Source: London Economics' analysis based on University of Southampton HESA data

3.2   Adjusting for completion rates

The previous section provided an overview of the number of UK-domiciled students *starting* qualifications or modules at the University of Southampton in the 2020-21 academic year. However, to aggregate individual-level impacts of the University of Southampton's teaching and learning activity, it is necessary to adjust the number of 'starters' to account for **completion rates**.

To achieve this, we used information provided by the University of Southampton on the completion outcomes of University of Southampton students - broken down by study mode, study intention, and study completion[36]. In other words, these completion data include the number of students who completed their intended qualification (or module); completed a different (usually lower) qualification; or discontinued their studies without being awarded a qualification (modelled as completion at 'other undergraduate' level (for students who originally enrolled in first degrees or

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[36] Note that, for consistency with our above definition of 'other undergraduate' students, we combined the original separate data for undergraduate-level credits and other undergraduate learning into a single category (and proceeded similarly for postgraduate-level credits and other postgraduate learning).
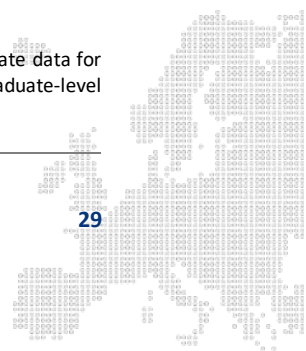
other undergraduate qualifications) or 'other postgraduate' level (for students who originally intended to complete higher degrees or other postgraduate qualifications)[37]).

Table 11 presents the resulting completion rates applied throughout the analysis. We assume that, of those students starting a full-time first degree at the University of Southampton in 2020-21, **96%** complete the first degree as intended, while the remaining **4%** undertake one or more of the credits/modules associated with their degree before discontinuing their studies (modelled as completion at 'other undergraduate' level). At postgraduate level, we assume that of those individuals starting a full-time postgraduate taught degree, **98%** complete the qualification as intended, while the remaining **2%** undertake one or more of the credits/modules associated with the intended degree before dropping out (in this case, modelled as completion at 'other postgraduate' level). For those individuals starting a full-time postgraduate research degree, approximately **97%** complete the qualification as intended, approximately **3%** complete a postgraduate taught degree with the remainder completing at 'other' postgraduate level. In all of these cases, **the analysis of the impact of teaching and learning calculates the estimated returns associated with the *completed* qualification/standalone module(s)**.

Table 11   Assumed completion rates of University of Southampton students

Completion outcome	Study intention				
	Other undergraduate	First degree	Other postgraduate	Higher degree (taught)	Higher degree (research)
Full-time students					
Other undergraduate	100%	4%	-	-	-
First degree	-	96%	-	-	-
Other postgraduate	-	-	100%	2%	3%
Higher degree (taught)	-	-	-	98%	-
Higher degree (research)	-	-	-	-	97%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
Part-time students					
Other undergraduate	100%	45%	-	-	-
First degree	-	55%	-	-	-
Other postgraduate	-	-	100%	27%	5%
Higher degree (taught)	-	-	-	73%	-
Higher degree (research)	-	-	-	-	95%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Totals may not sum due to rounding.

Source: London Economics' analysis based on information on the completion outcomes of the cohorts of students provided by the University of Southampton

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[37] In other words, we assume that students who discontinued their studies were assumed to at least complete one or several standalone modules associated with their intended qualification, so that these students' completion outcomes were modelled as either completion at 'other undergraduate' or 'other postgraduate' level. As a result, the total assumed completion rates sum up to 100%.

3.3 Defining the returns to higher education qualifications

The fundamental objective of the analysis of the impact of the University of Southampton's teaching and learning activities is to estimate the **gross and net graduate premium** to the individual and the **gross and net public purse benefit** to the Exchequer associated with higher education qualification attainment, defined as follows (and presented in Figure 7):

- The *gross* graduate premium associated with qualification attainment is defined as the **present value of enhanced after-tax earnings** (i.e. after income tax, National Insurance and VAT are removed, and following the deduction of any foregone earnings during study) relative to an individual in possession of the counterfactual qualification;

- The *gross* benefit to the public purse is defined as the **present value of enhanced taxation** (i.e. income tax, National Insurance and VAT, following the deduction of the costs of foregone tax earnings during study) relative to an individual in possession of the counterfactual qualification;

- The *net* graduate premium is defined as the gross graduate premium *minus* the present value of the direct costs associated with qualification attainment; and

- Similarly, the *net* benefit to the public purse is defined as the gross public purse benefit minus the direct Exchequer costs of provision during the period of attainment.

Figure 7   Overview of gross and net graduate premium, and gross and net Exchequer benefit
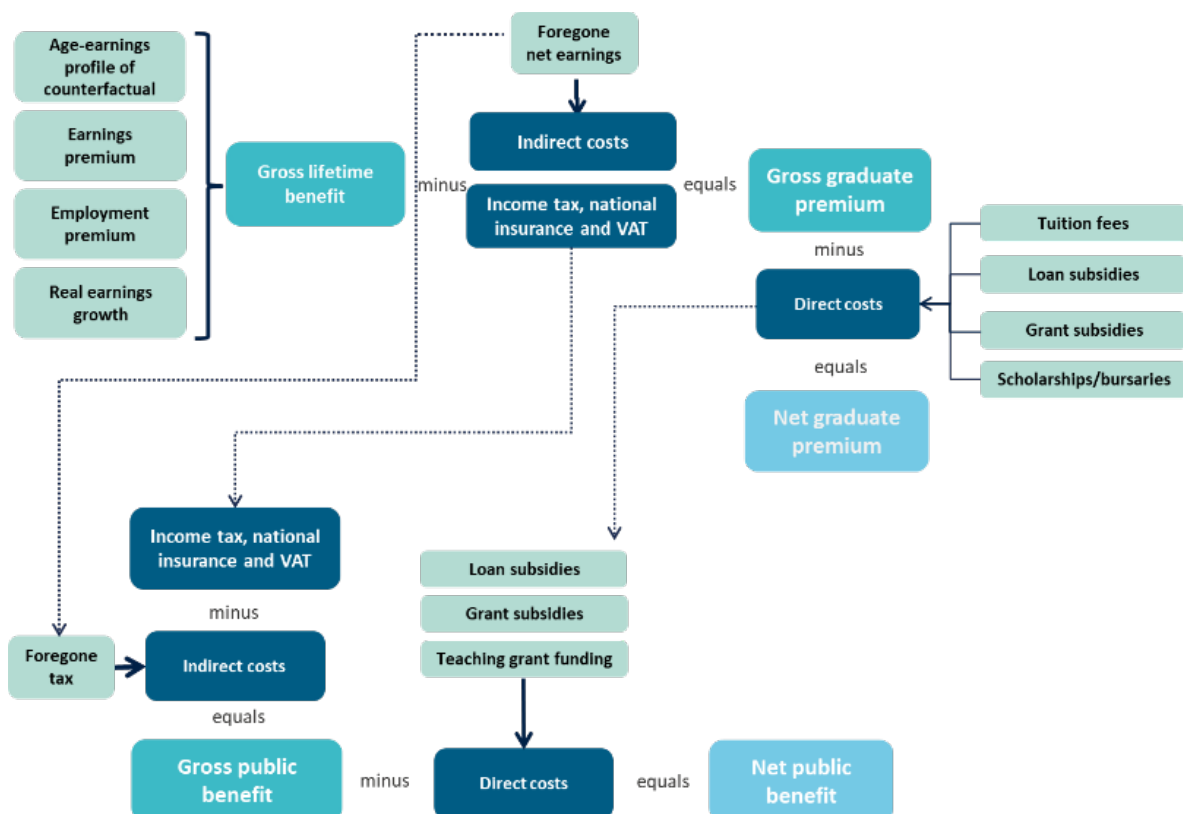
Source: London Economics' analysis based on Department for Business, Innovation and Skills (2011a)

3.4 Estimating the returns to higher education qualifications

3.4.1 Estimating the gross graduate premium and gross public purse benefit

To measure the economic benefits to higher education qualifications, we estimate the **labour market value associated with particular education qualifications**, rather than simply assessing the labour market outcomes achieved by individuals *in possession* of a higher education qualification. The standard approach to estimating this labour market value is to undertake an **econometric analysis** where the 'treatment' group consists of those individuals in possession of the qualification of interest, and the 'counterfactual' group consists of those individuals with comparable personal and socioeconomic characteristics but with the next highest level of qualification. The rationale for adopting this approach is that the comparison of the earnings and employment outcomes of the treatment group and the counterfactual group 'strips away' those other personal and socioeconomic characteristics that might affect labour market earnings and employment (such as gender, age, or sector of employment), leaving just the labour market gains attributable to the qualification itself (see Figure 8 for an illustration of this). The treatment and counterfactual groups, and details of the econometric approach, are presented in Annex A2.2.1 and A2.2.2, respectively.

Figure 8 Estimating the gross graduate premium and gross Exchequer benefit
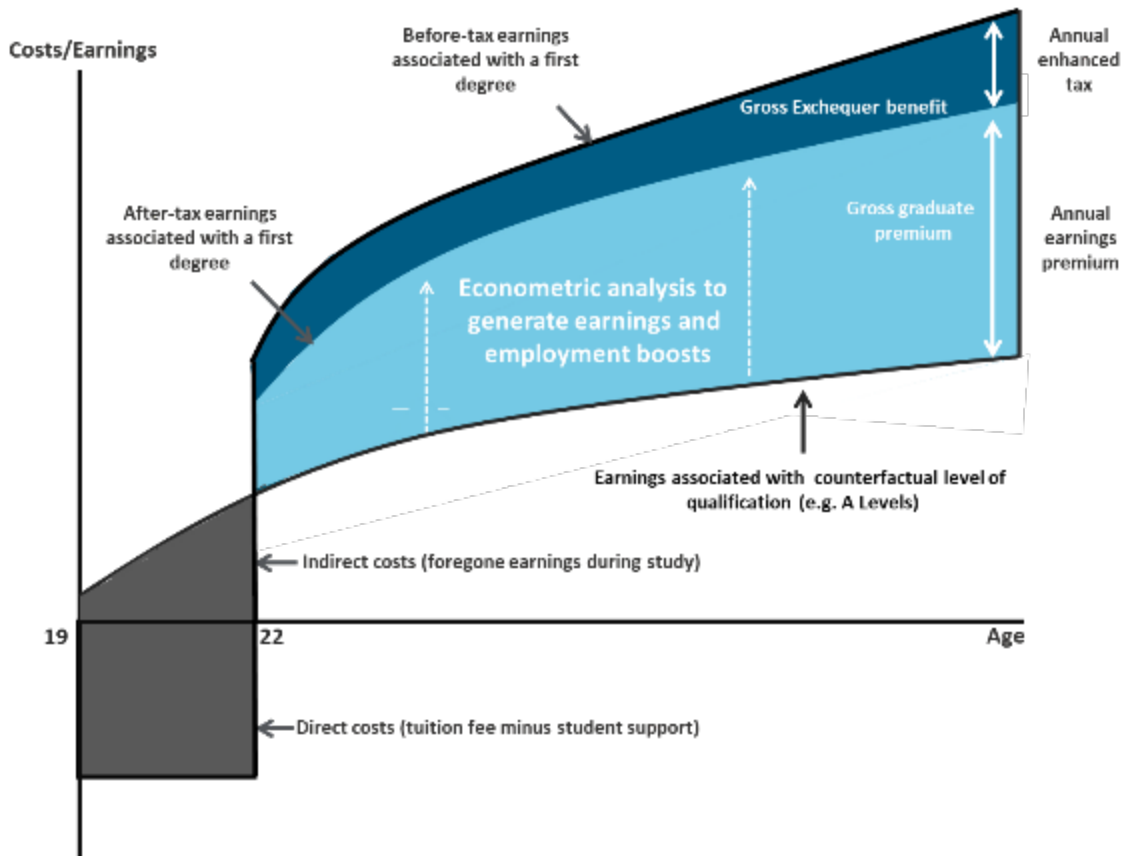
Note: The analysis assumes that the opportunity costs of foregone earnings associated with higher qualification attainment are applicable to full-time students only. For part-time students, we have assumed that these students are able to combine work with their academic studies and as such, do not incur any opportunity costs in the form of foregone earnings. This illustration is based on an analysis of University of Southampton's student cohort data for 2020-21, where the mean age at enrolment for full-time first degree students stands at 19, and we have assumed that a full-time first degree requires 3 years to complete. ***Source: London Economics***

Throughout the analysis, the assessment of earnings and employment outcomes associated with higher education qualification attainment (at all levels) is undertaken separately by **gender**, reflecting the different labour market outcomes between men and women. Further, the analysis is

undertaken **by subject** to illustrate the fact that there is significant variation in post-graduation labour market outcomes depending on the subject of study, but also to reflect the specific subject composition of students studying at the University of Southampton. In addition, given the fact that part-time students generally undertake and complete higher education qualifications later in life than full-time students, the analysis for part-time students applies a '**decay function**' to the returns associated with qualification attainment, to reflect the shorter period of time in the labour market[38].

To estimate the **gross graduate premium**, based on the econometric results, we then estimate the **present value of the enhanced post-tax earnings** of individuals in possession of different higher education qualifications (i.e. after income tax, National Insurance and VAT are removed, and following the deduction of foregone earnings) relative to an individual in possession of the counterfactual qualification (see Annex A2.2.4 for more detail[39]).

The **gross benefits to the Exchequer** from the provision of higher education are derived from the enhanced taxation receipts that are associated with a higher likelihood of being employed, as well as the enhanced earnings associated with more highly skilled and productive employees. Based on the analysis of the lifetime earnings and employment benefits associated with higher education qualification attainment, and combined with administrative information on the relevant taxation rates and bands (from HM Revenue and Customs), we estimated the **present value of additional income tax, National Insurance and VAT associated with higher education qualification attainment** (by gender, level of study, mode of study, and prior attainment). Again, please refer to Annex A2.2.4 for more detailed information on the calculation of the gross Exchequer benefit.

3.4.2   Estimating the net graduate premium and net public purse benefit

The difference between the gross and net graduate premium relates to **students' direct costs** of qualification acquisition[40]. These direct costs refer to the **proportion of the tuition fee paid by the student**[41] net of any **tuition fee support** or **maintenance support** provided by the Student Loans Company (SLC, for students from England and Wales and Northern Ireland) or the Students Awards Agency for Scotland (SAAS, for students from Scotland)[42] and minus any **fee waivers or bursaries**

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[38] See Annex A2.2.3 for more information.

[39] In terms of prior attainment, for **25** students in the 2020-21 cohort of UK domiciled students, previous attainment levels were specified as either 'Mature student admitted on basis of previous experience and/or admissions test ', 'Other qualification level not known', or 'Not known'. For these students, we imputed their prior attainment level using a group-wise imputation approach based on the most common prior attainment among students undertaking qualifications at the same level, separately by study mode.

[40] Note again that the *indirect* costs associated with qualification attainment, in terms of the foregone earnings during the period of study (for full-time students only), are already deducted from the gross graduate premium.

[41] We made use of information provided by the University of Southampton on the average **tuition fees** charged to students at the University of Southampton in the 2020-21 academic year, separately by domicile, study mode, and study level (with data provided for all undergraduate students combined, postgraduate (taught) students, and postgraduate (research) students (and we assume that students undertaking learning at 'other postgraduate' level are included in the postgraduate (taught) category)). The fees per *part-time* student were calculated using a separate data source provided by the University of Southampton, which contained average fee per student for both full-time and part-time students. The average fee per full-time student was multiplied by the ratio of full-time to part-time fees from the other data source to arrive at average fee per part-time student. Postgraduate research student part-time fees were assumed to have the same ratio as postgraduate taught part-time students. Other postgraduate fees were assumed to be the same as postgraduate taught fees.

The average **study intensity** was calculated based on HESA data provided by the University of Southampton relating to its 2020-21 cohort of students, where we divided the number of students in the cohort (in FTE terms) by the corresponding number of students (headcount terms), separately by study mode, study level (undergraduate (combined), higher degree (taught), higher degree (research), and students at 'other postgraduate level').

[42] The analysis makes use of average levels of support paid per student, separately by study mode, study level (i.e. undergraduate, higher degree (taught) and higher degree (research) (and we assume that no funding is available for students undertaking qualifications at 'other postgraduate' level)), and domicile. Our estimates are based on publications by the SLC on student support for higher education in England, Wales, and Northern Ireland in 2020-21 (see Student Loans Company 2021a, 2021b and 2021c, respectively) and a publication by the Student Awards Agency for Scotland on student support for higher education in Scotland (see Student Awards Agency for Scotland, 2021). To ensure comparability across the different Home Nations, we focus only on core student support in terms of tuition fee grants,

provided by the University of Southampton itself[43]. In this respect, the student benefit associated with tuition fee loan or maintenance loan support equals the **Resource Accounting and Budgeting charge** (RAB charge)[44], capturing the proportion of the loan that is not repaid. Given the differing approach to public support funding for students from each of the UK Home Nations, the direct costs incurred by students were assessed separately for students from England, Wales, Scotland, and Northern Ireland [45].

The **direct costs**[46] **to the public purse** include the **teaching grant funding** administered by the Office for Students (OfS)[47], the **student support** provided in the form of maintenance/fee grants (where applicable), and the **interest rate or write-off subsidies** that are associated with maintenance and tuition fee loans (i.e. the RAB charge). Again, the analysis tailors the cost of student support to the student's specific Home Nation of domicile.

These direct costs associated with qualification attainment to both students and the Exchequer (by qualification level, study mode and Home Nation domicile) are calculated from start to completion of a student's learning aim. Throughout the analysis, to ensure that the economic impacts are computed in **present value** terms (i.e. in 2020-21 money terms), all benefits and costs occurring at points in the future were **discounted** using the standard HM Treasury Green Book real discount rate of **3.5%** (see HM Treasury, 2022).

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tuition fee loans, maintenance grants and maintenance loans (where applicable), but exclude any Disabled Students' Allowance and other targeted support. Wherever possible, we focus on the average level of support for students in public providers only, for the most recent cohorts possible, split by domicile (i.e. 'Home' vs. EU). Furthermore, and again wherever possible, we adjusted the average levels of fee and maintenance loans for average loan take-up rates available from the same sources.

[43] Average fee waivers and other bursaries per student were calculated based on information provided by the University of Southampton on the total amount of scholarships, fee waivers and other bursaries provided to students by the University of Southampton in 2020-21, by level of study. The information on total funding was then combined with HESA data provided by the University of Southampton in terms of the total number of full-time students enrolled with the University of Southampton in 2020-21 (again by domicile and level), to arrive at an estimate of the average fee waiver/bursary funding per student per year, by level and domicile.

[44] For **undergraduate full-time** students, we have assumed a RAB charge of **31%** associated with tuition fee and maintenance loans for English domiciled students (based on data published by the Department for Education (2022)), approximately **26%** for Welsh domiciled students (based on information provided by the Welsh Government), **31%** for Scottish domiciled students (see Audit Scotland (2020)), **26%** for Northern Irish students (assumed to be the same as for Wales given the similar loan balance) and **31%** for EU students (assumed to be the same as for English domiciled students). For **undergraduate part-time students**, based on the same sources, we have assumed a RAB charge of **33%** for English domiciled students, approximately **36%** for Welsh domiciled students, **0%** for Northern Irish domiciled students (given that these students have a very small loan balance) and **33%** for EU domiciled students (again, assumed to be the same as for English domiciled students). There is currently no student loan funding provided to Scottish domiciled undergraduate part-time students (so no RAB charge assumptions are required).

For the (relatively recently introduced) loans for **postgraduate taught students** from England, Wales and Northern Ireland (and for EU students studying in England), we have assumed a RAB charge of **0%** for both full-time and part-time students (based on the Department for Education's (2022) student loan forecasts for Master's loans for English students). There were no postgraduate loans available for Scottish students studying outside Scotland.

Finally, for (full-time and part-time) **postgraduate research students** from England, Wales and the EU, we assumed a RAB charge of **19%** (again based on based on Department for Education (2022)). There were no Doctorate loans available for Scottish domiciled or Northern Irish domiciled students.

[45] Note that, in some instances, the total financial support provided to students (through tuition fee loans and grants, maintenance loans and grants, and fee waivers/other bursaries (where applicable)) *exceeds* the costs of their University of Southampton tuition fees – i.e. the net graduate premium *exceeds* the gross graduate premium per student. For example, this is the case for Welsh domiciled students undertaking full-time other undergraduate qualifications at the University of Southampton in 2020-21, which is driven by the maintenance funding received by these students (in terms of loans for English domiciled students, and grants for Welsh domiciled students). This results in the net graduate premium being (slightly) higher than the gross graduate premium (see the results presented in Table 26 and Table 27Table 27 in Annex A2.2.5).

[46] Again, any indirect costs to the public purse in terms of foregone income tax, National Insurance and VAT receipts foregone during the period of qualification attainment (applicable to full-time students only) are already incorporated in the gross public purse benefits as described above.

[47] This is based on published HESA financial information on the total OfS recurrent teaching grant received by the University of Southampton in 2020-21 (see HESA, 2020a), divided by the total number of students enrolled with the University of Southampton in 2020-21 (excluding any non-EU-domiciled students and higher degree (research) students (i.e. it is assumed that there is no teaching funding associated with these students)). We again adjusted for the average assumed study intensity among full-time and part-time students, to arrive at separate rates of teaching grant funding by study mode.

Deducting the resulting individual and Exchequer costs from the estimated gross graduate premium and gross public purse benefit, respectively, we arrive at the estimated **net graduate premium** and **net public purse benefit** per student.

3.5 Estimated net graduate premium and net Exchequer benefit

Table 12 presents the net graduate premiums and net Exchequer benefits achieved by English-domiciled students[48] undertaking qualifications at the University of Southampton in the 2020-21 cohort (by study mode, on average across men and women[49]).

> **The net graduate premium for a representative full-time first degree English-domiciled student stands at £86,000.**

The analysis indicates that the **net graduate premium** achieved by a representative[50] English-domiciled undergraduate student in the 2020-21 cohort completing a **full-time first degree** at the University of Southampton (with GCE 'A' Levels or equivalent as their highest level of prior attainment) is approximately **£86,000** in today's money terms. At postgraduate level, the net (post)graduate premiums for a representative[51] student completing a full-time postgraduate taught or postgraduate research degree at the University of Southampton (relative to a first degree) stand at approximately **£59,000** and **£40,000**, respectively.

Table 12   Net graduate premium and net Exchequer benefit per English domiciled student at the University of Southampton, by study level and mode

Level of study	Net graduate premium		Net public purse benefit	
	Full-time students	**Part-time students**	**Full-time students**	**Part-time students**
Other undergraduate[1]	£26,000	£29,000	£27,000	£18,000
First degree[1]	£86,000	-	£91,000	-
Other postgraduate[2]	£26,000	£31,000	£36,000	£34,000
Higher degree (taught)[2]	£59,000	£55,000	£68,000	£58,000
Higher degree (research)[2]	£40,000	£72,000	£84,000	£78,000

Note: All estimates constitute weighted averages across men and women (weighted by the estimated number of student completers in the 2020-21 cohort) and are presented in 2020-21 prices, discounted to reflect net present values and rounded to the nearest £1,000. Gaps may arise where there are no students in the 2020-21 University of Southampton cohort expected to complete the given qualification (of the given characteristics).
[1] Net graduate premiums and net public purse benefits associated with qualifications at 'other undergraduate' and first degree level are estimated relative to possession of GCE 'A' Levels.
[2] Net graduate premiums and net public purse benefits associated with qualifications at 'other postgraduate', higher degree (taught) and higher degree (research) level are estimated relative to the possession of first degrees.
Source: London Economics' analysis

There are also substantial **net graduate premiums** for **part-time** students. For instance, the estimate for a representative student completing a part-time postgraduate taught degree (again relative to a first degree) stands at approximately **£55,000** (compared to **£59,000** for full-time students), while the estimate for part-time postgraduate research degrees stands at **£72,000** (compared to **£40,000**

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[48] The full set of net graduate premiums and net Exchequer benefits for all domiciles (as well as study levels, study modes, and prior attainment levels) is presented in Annex A2.2.5A2.2.5.
[49] For a breakdown of the results by gender, again see Annex A2.2.5.
[50] The analysis is based on an average age at graduation of 22 for students undertaking full-time first degrees at the University of Southampton in the 2020-21 cohort (also see Annex A2.2.3 for further information).
[51] This is based on an average age at graduation in the 2020-21 cohort of 25 for full-time higher degree (taught) students and 29 for full-time higher degree (research) students.

for full-time students). The fact that part-time students tend to complete their studies later in life[52] (resulting in fewer years spent in the labour market post-graduation) results in a reduction in the net graduate premiums for part-time students compared to full-time students. However, it is assumed that part-time students are able to combine work with their academic studies and thus do not incur any *opportunity costs* in the form of foregone earnings, which results in increased net graduate premiums relative to full-time students. Depending on which of these effects dominates, the net graduate premiums for part-time students can be either lower or higher than the net graduate premiums achieved by full-time students.

> **The net public purse benefit associated with a representative full-time first degree English-domiciled student stands at £91,000.**

In terms of the benefits to the public purse, the **net Exchequer benefit** for a representative English-domiciled **full-time** first degree student (again with GCE 'A' levels or equivalent as their highest level of prior attainment) stands at approximately **£91,000** in 2020-21 money terms. Reflecting the lower level of public subsidy associated with postgraduate qualifications, the net Exchequer benefits for a representative student completing a full-time postgraduate taught or postgraduate research degree (relative to a first degree) were estimated at approximately

£68,000 and **£84,000**[53], respectively.

Again, there are also substantial net Exchequer benefits associated with **part-time students**. For instance, the net Exchequer benefits for a representative part-time student from England undertaking a postgraduate taught degree or postgraduate research degree (relative to a first degree) stand at approximately **£58,000** and **£78,000** (respectively).

3.6 Total impact of the University of Southampton's teaching and learning activities

Combining the information on the number of UK domiciled students in the 2020-21 University of Southampton cohort, expected completion rates, and the net graduate and public purse benefits associated with the different qualification levels (relative to students' specific prior attainment), the analysis estimates that the **aggregate economic benefit of the University of Southampton's teaching and learning activities** associated with the 2020-21 cohort in the UK stands at approximately **£682 million**.

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[52] Again, see Annex A2.2.3 for more information.

[53] Compared to corresponding net graduate premium for postgraduate research degree students (**£40,000**), the relatively large net Exchequer benefit (**£84,000**) reflects the limited direct costs (in terms of public funding) and low indirect costs (in terms of foregone taxation during study) associated with these qualifications.
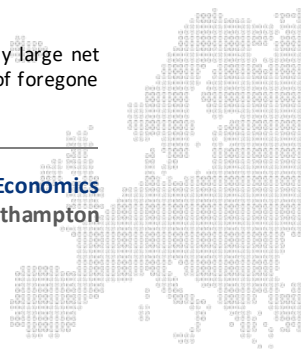
The total economic impact of teaching and learning generated by the 2020-21 cohort of University of Southampton students stands at £682 million.

This total impact is split approximately equally between students and the Exchequer, with **£319 million** (**47%**) of the economic benefit accrued by students undertaking qualifications at University of Southampton, and the remaining **£362 million** (**53%**) accrued by the Exchequer. In terms of study level, **84%** (**£575 million**) of the estimated economic impact is generated by the University of Southampton's undergraduate students, with the other **14%** (**£107 million**) generated by the University of Southampton's postgraduate students. In terms of domicile, **97%** (**£658 million**) of the estimated economic benefit is associated with students from England, while the remaining **3%** (**£24 million**) is generated by students from other Home Nations.

Table 13   Aggregate impact of the University of Southampton's teaching and learning activities associated with the 2020-21 cohort (£m), by type of impact, domicile, and level of study

Beneficiary and study level	Domicile				
	England	**Wales**	**Scotland**	**Northern Ireland**	**Total**
Students	**£308m**	**£8m**	**£1m**	**£2m**	**£319m**
Undergraduate	£267m	£8m	£1m	£2m	£278m
Postgraduate	£40m	£1m	£0m	£0m	£42m
Exchequer	**£350m**	**£8m**	**£1m**	**£3m**	**£362m**
Undergraduate	£288m	£7m	£1m	£2m	£297m
Postgraduate	£63m	£1m	£1m	£1m	£65m
Total	**£658m**	**£16m**	**£2m**	**£5m**	**£682m**
Undergraduate	£555m	£14m	£1m	£4m	£575m
Postgraduate	£103m	£2m	£1m	£1m	£107m

Note: All estimates are presented in 2020-21 prices, discounted to reflect net present values, rounded to the nearest £1m, and may not add up precisely to the totals indicated.
Source: London Economics' analysis

It is important to emphasise that these impacts are associated with the 2020-21 cohort of students only. Depending on the size and composition of subsequent cohorts of the University of Southampton students, a comparable estimate of the economic impact associated with teaching and learning activities would be associated with each successive cohort of starters (depending on the prevailing labour market conditions at the time).
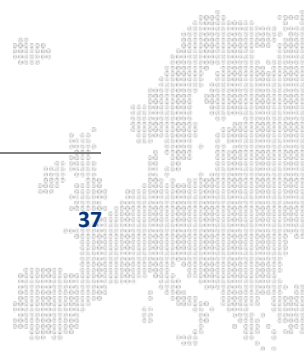
Launching the careers of student entrepreneurs

Future Worlds is the University of Southampton's on-campus start-up accelerator. Its team supports aspiring student and staff entrepreneurs who want to change the world with their ideas, enabling them to launch a start-up or spin-out. Members of this start-up community benefit from one-to-one support for aspiring founders, along with mentoring, workshops, pitching opportunities and introductions to its network of high-net-worth mentors and investors.

From PhD student to acclaimed start-up founder

Using groundbreaking technology developed during her PhD in Deep Learning at the University of Southampton, Dr Iris Kramer, an archaeologist-turned-computer-scientist, has launched a celebrated space technology startup — ArchAI.

ArchAI uses revolutionary software to leverage artificial intelligence (AI) from satellites, enabling archaeological sites to be automatically detected. This can accelerate the lengthy and expensive planning processes for construction projects and save historical sites from unnecessary destruction by automating archaeological assessments and making the process safer.

Iris was part of Future Worlds' 2020-2021 Founders Cohort. This intensive programme is a free opportunity for a limited number of founders who are ready to accelerate their start-up idea. It supports them to validate their start-up idea and go-to-market strategy through focused sprints designed to enable them to set and reach their own goals. Through the programme, founders can continuously refine their value proposition to get ready to pitch to the Future Worlds network of multi-millionaire angel investors and vice presidents of businesses at the exclusive Investor Demo Day hosted by the University of Southampton.

Through this Dragons' Den style pitching event Iris secured a valuation of £770,000 and an investment of £70,000 from investors for her world-first Deep Learning tool in 2020. This was the biggest valuation in the event's history, allowing Iris to focus on product development and sales and marketing to transform the £34bn global environmental assessments market.

In 2021, ArchAI secured funding through Research England's Space Research and Innovation Network for Technology (SPRINT) programme. This gave Iris the opportunity to increase her team and further develop the software in collaboration with University of Southampton researchers in Archaeology and Electronics and Computer Science. Further funding from the European Space Agency Business Innovation Centre (ESA BIC) has allowed ArchAI to move to the ESA BIC UK Harwell Campus to work alongside the most innovative Space start-ups in the country.

Over the past year, ArchAI has landed both the National Trust and the Forestry Commission as clients and Iris is working with stakeholders from the archaeological community to consider how ArchAI's services could be made available on-demand at a national scale. The Future Worlds alumna has been named on the prestigious Forbes 30 Under 30 Europe 2022 list for Science & Healthcare.
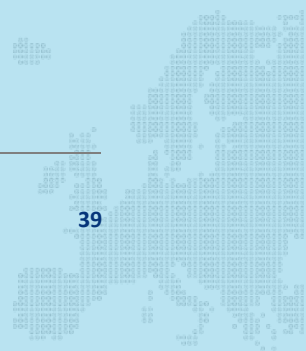
4   The impact of the University of Southampton's educational exports

With the United Kingdom being an attractive destination for many overseas students, the higher education sector is a tradeable industry with imports and exports like any other tradeable sector.

In this part of the analysis, we focus on the impact of educational exports through the injection of overseas funding into the UK generated by the University of Southampton. In particular, we analyse overseas income in the form of tuition fee spending (net of any Exchequer costs) and non-tuition fee (off-campus) expenditures by international (EU and non-EU domiciled) students in the 2020-21 cohort of University of Southampton students, over the entire course of their studies[54]. The analysis estimates the **direct, indirect, and induced economic impacts** associated with this export income, defined as follows:

- **Direct effect:** This is captured by the level of (net) fee income (accrued by the University of Southampton itself) and non-fee income (accrued by other organisations providing goods and services to international students) associated with non-UK students in the 2020-21 cohort.

- **Indirect effect ('supply chain impacts'):** The University of Southampton and local businesses providing other goods and services to international students spend their income on purchases of goods and services from their suppliers, which in turn use this revenue to buy inputs (including labour) to meet these demands. This results in a chain reaction of subsequent rounds of spending across industries, often referred to as a 'ripple effect'.

- **Induced effect ('wage spending impacts'):** The employees of the University of Southampton (supported by its tuition fee income) and of companies providing goods and services to the University of Southampton's international students use their wages to buy consumer goods and services. This in turn generates wage income for employees within the industries producing these goods and services, again leading to subsequent rounds of spending, i.e. a 'ripple effect' throughout the economy as a whole[55].

In this section, we outline our estimates of the direct, indirect, and induced impacts associated with the University of Southampton's export income. In line with the other strands of impact, the analysis focuses on the 2020-21 academic year. As with the impact of the University's knowledge exchange activities, these impacts can be measured in terms of economic output, gross value added, and (full-time equivalent) employment.

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[54] Note that other types of export income accrued directly by the University of Southampton (such as research income from international sources, or any other income received from non-UK sources) are taken account of in our analysis of the impact of the University of Southampton's research activity (Section 2) and the impact of the expenditures of the University of Southampton (Section 5), and are thus excluded from the analysis of exports to avoid double-counting.

[55] Our analysis excludes any similar direct, indirect, and induced effects associated with the non-fee expenditures of *UK* domiciled students. In this respect, we (conservatively) assume that these expenditures are *not* additional to the UK economy (i.e. that they would likely have occurred even if these students had not enrolled in programmes at the University of Southampton). The economic impact associated with UK students' tuition fee expenditures is instead (implicitly) included in the estimated direct, indirect, and induced impacts associated with the University of Southampton's own expenditures (see Section 5).

4.1 The 2020-21 cohort of international University of Southampton students

Figure 9, Figure 10, and Figure 11 present information on the number of non-UK domiciled students included in the 2020-21 cohort of University of Southampton students (by domicile, mode of study, and level of study, respectively).

In terms of domicile (Figure 9), of the total of **4,185** international students starting higher education qualifications at the University of Southampton in 2020-21, **540** (**13%**) were domiciled within the European Union, while **3,645** (**87%**) were from non-EU countries. In terms of study mode (Figure 10), the majority of international students in the cohort (**4,150, 99%**) were undertaking their qualifications on a full-time basis, with the remaining **35** (**1%**) studying on a part-time basis.

In terms of study level (Figure 11), in contrast to UK domiciled students (see Section 3.1), the majority of non-UK domiciled students in the cohort were undertaking postgraduate qualifications (**3,380**, **81%**), including **3,085** (**74%**) enrolled in postgraduate taught degrees, **260** students (**6%**) undertaking postgraduate research degrees, and **35** (**1%**) undertaking other postgraduate learning. At undergraduate level, there were **805** (**19%**) students undertaking first degrees, while there were no non-UK domiciled students enrolled in other undergraduate learning[56] in the cohort.

Figure 9   Non-UK domiciled students in the 2020-21 cohort of University of Southampton, by domicile
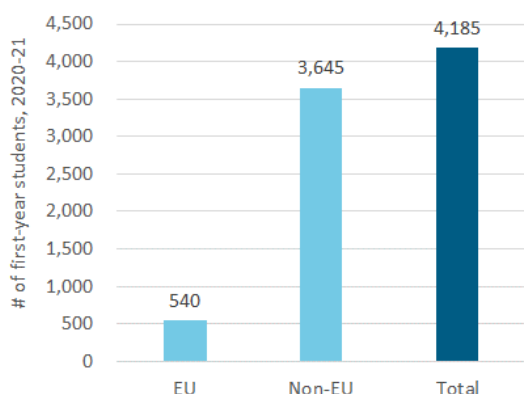
Note: All numbers are rounded to the nearest 5, and the total values may not add up precisely due to this rounding.
Source: London Economics' analysis based on the University of Southampton's HESA data

Figure 10   Non-UK domiciled students in the 2020-21 cohort of University of Southampton students, by study mode
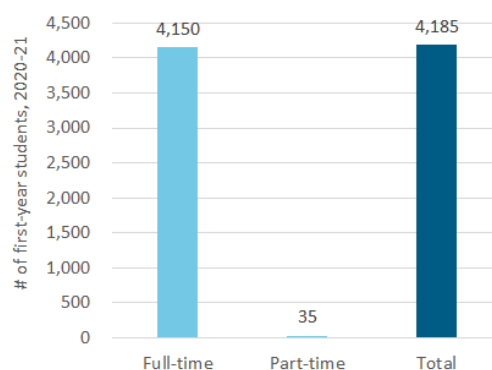
Note: All numbers are rounded to the nearest 5, and the total values may not add up precisely due to this rounding.
Source: London Economics' analysis based on the University of Southampton's HESA data

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[56] For more detailed information on the University of Southampton's 2020-21 cohort of non-UK domiciled students, please refer to Annex A2.3.1.

Figure 11   Non-UK domiciled students in the 2020-21 cohort of University of Southampton students, by level of study
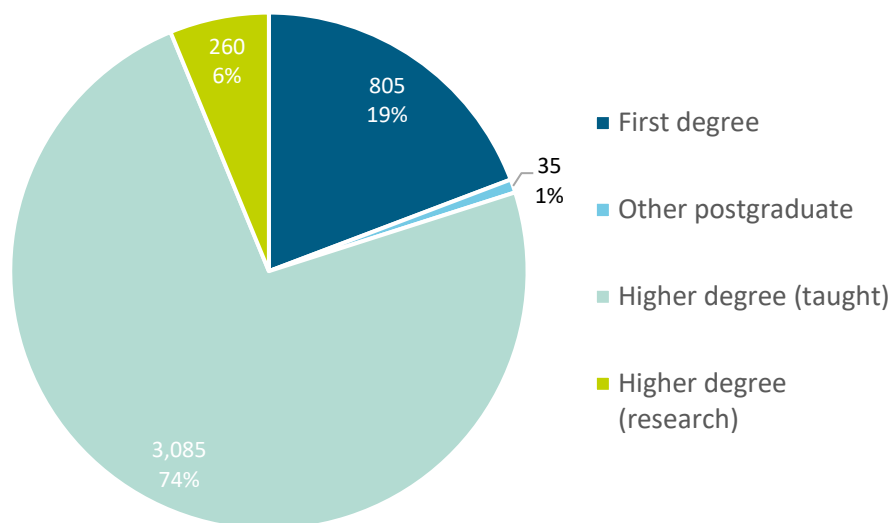
Note: All numbers are rounded to the nearest 5, and the total values may not add up precisely due to this rounding.
Source: London Economics' analysis based on the University of Southampton's HESA data

4.2   Changes in the number of international students at the University of Southampton over time

Alongside the analysis of the 2020-21 cohort of non-UK domiciled *first-year* students, we have also examined the trends in the University of Southampton's *entire* non-UK[57] student body over the past decade (i.e. academic years 2010-11 to 2020-21).

With the University of Southampton being a highly popular destination for international students, there has been an increase in the number of non-UK domiciled students enrolled at the University of Southampton over the last decade, increasing from **5,360** students in 2010-11 to **6,735** students in 2020-21. This has resulted in an increase in the proportion of the University of Southampton's students that are from non-UK domiciles over the period, from **23%** in 2009-10 to **31%** in 2020-21 (see Figure 12).

In terms of the breakdown of these non-UK students by domicile (Figure 13), the overall increase in international students was predominantly driven by an increase in students from non-EU domiciles (**3,905** in 2010-11 to **5,140** in 2020-21), with a relatively smaller increase in students from EU domiciles (**1,455** in 2010-11 to **1,595** in 2020-21). This has resulted in a slight increase in the number of non-EU domiciled students as a proportion of the total non-UK-domiciled student population, from **73%** in 2010-11 to **76%** in 2020-21.

The increase in the number of international students studying at the University of Southampton occurred across both undergraduate and postgraduate students (Figure 13), with the number of non-UK undergraduate students increasing from **2,290** in 2010-11 to **2,660** in 2020-21, and the number of non-UK postgraduate students rising from **3,070** in 2010-11 to **4,075** in 2020-21. With relatively stronger growth at postgraduate level, there has been a slight increase in the proportion of non-UK domiciled students undertaking postgraduate as compared to undergraduate qualifications, increasing from **57%** in 2010-11 to **61%** in 2020-21.

Figure 12   Total students at the University of Southampton, 2010-11 to 2020-21, by domicile
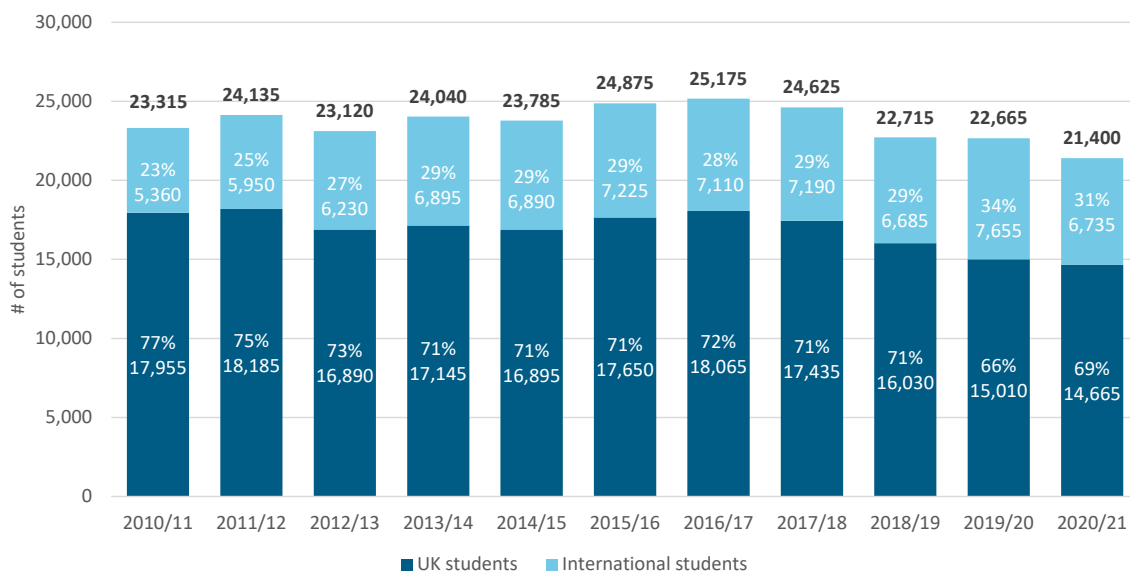
Source: London Economics' analysis based on HESA (2011, 2012, 2013, 2014, 2015 and 2021)

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[57] Non-UK refers to individuals not domiciled in the UK, including both EU (excluding UK) and non-EU international students.

Figure 13   Non-UK domiciled students at the University of Southampton, 2010-11 to 2020-21, by level of study and domicile
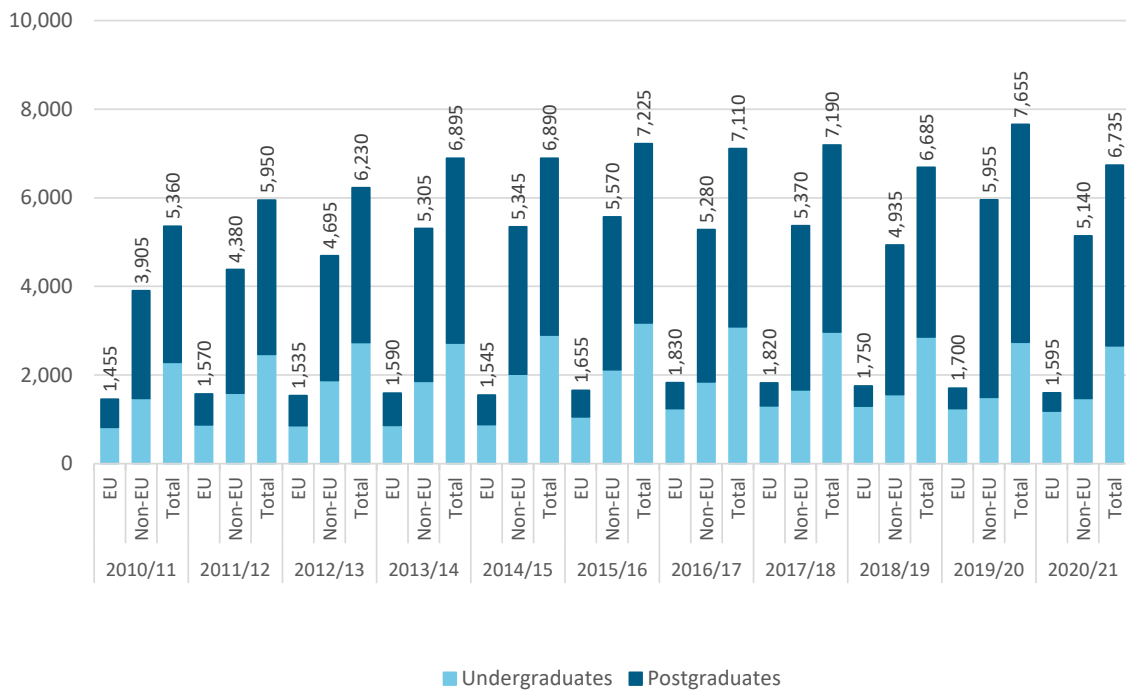
Source: London Economics' analysis based on HESA (2011, 2012, 2013, 2014, 2015 and 2021)

4.3   Direct impact

4.3.1   Net tuition fee income

To assess the level of *gross tuition fee income* associated with international students in the 2020-21 cohort, we made use of data on average tuition fees charged by the University of Southampton in 2020-21 (by study level, mode, and domicile[58]). Assuming the same average study durations as in the analysis of the impact of the University of Southampton's teaching and learning activities (see Section 3), we calculated the resulting tuition fee income per international student in the cohort from the start of a student's learning aim until completion. Expressing the total income until completion in 2020-21 prices and using the HM Treasury Green Book real discount rate of 3.5% (see HM Treasury, 2022), we arrived at an estimate of the gross tuition fee income per student (in present value terms over the total study duration).

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[58] As in the analysis of the University of Southampton's teaching and learning activities (see Section 3), we used information provided by the University of Southampton on average tuition fees per *full-time* student charged by the University of Southampton in 2020-21, separately by domicile (i.e. UK, EU, and non-EU students), study mode, and study level. The fees per *part-time* student were calculated using a separate data source provided by the University of Southampton, which contained average fee per student for both full-time and part-time students. The average fee per full-time student was multiplied by the ratio of full-time to part-time fees from the other data source to arrive at average fee per part-time student. Postgraduate research student part-time fees were assumed to have the same ratio as postgraduate taught part-time students. Other postgraduate fees were assumed to be the same as postgraduate taught fees.
The average study intensity was estimated separately by qualification level and calculated by dividing the number of part-time students in the cohort in full-time equivalents by the number of students in terms of headcount (again based on HESA data provided by the University of Southampton).

To calculate the *net tuition fee income* per student, we then deducted the costs to the UK Exchequer associated with funding higher education for EU-domiciled students studying in England[59]. These Exchequer costs include the subsidies associated with the tuition fee support provided by the Student Loans Company, in terms of:

■ The RAB charge on **tuition fee loans provided to eligible EU domiciled full-time and part-time undergraduate students**;

■ The RAB charge on **Master's and Doctorate loans provided to eligible EU full-time and part-time postgraduate students**; and

■ The **recurrent teaching grant funding** paid to the University of Southampton in relation to the provision of teaching to EU domiciled students (by the Office for Students)[60].

In addition to these public purse costs, we also deducted any **fee waivers and bursaries** paid to international students by the University of Southampton itself[61]. Again, all of these costs were calculated over students' total study duration and estimated in present value terms[62].

Combining the estimates per student with information on the number of non-UK students in the 2020-21 cohort, and using the same assumptions on completion rates as for UK domiciled students (as part of the analysis of the impact of teaching and learning (see Section 3.2)), we arrived at estimates of the total net tuition fee income associated with EU and non-EU students in the 2020-21 cohort of University of Southampton students. As presented in Figure 14, the **total net tuition fee income** generated by international students in the cohort was estimated at **£116 million**, of which **£7 million** was generated by **EU students**, and **£109 million** was generated by **non-EU students**.

Figure 14   Aggregate net tuition fee income associated with international students in the 2020-21 cohort, by domicile (£m)
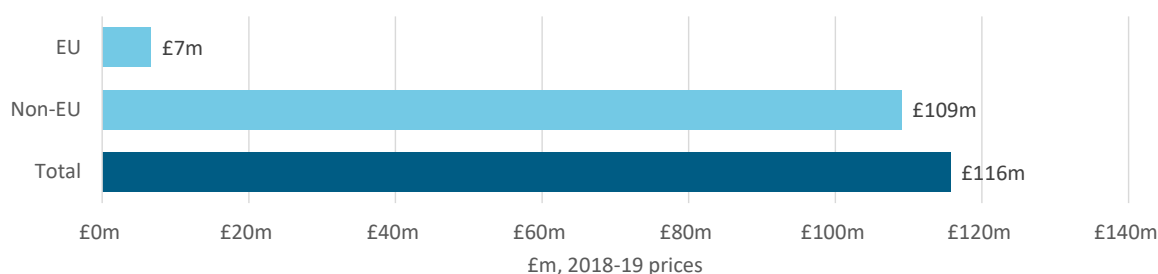
Note: All estimates are presented in 2020-21 prices, discounted to reflect net present values, and rounded to the nearest £1m. Values may not add up precisely to the totals due to rounding.
Source: London Economics' analysis

4.3.2   Non-fee income

In addition to tuition fees, the UK economy benefits from export income from overseas students' **non-tuition fee (i.e. living cost) expenditures** incurred during their studies at University of Southampton. These costs include:

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[59] Note that there is no such Exchequer funding associated with non-EU students.
[60] For more information on our assumptions in relation to public student support and recurrent teaching grants, please refer to Section 3.4.2.
[61] Again, see Section 3.4.2 for more information on our assumptions in relation to fee waivers and bursaries.
[62] For information on the estimated levels of net fee income per student, please refer to Annex A2.3.2.

- **Accommodation costs** (e.g. rent costs, council tax, household bills etc.);
- **Subsistence costs** (e.g. food, entertainment, personal items, non-course travel etc.);
- **Direct course costs** (e.g. course-related books, subscriptions, computers etc.);
- **Facilitation costs** (e.g. course-related travel costs); and
- **Spending on children** (including childcare that is not related to students' course participation).

The level of non-tuition fee expenditure by overseas students is often found to be greater than their tuition fee expenditure[63], making these living cost expenditures a significant component of the UK's export income from international students coming to study at UK higher education institutions.

To analyse the level of non-tuition fee expenditure associated with the 2020-21 cohort of international students studying at the University of Southampton, we used estimates from the **2014-15 Student Income and Expenditure Survey** (SIES)[64]. The survey provides estimates of the average expenditures of English domiciled undergraduate students (studying in England or Wales) on living costs, housing costs, participation costs (including tuition fees) and spending on children, separately for full-time and part-time students. For the purpose of this analysis, we made the following adjustments to the 2014-15 SIES estimates:

- We excluded estimates of **tuition fee expenditure** (to avoid double-counting with the analysis presented in Section 4.3.1).

- We deducted any **on-campus expenditure** that students might incur (to avoid double-counting with the analysis of the impacts of the expenditure of the University of Southampton itself (see Section 5))[65].

- Since the SIES results do not provide expenditure estimates for non-UK domiciled students, our analysis implicitly assumes that non-tuition fee expenditure levels do not vary significantly between UK and international students. We do however adjust the SIES estimates for the longer **average stay durations** in the UK of non-EU students compared to EU students[66].

- We further adjusted the estimates for any **foregone subsistence expenditures in the UK due to international students returning to their home countries during the Covid-19 pandemic** (and due to the suspension of in-person teaching across UK universities). Specifically, we assume that 50% of full-time students in the 2020-21 cohort returned home during the second and third terms of the 2020-21 academic year[67, 68]. We assume that, during this time, these students did not incur any subsistence expenditure in the UK (e.g. on food, entertainment, etc.), but still incurred all other types of non-fee spending in the

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[63] See Department for Business, Innovation and Skills (2011b).

[64] See Institute for Employment Studies & National Centre for Social Research (2018). At the time of writing, estimates for a more recent academic year were not available.

[65] Specifically, following the approach undertaken by Oxford Economics (2017) in analysing the collective economic impact of all UK higher education institutions in 2014-15, we assume that **10%** of students' non-tuition fee expenditures are spent on campus (i.e. are accrued as income by University of Southampton itself).

[66] These adjustments are based on the approach outlined by the Department for Business, Innovation and Skills (2011b) in estimating the value of educational exports to the UK economy. For more information, please refer to Annex A2.3.3.

[67] In other words, we assume that due to the Covid-19 pandemic, the subsistence expenditures of full-time international students in the 2020-21 cohort were 33% lower in 2020-21 (i.e. 50% x 67%) than would otherwise have been the case.

[68] We assume that international part-time students in the cohort did *not* leave the UK due to the pandemic, given that part-time students typically combine their studies with work in the labour market. In addition, any full-time students with an assumed one-year study duration (including postgraduate taught degrees, 'other postgraduate' qualifications, and 'other undergraduate' qualifications) are not affected by these assumptions (since they are assumed to have completed their studies in the 2020-21 academic year). As a result, the majority of students in the 2020-21 cohort of the University of Southampton students are not impacted by these Covid-19 adjustments.

UK listed above (e.g. we assume that these students were still liable to pay any accommodation costs in the UK).

■ Finally, we **inflated** the estimates to 2020-21 prices[69].

Similar to tuition fees, we then calculated the non-tuition fee expenditure over the entire duration of students' higher education courses (and discounted to reflect present values). The resulting estimates provide the total average (off-campus) non-fee expenditure per student in 2020-21 prices, by level of study, mode, and domicile[70].

Again combining the estimated non-tuition fee income per student with the number of international students in the 2020-21 cohort expected to complete qualifications (or credits/modules) at the University of Southampton, the **total (off-campus) non-tuition fee expenditure** associated with international students in the 2020-21 cohort was estimated at **£82 million** (Figure 15). Of this total, **£17 million** was associated with **EU students**, whereas **£65 million** was generated by **non-EU students** in the cohort.

Figure 15   Aggregate non-fee income associated with international students in the 2020-21 cohort, by domicile (£m)
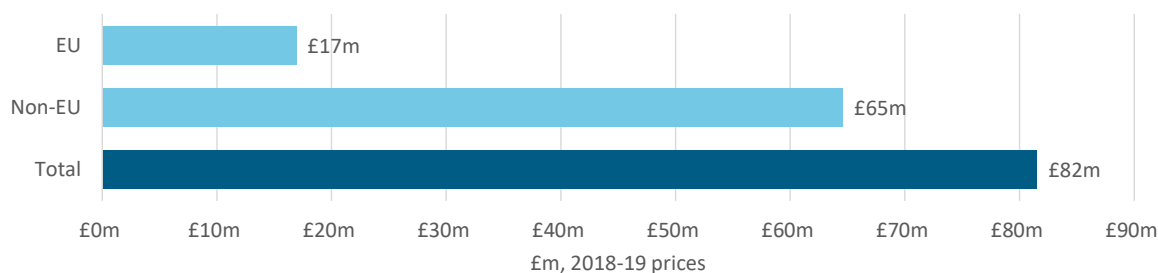
Note: All estimates are presented in 2020-21 prices, discounted to reflect net present values, and rounded to the nearest £1m. Values may not add up precisely to the totals due to rounding.
Source: London Economics' analysis

4.3.3   Total direct impact

Combining the above estimates of (net) fee and non-fee income, the total direct economic impact of the expenditures of international students in the 2020-21 University of Southampton cohort (in economic output terms) was estimated at **£197 million** (Figure 16). Slightly under half of this total (**£82 million**) was generated from international students' non-tuition fee spending, while just over a half (**£116 million**) was generated from international students' tuition fees accrued by the University of Southampton (net of any public costs of provision or fee waivers/bursaries provided by the University of Southampton). In terms of student domicile, the majority of this impact (**£174 million**, **88%**) was generated by non-EU domiciled students, while **£24 million** (**12%**) was associated with EU students.

In addition to economic output (i.e. export income), it was possible to convert the above estimates into gross value added and the number of full-time equivalent jobs supported[71]. We thus estimate

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[69] Inflation estimates are based on Consumer Price Index inflation estimates provided by the Office for National Statistics (2021).

[70] For information on the estimated levels of non-tuition fee income per student, please refer to Annex A2.3.4.

[71] To estimate the direct GVA and employment associated with the (net) tuition fee income generated by the University of Southampton's international students, we multiplied this income by the average ratio of GVA to output and FTE employees to output within the South East's government, health, and education sector as a whole (again based on the above-described multi-regional Input-Output model). To estimate the direct GVA and employment associated with the non-tuition fee income generated by the University of Southampton's international students, we instead multiplied this income by the average ratio of GVA to output and FTE employees to output associated

that the export income generated by international students in the 2020-21 University of Southampton cohort directly generates **£116 million** in GVA (**£69 million** from international (net) fee income and **£47 million** from non-fee income), and supports **1,935 full-time equivalent jobs** (**1,395** from (net) tuition fee income and **540** from non-tuition fee income[72]).

Figure 16   Total direct impact associated with non-UK students in the 2020-21 University of Southampton cohort, by type of impact

Output, £m
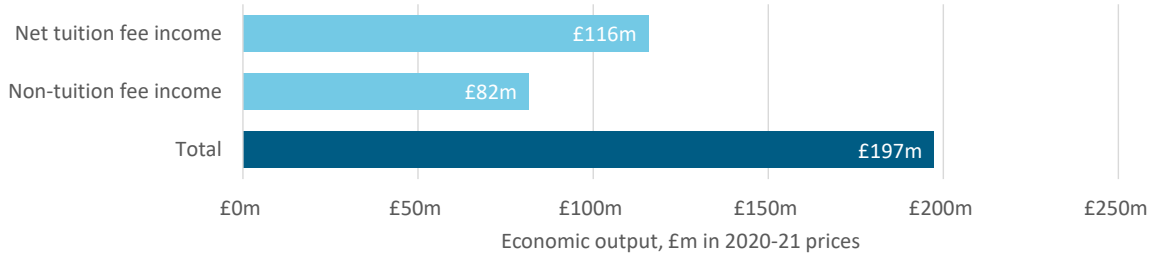
GVA, £m
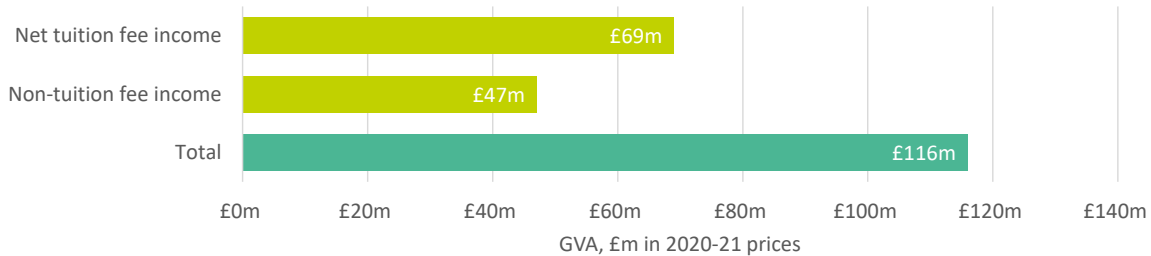
FTE employment
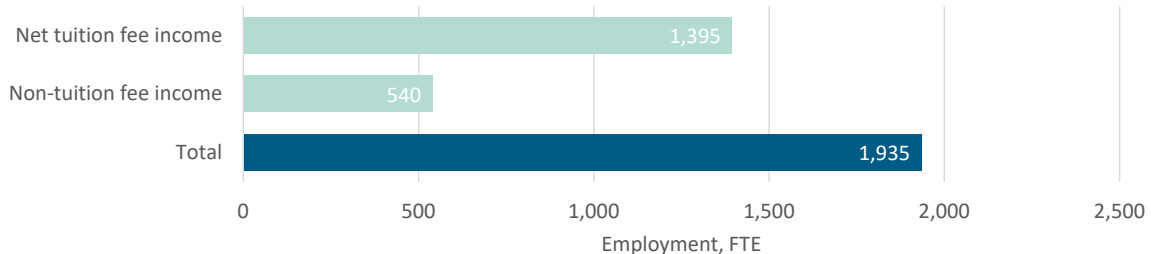
Note: All monetary estimates are presented in 2020-21 prices, discounted to reflect net present values, and rounded to the nearest £1m. Values may not add up precisely to the totals due to rounding. The employment figures are rounded to the nearest 5.
Source: London Economics' analysis

4.4   Total economic impact associated with the University of Southampton's educational exports

To estimate the total (direct, indirect, and induced) economic impact associated with the export income generated by international students studying at the University of Southampton, we used economic multipliers derived from the above-described multi-regional Input-Output model,

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with the expenditure of households located in the South East (again based on the multi-regional Input-Output model). In other words, we assume that the non-tuition fee expenditures of the University of Southampton's international students support the same levels of GVA and employment (in relative/proportionate terms) as the expenditure of households located in the South East more generally.
[72] The difference in direct employment supported by international students' tuition fee vs. non-tuition fee income is driven by the fact that the underlying ratio of FTE employees to output within the South East's government, health, and education sector is considerably larger than the corresponding ratio for sectors producing consumer goods and services purchased by households located in the South East (e.g. including the real estate or production sectors).

estimating the extent to which the direct export income generates additional activity throughout the UK economy. Specifically, we applied two types of multipliers to the above-described tuition fee and non-tuition fee income associated with international students in the 2020-21 cohort, including:

- **Multipliers relating to international tuition fee income (accrued by the University of Southampton itself)**: The multipliers used to estimate the impact of the University of Southampton's international tuition fee income were calculated based on the inter- and intra-industry flows of goods and services for the South East's government, health, and education sector as a whole[73].

- **Multipliers relating to income from international students' (off-campus) non-tuition fee expenditures**: These were calculated based on the final consumption expenditure patterns of households located in the South East[74], and subsequently applied to the estimated off-campus non-tuition fee expenditures of overseas students in the 2020-21 cohort of University of Southampton students.

Again, these multipliers are expressed in terms of **economic output**, **gross value added**, and (full-time equivalent) **employment**, and are calculated as **total multipliers**, capturing the aggregate impact on all industries in the UK economy arising from an initial injection relative to that initial injection.

Table 14 presents the economic multipliers applied to the income generated by international students at the University of Southampton (in terms of the impact on the South East and the UK economy as a whole)[75]. In terms of economic output, the analysis assumes that every £1 million of **tuition fee expenditure** incurred by international students generates an *additional* **£1.71 million** of impact throughout the UK economy, of which **£0.71 million** is generated in the South East. In addition, we assume that every £1 million of **non-fee expenditure** incurred by international students generates an *additional* **£1.72 million** of impact throughout the UK, of which **£0.77 million** is located in the South East.

Table 14   Economic multipliers associated with the income from international students in the 2020-21 cohort of University of Southampton students

Location of impact and type of income	Output	GVA	FTE employment
Tuition fee income			
South East	1.71	1.61	1.40
Total UK	2.71	2.51	2.06
Non-fee income			
South East	1.77	1.72	1.74
Total UK	2.72	2.62	2.85

Note: All multipliers constitute Type II multipliers, defined as [Direct + indirect + induced impact]/[Direct impact].
Source: London Economics' analysis

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[73] This approach is based on the fact that the tuition fee income from international students is accrued by the University of Southampton itself. In other words, we assume that the expenditure patterns of the University of Southampton are the same as for other institutions operating in the South East's government, health, and education sector. Specifically, we apply these multipliers to the *gross* tuition fee income generated by international students in the 2020-21 University of Southampton cohort, and then deduct the Exchequer/University of Southampton's cost of provision (i.e. public teaching grants, public student support, and University of Southampton fee waivers and bursaries) to arrive at the *net* direct, indirect and induced impact associated with this income.

[74] In other words, for the purpose of applying relevant economic multipliers, we assume that international students studying at the University of Southampton have similar expenditure patterns as households in the South East more generally. To estimate these multipliers, we inserted a separate vector into the multi-regional Input-Output model, capturing the estimated final demand (again by industry and region) of households located in each region.

[75] While the table presents the multipliers for the impacts on the South East and the UK as a whole, a full breakdown of the total impacts across all regions (as well as by sector) is provided in Figure 17.
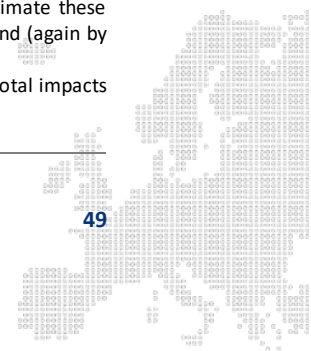
Applying these multipliers to the above direct economic impacts[76], we estimate that the total economic impact on the UK generated by the (net) tuition fee income and non-tuition fee income associated with international students in the 2020-21 University of Southampton cohort amounts to **£553 million** of **economic output** (see top panel of Figure 17):

> **The impact of the export income generated by the 2020-21 University of Southampton cohort stood at £553 million.**

- In terms of the breakdown by type of income from international sources, **£331 million** of this impact was associated with international students' (net) **tuition fees**, and **£222 million** was associated with these students' **non-tuition fee expenditures** over the duration of their studies at the University of Southampton.

- In terms of the breakdown by region, the majority of this impact (**£354 million**, **64%**) was generated in the **South East region**, with the remaining **£199 million** (**36%**) occurring in **other regions** across the UK.

- In terms of sector, the tuition fee and non-tuition fee income generated from the University of Southampton's international students generated particularly large impacts within the **government, health, and education sector** (**£158 million** (**29%**), given that the cohort's tuition fee income is accrued as income by the University of Southampton itself). In addition, there are relatively large impacts felt within the **distribution, transport, hotel, and restaurant sector** (**£98 million**, **18%**), the **production sector** (**£76 million**, **14%**), and the **real estate industry** (**£218 million**, **13%**)[77].

The impact in terms of gross value added was estimated at **£305 million** across the UK economy as a whole (with **£198 million** generated within the South East), while the corresponding estimates in terms of employment stood at **4,550 full-time equivalent jobs** across the UK as a whole, with **2,990 jobs** supported across the South East.

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[76] Again, in terms of tuition fee income, note that we apply the relevant multipliers to the *gross* tuition fee income generated by international students in the 2020-21 University of Southampton cohort, and then deduct the Exchequer/University of Southampton cost of provision (i.e. public teaching grants, public student support, and University of Southampton fee waivers and bursaries) to arrive at the *net* direct, indirect and induced impact associated with this income.

[77] Again, for more detail on what industries are included in this high-level sector classification, please refer to Table 20 in Annex A2.1.

Figure 17 **Total economic impact associated with international students in the 2020-21 University of Southampton cohort, by region and sector**

By region

Output, £m

Region	Value
North East	£7m
North West	£18m
Yorkshire & the Humber	£15m
East Midlands	£15m
West Midlands	£17m
East of England	£21m
London	£61m
South East	£354m
South West	£17m
Wales	£8m
Scotland	£13m
Northern Ireland	£5m
Total	£553m

Economic output, £m

GVA, £m

Region	Value
North East	£5m
North West	£10m
Yorkshire & the Humber	£8m
East Midlands	£9m
West Midlands	£10m
East of England	£12m
London	£26m
South East	£198m
South West	£10m
Wales	£6m
Scotland	£8m
Northern Ireland	£4m
Total	£305m

GVA, £m

FTE employment

Region	Value
North East	80
North West	150
Yorkshire & the Humber	140
East Midlands	145
West Midlands	155
East of England	180
London	275
South East	2,990
South West	155
Wales	100
Scotland	115
Northern Ireland	65
Total	4,550

# of full-time equivalent employees

By sector

Output, £m

Sector	Value
Agriculture	£4m
Production	£76m
Construction	£16m
Distr., transport, hotels & restaurants	£98m
Information & communication	£24m
Financial & insurance	£36m
Real estate	£72m
Professional & support activities	£49m
Government, health & education	£158m
Other services	£20m
Total	£553m

Economic output, £m

GVA, £m

Sector	Value
Agriculture	£2m
Production	£26m
Construction	£6m
Distr., transport, hotels & restaurants	£51m
Information & communication	£13m
Financial & insurance	£16m
Real estate	£56m
Professional & support activities	£28m
Government, health & education	£95m
Other services	£12m
Total	£305m

GVA, £m

FTE employment

Sector	Value
Agriculture	60
Production	300
Construction	75
Distr., transport, hotels & restaurants	1,065
Information & communication	140
Financial & insurance	140
Real estate	105
Professional & support activities	580
Government, health & education	1,900
Other services	170
Total	4,550

# of full-time equivalent employees

Note: Monetary estimates are presented in 2020-21 prices, discounted to reflect net present values, rounded to the nearest £1 million, and may not add up precisely to the totals indicated. Employment estimates are rounded to the nearest 5, and again may not add up precisely to the totals indicated. *Source: London Economics' analysis*

5 The impact of the University of Southampton's expenditures

Much of the existing literature on the economic impact of higher education institutions focuses (almost exclusively) on the **direct, indirect, and induced impact** of universities. Analyses of these impacts consider universities as economic units creating output within their local economies by purchasing products and services from their suppliers and hiring employees. Similar to the impact of the University's knowledge exchange activities (see Section 2.2) and the impact of the University of Southampton's educational exports (see Section 4) , the direct, indirect, and induced economic impacts of a university's expenditures are defined as follows:

- **Direct effect**: This considers the economic output generated by the University of Southampton itself, by purchasing goods and services (including labour) from the economy in which it operates.

- **Indirect effect**: The University of Southampton's purchases generate income for the supplying industries, which they in turn spend on their own purchases from suppliers to meet the University of Southampton's demands. This again results in a chain reaction of subsequent rounds of spending across industries, i.e. a 'ripple effect'.

- **Induced effect**: The employees of the University of Southampton and of businesses operating in the University of Southampton's supply chain use their wages to buy consumer goods and services within the economy. This in turn generates wage income for employees within the industries producing these goods and services, who then spend their own income on goods and services – leading to a further 'ripple effect' throughout the economy as a whole.

In this section, we outline our estimates of the direct, indirect, and induced impacts associated with the operational and capital expenditures of the University of Southampton. In line with the other strands of impact, the analysis focuses on the 2020-21 academic year. As with the impact of the University's knowledge exchange activities and the impact of the University of Southampton's educational exports, these impacts can be measured in terms of economic output, gross value added, and (full-time equivalent) employment.

5.1 Direct impact of the University of Southampton's expenditures

To measure the direct economic impact of the purchases of goods, services, and labour by the University of Southampton, we used information on the University of Southampton's operational expenditures (including staff and non-staff spending), capital expenditures, as well as the number of staff employed (in terms of full-time equivalent employees), for the 2020-21 academic year[78].

Based on this, in terms of monetary economic **output** (measured in terms of expenditure), **the direct economic impact** associated with the University of Southampton's expenditures stood at approximately **£561 million** in 2020-21 (see Figure 18). This includes **£329 million** current

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[78] Based on staff data published by the Higher Education Statistics Agency (see HESA (2020a) and HESA (2020c)) and financial data from the University of Southampton's financial statement.

expenditure on staff related costs, **£194 million** current expenditure on other (non-staff) operating expenses[79], as well as **£37 million** of capital expenditure incurred in that academic year.

Figure 18   Direct economic impact (in terms of output) of the University of Southampton's expenditure in 2020-21, by type of expenditure
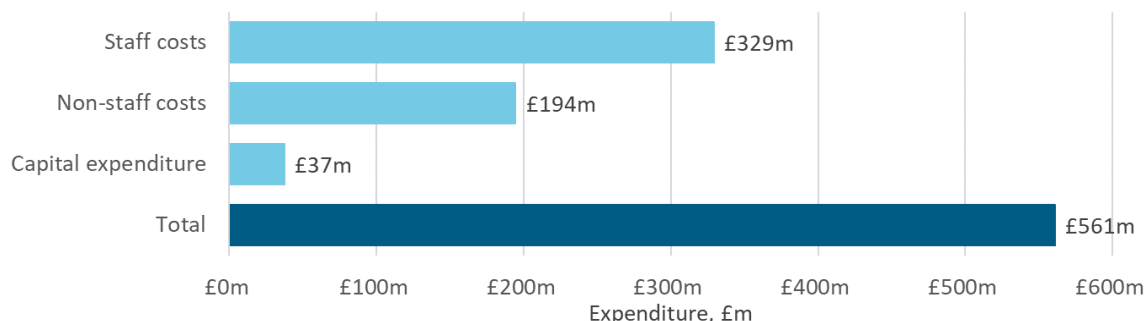
Note: We exclude a total of **£29 million** of non-staff costs associated with depreciation, and -**£7 million** of staff costs associated with movements in pension provisions, as it is assumed that these are not relevant from a procurement perspective (i.e. these costs are not accounted for as income by other organisations). All estimates are presented in 2020-21 prices, and rounded to the nearest £1m.
Source: London Economics' analysis based on HESA (2020a) and data provided by the University of Southampton

In addition to these total expenditures, we investigated the **geographical breakdown** of the University of Southampton's procurement expenditures, residential addresses of staff and staff expenditure, to demonstrate the breadth of the University of Southampton's impact across the South East and the rest of the UK.

Figure 19 presents the distribution of the University of Southampton's procurement expenditures (based on invoice data for 2020-21) by postcode. The map illustrates a clear concentration of procurement expenditure in the **South East** (approximately **45% of expenditure**) and **London** (approximately **17% of expenditure**)[80]. Although these two regions account for approximately three-fifths of the University of Southampton's procurement expenditure, the University of Southampton also spends significant amounts on goods and services from suppliers in other regions, including the **South West** (**10%**), the **East of England** (**9%**), and the **East Midlands** (**5%**).

In addition to the analysis of the University of Southampton's procurement expenditure, Figure 20 and Figure 21 illustrate the distribution of the University of Southampton's staff by number and expenditure (respectively) based on the outward postcode area of employees' home address. The maps again show a large concentration of staff and staff expenditure around the University of Southampton (approximately **83% of staff are based in the South East**), as would be expected, but also dispersion around the **South West** (approximately **8%**) and **London** (approximately **4%**).

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[79] The total current operational expenditure (excluding capital expenditure) of the University of Southampton in 2020-21 stood at **£546 million**. From this, for the purpose of the analysis, we excluded **£29 million** in depreciation costs (from non-staff expenditure) and -**£7 million** in movements in pension provisions (from staff expenditure), as it is assumed that these are not relevant from a procurement perspective (i.e. these costs are not accounted for as income by other organisations). This results in operational expenditure of **£523 million** in 2020-21.
[80] It is likely that the data overestimates the level of procurement expenditure occurring in London as compared to other regions, since the invoice data would reflect suppliers' head office locations, rather than reflecting the location where these activities took place.

Partnering to deliver an innovative testing service during the COVID-19 crisis

The Hampshire and Isle of Wight Saliva Testing Programme was designed to assess the feasibility of population-scale regular saliva testing to reduce the transmission of COVID-19 and enable the safe easing of restrictions on society in the period before vaccines became widely available. The government-funded programme was led by a partnership between the University of Southampton, Southampton City Council, and the local NHS, alongside a wider Hampshire network of public services.

Lighting the way with LAMP

An emerging technology known as 'Reverse Transcriptase Loop-mediated Isothermal Amplification' (LAMP or RT-LAMP) was used for the programme. It offered advantages over other methods for COVID-19 testing, such as Lateral Flow Tests (LFTs) and Polymerase Chain Reaction (PCR or RT-PCR) tests. This test required people to collect saliva only, avoiding invasive nose and throat swabs. Crucially, it made it easy for people to do at it home or at work without involving a health professional. It was more sensitive than LFTs and was quicker and cheaper to process than PCRs.

A rapid scale-up

The programme was delivered in three phases. Phase 1 (21 May 2020–14 August 2020) was a small-scale pilot that showed LAMP's effectiveness and accuracy. Over 9,500 individuals who worked at the University, the local Council, and Solent NHS Healthcare Trust took part, producing over 20,000 tests in total.

Phase 2 (14 September 2020–31 October 2020) broadened the scope of the first pilot phase. It included staff, students, and contractors at four schools (infant, junior, primary, and secondary) serving less advantaged areas of the city, as well as the University of Southampton. It showed the feasibility, acceptability and usefulness of saliva testing within the education sector, with over 27,000 tests conducted.

The third and final phase (28 October 2020–31 March 2022) expanded to cover the local population of Hampshire and the Isle of Wight. A total of 663,403 samples were processed, with the LAMP technique detecting 819 positive cases.

Collaboration and engagement in challenging circumstances

The Hampshire and Isle of Wight Saliva Testing Programme brought together leading interdisciplinary expertise from the University of Southampton's Faculties of Medicine,

Environmental and Life Sciences, Engineering and Physical Sciences and Social Sciences. They worked alongside local government leaders and public health teams, NHS clinical leaders from University Hospital Southampton and Hampshire Hospitals NHS Trusts, central government bodies and leading companies in the diagnostics, automation, production, and scientific sectors. Within just 18 months the programme moved from concept to service. It delivered a scalable service model capable of processing over 50,000 tests per day.

Strong engagement with stakeholders and participants was central to the success of the programme. The programme worked with stakeholders in local education settings, first response organisations, and the Council to ensure participants understood how to take part and feedback on the testing process. This was challenging as many of these individuals did not have their own corporate email addresses, and in-person briefings had to adhere to social distancing guidelines. A detailed stakeholder analysis was conducted in partnership with leads from each group to understand the motivations and behaviours of participants and how best to engage with them.

One successful outcome of this approach was the relationship built with the participating schools. The University of Southampton's 'LifeLab' designed and delivered multilingual educational and engagement materials for primary and secondary school students and their parents, together with continuing professional development for school staff. The resources were co-created with students and staff from the Aspire community group of nine Southampton schools and used in over 200 schools regionally and in other schools nationally, including schools providing for students with special educational needs and disabilities.

Confidence for businesses and the community

The testing programme had clear benefits for organisations that took part. Local schools and critical infrastructure were able to manage localised outbreaks of COVID-19 through regular testing, avoiding blanket closures. School attendance increased, particularly in vulnerable and disadvantaged communities. Thanks to the programme, face-to-face teaching and business continuity were maintained.

Asymptomatic monitoring of COVID-19 levels helped to prevent further spread of the virus by those that felt healthy.

The programme was developed by Professor Keith Godfrey, MBE, Professor of Epidemiology and Human Development at the University, who commented: "A truly dedicated team worked tirelessly to mitigate the worst effects of the COVID epidemic on the most vulnerable in society. Working together with communities and stakeholders, we made enormous progress in developing saliva-based testing to reduce the risk of infection transmission in educational and other settings, to give confidence to students, staff, parents, and local communities, and informing national policy and coronavirus control measures elsewhere across the country."

The laboratory developed to process samples was described by Managing Director Peter Baker as "one of the most advanced automated screening facilities in Europe".

The partnership approach taken by the programme has set an example of cost and time-effective infection screening, scalable to national levels, should the need arise in the future.

Figure 19   Distribution of the University of Southampton's procurement expenditure in 2020-21, by outward postcode area (of invoice address)
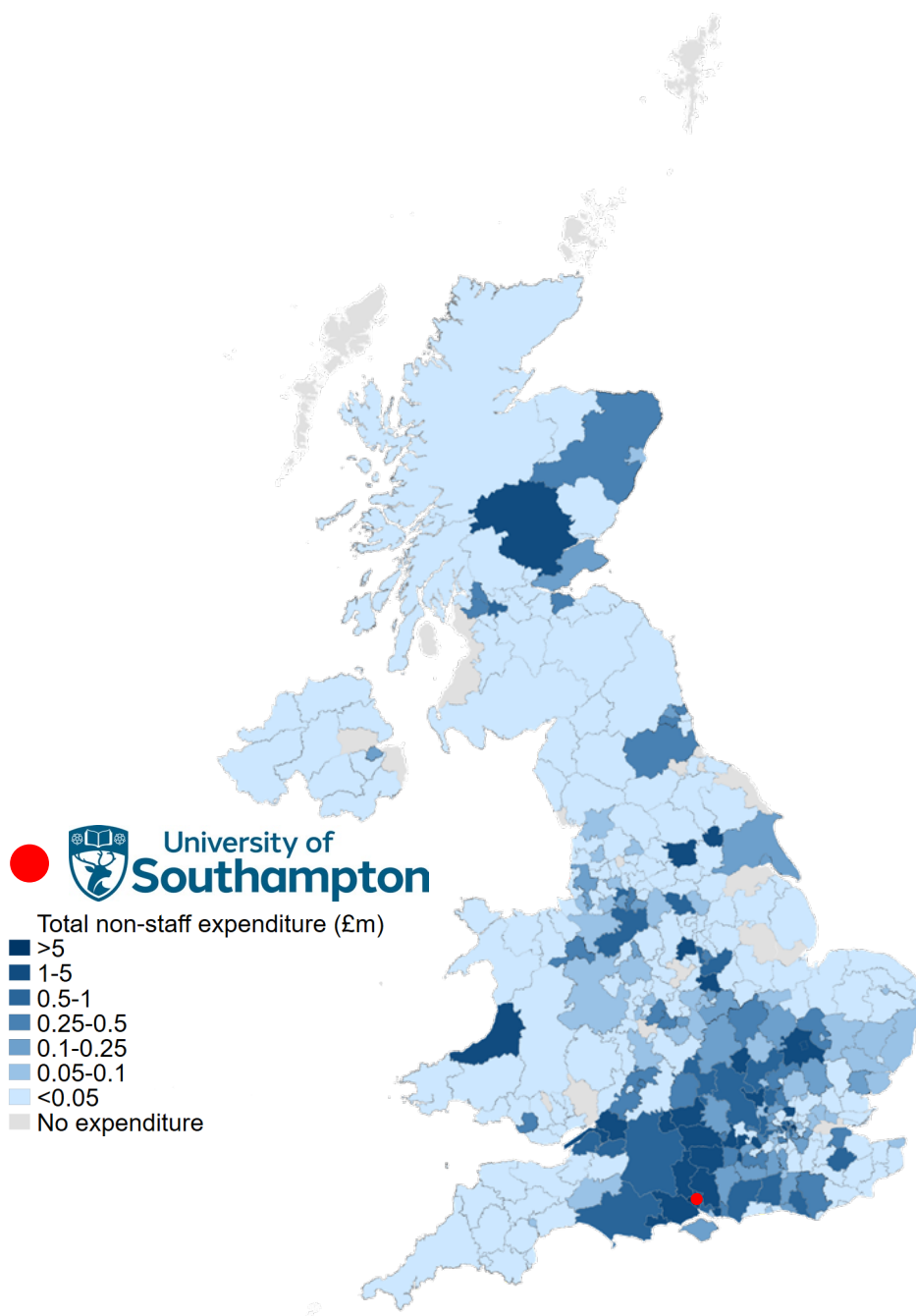
Note: We received data on the invoice postcodes associated with £126 million of procurement expenditure by the University of Southampton in 2020-21. Of this total, 411 records were provided with no postcode data, of these records 22 were given postcodes manually using the supplier name provided. For 86 records, the postcodes given did not originally match with the ONS database, 4 of these records were corrected manually, whilst the other 82 were unmatched. We excluded expenditure records with negative expenditure (33 records) and non-UK suppliers (121 records) as a result of these exclusions, the figure is based on a total of £118 million of procurement expenditure. We used the August 2021 ONS Postcode Directory to determine the Local Authority for each postcode included in the dataset. The data was then matched with the ONS digital vector boundaries for Local Authorities as of May 2021 to generate the map.
Source: London Economics' analysis based on the University of Southampton's data and Office for National Statistics data. Contains National Statistics, OS, Royal Mail, Gridlink, ONS, NISRA, NRS and Ordnance Survey data © Crown copyright and database right 2021

Figure 20   Distribution of the University of Southampton's staff, by outward postcode area (of home address)

Figure 21   Distribution of the University of Southampton's staff expenditure, by outward postcode area (of home address)
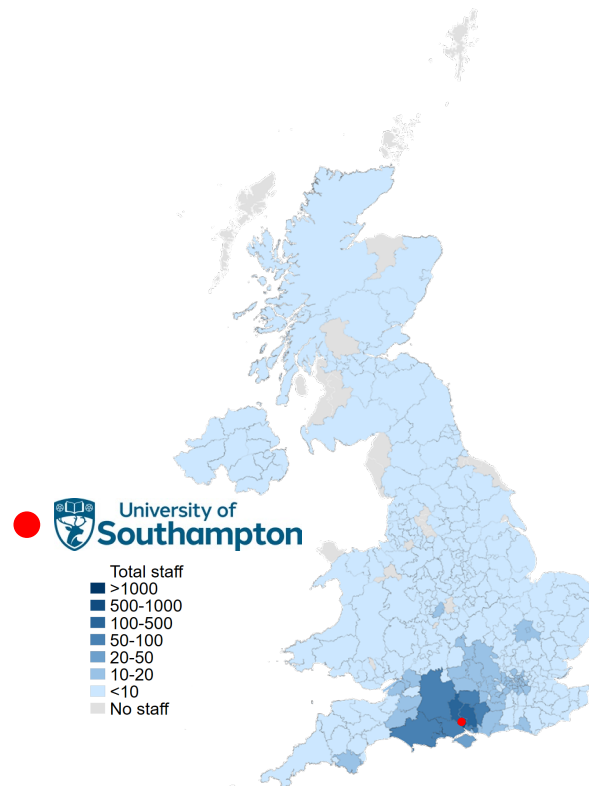
Note: We received data on home address outward postcode for a total of 9,339 staff (in headcount) from University of Southampton. Of this total, we excluded staff records where the outward postcode is listed as 'Overseas' (37 staff) and where staff outward postcode is missing (63 staff). 15 outward postcodes did not originally match with the ONS database, of which 3 were matched manually. The figure is thus based on the home addresses of 9,226 staff. We used the August 2021 ONS Postcode Directory to determine the Local Authority for each outward postcode included in the dataset. The data was then matched with the ONS digital vector boundaries for Local Authorities as of May 2021 to generate the map.
Source: London Economics' analysis based on University of Southampton's data and Office for National Statistics data. Contains National Statistics, OS, Royal Mail, Gridlink, ONS, NISRA, NRS and Ordnance Survey data © Crown copyright and database right 2021

Note: We received data on home address outward postcodes for a total of £319m of staff expenditure from the University of Southampton. Of this total, we excluded staff records where the outward postcode is listed as 'Other UK' (£1.1m of staff expenditure) and where staff outward postcode is missing (£1.2m of staff expenditure). 15 outward postcodes did not originally match with the ONS database, of which 3 were matched manually. The figure is thus based on the home addresses of £316m of staff expenditure. We used the August 2021 ONS Postcode Directory to determine the Local Authority for each outward postcode included in the dataset. The data was then matched with the ONS digital vector boundaries for Local Authorities as of May 2021 to generate the map.
Source: London Economics' analysis based on University of Southampton's data and Office for National Statistics data. Contains National Statistics, OS, Royal Mail, Gridlink, ONS, NISRA, NRS and Ordnance Survey data © Crown copyright and database right 2021
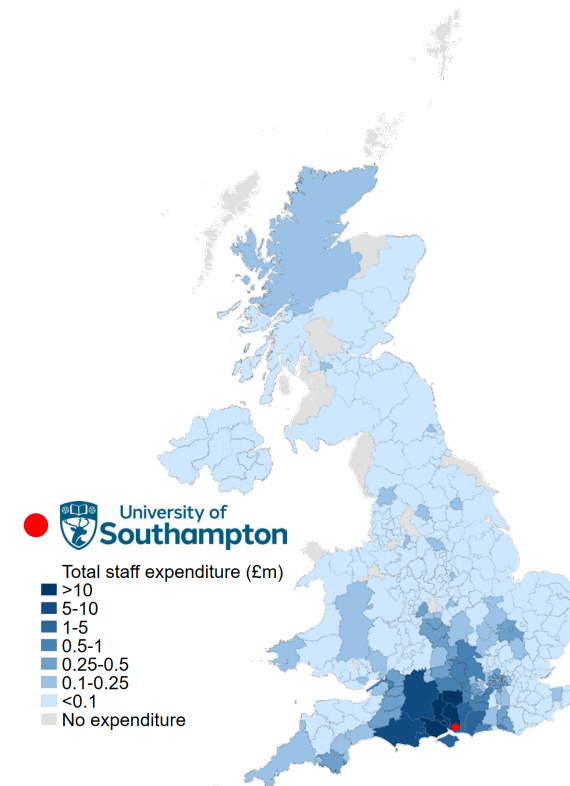
5.2 Indirect and induced impacts of the University of Southampton's expenditures

As with the economic impact of the University of Southampton's educational exports (see Section 4), the assessment of the indirect and induced economic impacts associated with the expenditures of the University of Southampton is again based on economic multipliers derived from the above-discussed multi-regional Input-Output model[81]. In particular, we applied the estimated average economic multipliers associated with organisations in the South East's government, health, and education sector. This mirrors the approach used to assess the impact of the University of Southampton's international tuition fee income, since this income was accrued (and subsequently spent) by the University of Southampton itself. Again, this approach asserts that the spending patterns of the University of Southampton reflect the average spending patterns across organisations operating in the South East's government, health, and education sector.

These multipliers (for the South East and the UK as a whole[82]) are presented in Table 15, indicating that every £1 million of operational or capital expenditure incurred by the University of Southampton generates an *additional* **£1.71 million** of impact throughout the UK economy, of which **£0.71 million** is generated in the South East[83]. In terms of employment, we assume that, for every **1,000** (FTE) staff employed directly by the University of Southampton, an additional **1,060** staff are supported throughout the UK, of which **400** are located in the South East.

Table 15   Economic multipliers associated with the expenditures of the University of Southampton

Location of impact	Output	GVA	FTE employment
South East	1.71	1.61	1.40
Total UK	2.71	2.51	2.06

Note: All multipliers constitute Type II multipliers, defined as [Direct + indirect + induced impact]/[Direct impact]. The figures match the assumed multipliers associated with the University of Southampton's international tuition fee income (see Table 14 in Section 4.4).
Source: London Economics' analysis

5.3   Adjustments for double-counting and transfers

Before arriving at the total direct, indirect, and induced impact associated with the University of Southampton's institutional spending, it is necessary to deduct a number of income and expenditure items to avoid double-counting, and to take account of the 'netting out' of the costs and benefits associated with the University of Southampton's activities between different agents in the UK economy. Specifically, we deducted:

- The total research income received by the University of Southampton in 2020-21 (**£173 million**), to avoid double-counting with the estimated impact of the University of Southampton's research activities (Section 2);
- The direct, indirect, and induced impacts associated with the University's knowledge exchange activities (**£240 million** in economic output terms), to avoid double-counting with the impact of the University's other knowledge exchange activities (Section 2.2);

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[81] See Section 4 for more information.
[82] Again, in addition to the impacts on the South East and the UK as whole, the analysis estimates a full breakdown across all regions, as well as by sector. These detailed results are presented in Section 5.4.
[83] This exactly matches the assumed multipliers associated with the University of Southampton's international tuition fee income (see Table 14 in Section 4.4).

- **£1 million** in the University of Southampton fee waivers and other bursary spending for UK-domiciled students[84], as this was included (as a benefit) in the analysis of the University of Southampton's teaching and learning activities (Section 3); and

- The direct, indirect, and induced impacts generated by the University of Southampton's (gross) international fee income associated with the 2020-21 cohort of non-UK students (**£342 million**[85]), to avoid double-counting with the impact of the University of Southampton's educational exports (Section 4).

5.4   Aggregate impact of the University of Southampton's spending

Figure 22 presents the estimated total direct, indirect, and induced impacts associated with expenditures incurred by the University of Southampton in 2020-21 (after the above-described adjustments have been made). The aggregate impact of these expenditures was estimated at approximately **£763 million** in economic output terms (see top panel of Figure 22):

> **The impact of the University of Southampton's expenditure on the UK economy in 2020-21 stood at £763 million.**

- In terms of region, as with the impact of exports (Section 4), the majority of this impact (**£482 million, 63%**) was generated in the **South East**, with **£281 million** (**37%**) occurring in **other regions** across the UK.

- In terms of sector, in addition to the impacts occurring in the **government, health, and education sector** itself (**£325 million, 43%**[86]), there are also large impacts felt within other sectors, e.g. including the **distribution, transport, hotel, and restaurant sector** (**£105 million, 14%**), the **production sector** (**£91 million, 12%**)[87], and the **real estate sector** (**£68 million, 9%**).

In terms of the number of jobs supported (in FTE), the results indicate that the University of Southampton's spending supported a total of **5,595** FTE jobs across the UK economy in 2020-21 (of which **3,810** are located in the South East). In addition, the impact in terms of gross value added was estimated at **£475 million** across the UK economy as a whole (with **£305 million** generated within the South East).

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[84] The University of Southampton's bursary support to UK domiciled students is considered as a benefit to the student in the analysis of the impact of teaching and learning (see Section 3). It was therefore necessary to deduct these bursaries from the direct impact of the University of Southampton's spending to correctly take account of the fact that these bursaries are a transfer from the University of Southampton to its students, and not an additional benefit to the UK economy.

[85] This is slightly larger than the above impact of the *net* tuition fee income associated with international students in the 2020-21 cohort (**£331 million**; see Section 4.4), as the value deducted here relates to the impact of the University of Southampton's *gross* international fee income *before* the deduction of the Exchequer or the University of Southampton's funding costs associated with these students (since these costs are already deducted when estimating the impact of the University of Southampton's educational exports).

[86] The size of this impact is driven by the fact that, along with the indirect and induced impacts, it includes the *direct* level of expenditure of the University of Southampton (net of the above adjustments to avoid any double-counting).

[87] Again, for more detail on what industries are included in this high-level sector classification, please refer to Table 20 in Annex A2.1.
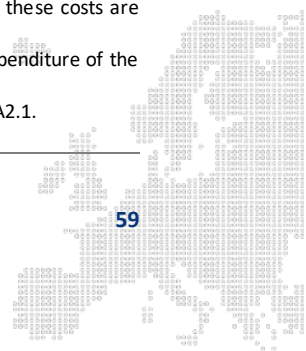
Figure 22   Total economic impact associated with the University of Southampton's expenditure in 2020-21, by region and sector

By region

Output, £m

Region	£m
North East	£10m
North West	£25m
Yorkshire & the Humber	£21m
East Midlands	£22m
West Midlands	£24m
East of England	£30m
London	£88m
South East	£482m
South West	£24m
Wales	£12m
Scotland	£19m
Northern Ireland	£8m
Total	£763m

Economic output, £m

GVA, £m

Region	£m
North East	£8m
North West	£15m
Yorkshire & the Humber	£13m
East Midlands	£14m
West Midlands	£15m
East of England	£19m
London	£43m
South East	£305m
South West	£16m
Wales	£9m
Scotland	£12m
Northern Ireland	£6m
Total	£475m

GVA, £m

FTE employment

Region	FTE
North East	90
North West	170
Yorkshire & the Humber	155
East Midlands	170
West Midlands	170
East of England	205
London	330
South East	3,810
South West	180
Wales	110
Scotland	130
Northern Ireland	75
Total	5,595

# of full-time equivalent employees

By sector

Output, £m

Sector	£m
Agriculture	£4m
Production	£91m
Construction	£20m
Distr., transport, hotels & restaurants	£105m
Information & communication	£29m
Financial & insurance	£38m
Real estate	£68m
Professional & support activities	£63m
Government, health & education	£325m
Other services	£20m
Total	£763m

Economic output, £m

GVA, £m

Sector	£m
Agriculture	£2m
Production	£35m
Construction	£8m
Distr., transport, hotels & restaurants	£61m
Information & communication	£18m
Financial & insurance	£18m
Real estate	£59m
Professional & support activities	£40m
Government, health & education	£220m
Other services	£14m
Total	£475m

GVA, £m

FTE employment

Sector	FTE
Agriculture	50
Production	295
Construction	75
Distr., transport, hotels & restaurants	930
Information & communication	140
Financial & insurance	120
Real estate	80
Professional & support activities	605
Government, health & education	3,155
Other services	140
Total	5,595

# of full-time equivalent employees

Note: Monetary estimates are presented in 2020-21 prices, rounded to the nearest £1 million, and may not add up precisely to the totals indicated. Employment estimates are rounded to the nearest 5, and again may not add up precisely to the totals indicated. *Source: London Economics' analysis*

Culture in the heart of the community

The University of Southampton is an active partner working with the city of Southampton to celebrate diversity and bring people together through culture to create new economic and social opportunities.

In November 2018, the University of Southampton signed a Memorandum of Understanding with Arts Council England (ACE) committing to shared ambitions for arts and culture in Southampton. Following this in December 2020, the University – under the leadership of the new Vice-Chancellor Professor Mark E. Smith – became an official partner for the Southampton City of Culture 2025 bid. The University is currently working to achieve Civic University status, which is underpinned by the four key principles of place, public, partnerships and measurement of impact.

The John Hansard Gallery

In 2018, the John Hansard Gallery (JHG) relocated from its historic home on the University of Southampton Highfield Campus to the purpose-built Studio 144 in Southampton's Cultural Quarter, which the University rents from Southampton City Council. This new location in the city centre has dramatically increased opportunities for more people to experience and be inspired by its programme of locally engaged and internationally acclaimed art. It has improved links with local communities, giving the JHG a unique opportunity to reach new, diverse, and expanded public audiences, including those least likely to engage with arts and culture.

Community Takeover 2019

Community Takeover is a result of an ongoing quest to evolve, be responsive to, and expand, JHG's understanding of its place within the community and the city. It is a celebration of the rich vitality of ideas and talents of local people in Southampton of all ages and backgrounds.

During May and June 2019, diverse groups and organisations were invited to take over the main gallery space for a few days each. These partnerships included Skate Southampton, Southampton

Women's Integration Group, Fashion Fest, Art Asia, and local children who were involved in Street Art, alongside University researchers and departments.

Over nine weeks, the main gallery was transformed into a welcoming space where anyone could be creative. Communities explored concepts and issues such as sustainability, environment, diversity, and inclusion and how they want to see and use their public spaces.

The gallery employed 17 professional artists, who helped visitors to experiment and learn through making with clay; batik on silk banners; zine making; recording their voices; or photographing skateboarders on ramps. There were demonstrations and talks celebrating skateboarding culture, promoting the South Asian Mela Festival, as well as a debate about the impact of fashion and textiles on the environment.

Fourteen members of the Women's Integration Group – mostly based in Southampton's Northam district and of Black, Asian and minority ethnicity – worked over several weeks with the artist Suna Imre as part of the Shaping Clay exhibition, creating beautifully handmade ceramics for display.

Bringing the University into the city centre

Community Takeover 2019 events brought the University into the heart of the city, attracting new audiences and participants to debate theoretical and practical academic approaches. These included a talk by Professor Olivette Otele, who visited the city to discuss 'Memory, Trauma and Citizenship in post-Slavery Societies'. Southampton researcher Dr Sarah Hayden led listening experiments and a mediated discussion on voice, the creative space it inhabits, and listening.

Meanwhile, Pint of Science's celebration of the UNESCO International Day of Light sparked conversations between Southampton researchers and members of the public on the frontiers of light science – including how artificial intelligence is used in archaeology, the role of the next generation of optical fibres in delivering the internet and using nanotechnology to create super-efficient Light Emitting Diode (LEDs) and Virtual Reality (VR) displays.

Community Takeover publicly championed the work of women in academia. The University's Women in Science, Engineering, Technology and Humanities+ (WiSET+) Network partnered with the University of Southampton's Winchester School of Art and JHG to produce an exhibition celebrating the positive work of women in higher education. Over 30 pieces of art were created as part of a competition involving both the University community and the wider public. The resulting exhibits ranged from paintings, poetry, film, and animation to origami, crocheted and knitted pieces, and even an iced cake, celebrating women colleagues, tutors, students, and significant role models from history.

Community Takeover 2019 attracted over 6,500 visitors and over 1,020 people took part in talks, workshops, and events.

Taking the gallery into the community

Community Takeover returned to JHG in 2022 after pandemic closures hosting a range of vibrant, creative responses to the themes of environment, sustainability, and wellbeing. Key partnerships included Skate Southampton, and counselling and advocacy charities Yellow Door and No Limits, alongside university researchers and departments. In future, JHG hopes to run Community Takeover in its own building every two years, taking the gallery out to the community in an off-site version of Community Takeover in the years in-between.

6 The University of Southampton's contribution to tourism

As a final strand of economic contribution, the University attracts a range of visitors to Southampton, including business visitors, friends and family visiting the University's staff and students, or visitors participating in study trips to the University. To understand the economic impact associated with the University's contribution to tourism through the attraction of these visitors, we combine information on the number of visitors to Southampton that are associated with the University's presence with information on the average trip expenditure per visitor. As with the University's knowledge exchange activities (Section 2.2), the expenditures of its international students (Section 4.3.2), and the spending of the University (Section 5), these visitors' expenditures result in subsequent rounds of spending and economic activity within the local economy, captured by the direct, indirect, and induced impacts associated with these expenditures. Again, these impacts are estimated using economic multipliers, and are measured in terms of the contribution to **economic output**, **gross value added**, and (full-time equivalent) **employment** in 2020-21.

6.1 Estimating the number of visitors associated with the University's activities

Data from the International Passenger Survey (IPS), by the Office for National Statistics[88] estimated that, in 2019, there were a total of approximately **236,000** overseas staying visits to Southampton. Domestic visits are not considered in the analysis as they are not contributing additionally to the UK economy. More specifically, it is likely that any domestic (day or overnight) visits to Southampton would have *displaced* activity from other regions of the United Kingdom. Therefore, following standard evaluation guidance (HM Treasury (2022)), all visitor trips and associated expenditure originating from elsewhere in the United Kingdom - i.e. domestic day trips and domestic overnight trips - are excluded from the analysis. As a result, the remainder of this analysis focuses only on the **236,000** trips to Southampton involving overnight stays by visitors from overseas.

In addition to the total number of these overseas overnight visits, a key element of the analysis involves understanding the specific reason for these visits. Using information from the IPS (2019), of the total of **236,000** overnight trips to Southampton by overseas visitors, approximately **33%** (**78,000**) were business trips, **33%** (**77,000**) were for the purposes of visiting friends and family, **27%** (**58,000**) were for the purposes of holidays, and the remaining **9%** (**22,000**) were study trips to Southampton or trips for other purposes. Using this breakdown by purpose of visit, to estimate the impact of the University of Southampton's contribution to tourism in the 2020-21 academic year[89], we made the following assumptions in relation to the **number of overseas overnight visits to Southampton that resulted from the University's presence**:

- We assumed that **none** of the visits for the purposes of **holidays** (**58,000**) or **other trips** (**12,000**) were directly as a result of the University (i.e. that no visitors on holiday were attracted specifically by the University, and that all visitors on other trips were undertaking trips to Southampton for reasons not associated with the University);

- In terms of the **study trips** to Southampton, we assumed that all trips were as a result of either the University of Southampton or Southampton Solent University. According to data from HESA there were **6,735** non-UK-domiciled students[90] enrolled at the University of Southampton in

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[88] Number of visits is based on the town's visitor's reported spending on at least one night during their trip.

[89] The analysis (for the 2020-21 *academic year*) is based on visits to Southampton in the 2019 *calendar year* (i.e. we assume that there were the same number of overseas visitors to Southampton in the 2020-21 academic year as in the 2019 calendar year), due to the lack of more recently available data.

[90] Note that this includes *all* students enrolled with the University in 2020-21, i.e. including both first-year and continuing students.

2020-21 accounting for **70%** of the total non-UK-domiciled student population in Southampton in 2020-21[91]. Therefore, we assume that approximately **70%** of study trips to Southampton in 2020-21 are related to the University (corresponding to approximately **7,000** visits/trips).

- In relation to **business trips**, the University employed approximately **5,970** staff[92] in 2020-21 (in Full Person Equivalent terms, which is equal to **5,405** FTE employees (see Section 5))[93], accounting for approximately **4%** of the total employed population of Southampton in 2020-21[94]. Based on this, we assumed that **4%** of business trips to Southampton in 2020-21 were related to the University (corresponding to approximately **3,500** visits/trips).

- We adopted a similar approach with respect to **trips to visit family and friends**. Specifically, the total population of Southampton in 2019 was estimated to be **252,900**[95]. According to information from the University of Southampton and HESA, there were approximately **1,460** non-UK nationals employed by the University[96] (representing **1%** of the resident population of Southampton), as well as **6,735** non-UK-domiciled students attending the University[97] (representing **3%** of the resident population). Based on a previous analysis assessing the economic impact of international students on the UK economy[98], we assumed that, on average, there were **1.4** visits from overseas per non-EU-domiciled student or non-EU member of staff and **2.0** visits from overseas per EU-domiciled student or EU member of staff in 2020-21[99]. As a result, we assumed that approximately **16%** of all overseas visits to Southampton to visit family or friends were visits to the University's students and staff (equivalent to approximately **12,000** trips in 2020-21).

Table 16 presents the resulting estimated number of trips to Southampton by overseas visitors in 2020-21 that were due to the University of Southampton's activities, estimated at a total of **236,000** (or **10%** of total overseas trips to Southampton).

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[91] HESA data indicates that there were approximately **2,905** non-UK-domiciled students studying at Solvent University in the 2020-21 academic year, meaning that the **6,735** non-UK-domiciled students studying at the University of Southampton in 2020-21 made up approximately **70%** of the **9,640** total non-UK-domiciled students studying in Southampton in the 2020-21 academic year.

[92] The disparity between this figure and the 9,339 staff postcode districts in Section 5.1 is due to the count being Full Person Equivalent rather than purely headcount, e.g. two individuals on half-time contracts would count as 1 FPE. The postcode data is also based on the full payroll for the year, which may include both leavers and joiners during the time period; whilst the FPE data smooths these figures out.

[93] In 2020-21, there were **5,970** FTE staff employed by the University of Southampton. Using the same assumption as in Section 5 relating to the number of FTE employees as a proportion of headcount employees (**91%**), we thus estimate that there were approximately **5,405** staff employed by the University in headcount terms.

[94] Using official labour market statistics data (Nomis, 2022), there were approximately **135,200** individuals employed (or self-employed) in Southampton between October 2020 and September 2021.

[95] See Nomis (2022).

[96] This was estimated based on the distribution of the University of Southampton's staff in 2020-21 by nationality (see HESA, 2020c), the number of total FTE staff employed across the University in 2020-21, and the number of FTE employees as a proportion of headcount employees (**91%**) at the University of Southampton (same assumption as used in footnote 93).

[97] Note that this includes *all* students enrolled with the University in 2020-21, i.e. including both first-year and continuing students.

[98] See London Economics (2018b).

[99] The previous analysis (London Economics, 2018b) estimated that there are 3.0 visits from overseas per EU student per year, and 0.9 visits per non-EU student per year. Here, we calculated a weighted average across EU and non-EU students (weighted by the number of total (first-year and continuing) EU and non-EU students enrolled at the University of Southampton in 2020-21). We then used the same method to calculate this figure for Non-UK staff employed by the University in 2020-21.

Table 16   Total number of visits to Southampton and University-related visits by overseas overnight visitors in 2020-21

Type of trip	Total visits	Visits associated with the University	% associated with the University
Holidays	58,000	-	-
Study trips	10,000	7,000	70%
Business trips	78,000	3,000	4%
Trips to visit friends and family	77,000	12,000	16%
Other trips	12,000	-	-
Total visits	**236,000**	**23,000**	**10%**

Note: All numbers are rounded to the nearest 1,000, and the total values may not add up due to this rounding.
Source: London Economics' analysis

6.2   Direct impact associated with visitor expenditure

The **spend per trip** by purpose is calculated using information from Visit Britain (2019) on the value of tourism in England. The spend per trip was calculated using information on the total spend by purpose in 2019 and the number of visits by purpose in the same year, by dividing total spend by visits. Table 17 shows the spend per overseas staying visit in 2019 and these same values that are inflated to 2020-21 prices in the third column. Using the figures for spend per trip, the **direct impact** associated with the University's contribution to tourism in 2020-21 stood at approximately **£25 million**.

Table 17   Spend per overseas staying trip by purpose in 2019 and in 2020-21

Type of trip	Overseas staying visits (2019)	Overseas staying visits (2020-21)
Holidays	£751	£757
Study trips	£2,315	£2,334
Business trips	£721	£727
Trips to visit friends and family	£507	£511
Other trips	£645	£650
Total visits (weighted average)	**£723**	**£729**

Source: London Economics' analysis and data from Visit Britain (2019) 'England Tourism Factsheet for 2019'

In terms of the breakdown by purpose of trip, the analysis suggest that approximately **£16 million** (**65%**) of this total was from study trips, an estimated **£3 million** (**10%**) was associated with business trips, while the remaining **£6 million** (**25%**) was spent during visits to see friends and family associated with the University.

In terms of the nature of this visitor expenditure, the analysis suggests that approximately **£8 million** (**33%**) of this total was spent on accommodation, an estimated **£7 million** (**24%**) was associated with general shopping activities, **£5 million** (**20%**) was spent on food and drink, **£3 million** (**11%**) was spent on attractions, with the remaining **£2 million** (**12%**) spent on travel[100]. In terms of sector, this suggests that approximately **£22 million** (**89%**) of visitor spending occurred in the **distribution, transport, hotels, and**

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[100] This breakdown was estimated using a breakdown of expenditure by type provided by Destination Research (2017). The breakdown is based on tourism in Oxford, similar data has not been identified for Southampton and thus the Oxford data is used in this instance, as a city in the South East of England.

restaurants sector, while the remaining **£3 million** (**11%**) was spent on '**other**' services (i.e. expenditure on attractions).

In addition to economic output (i.e. visitor expenditure), we converted the above estimates into gross value added and the number of full-time equivalent jobs supported by this direct expenditure[101]. We thus estimated that the visitor expenditure associated with the University's activities directly generated **£12 million** in direct GVA and supported **235 FTE jobs**.

6.3 Indirect and induced impacts associated with visitor expenditure

As with the impacts of the University's knowledge exchange activities (Section 2.2), the expenditures of its international students (Section 4.3.2), and the expenditure of the University (Section 5), the assessment of the indirect and induced economic impacts associated with visitor expenditure is again based on economic multipliers derived from the above-described multi-regional Input-Output model[102]. In particular, given the concentration of visitor expenditure in the distribution, transport, hotels, and restaurants sector and the 'other' services sector, we applied the estimated average economic multipliers associated with organisations in these sectors located in the South East.

These multipliers (for the South East and the UK as a whole; presented in Table 18) indicate that every £1 million of (overseas overnight) visitor expenditure associated with the University of Southampton generates an *additional* **£1.77 million** of impact throughout the UK economy, of which **£0.75 million** is generated in the South East. In terms of employment, for every 1,000 (FTE) staff directly supported by this visitor expenditure, an additional **1,410** staff are supported throughout the United Kingdom, of which **550** are located in the South East.

Table 18   Economic multipliers associated with tourism expenditures related to the University

Location of impact	Output	GVA	FTE employment
South East	1.75	1.76	1.55
Total UK	2.77	2.84	2.41

Note: All multipliers constitute Type II multipliers, defined as [Direct + indirect + induced impact]/[Direct impact].
Source: London Economics' analysis

6.4 Total impact associated with visitor expenditure

> **The impact of the University's contribution to tourism in 2020-21 stood at £69 million.**

Figure 23 presents the estimated total direct, indirect, and induced impacts associated with the above visitor expenditures generated by the University's activities in 2020-21. The analysis indicates that the aggregate impact of these expenditures stood at approximately **£69 million** in economic output terms (see top panel of Figure 23). In terms of region, the majority of this impact (**£44 million**, **63%**) was generated in the **South East**, with **£26 million** (**37%**) occurring in **other regions** across the UK.

In terms of sector of impact, in addition to the impacts occurring in the **distribution, transport, hotels and restaurants sector** (**£34 million**, **49%**), there were also large impacts within other sectors, such as the

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[101] To estimate the direct GVA and employment associated overseas visitor expenditure, we multiplied this expenditure by the average ratio of GVA to output and FTE employees to output within the South East's distribution, transport, hotels and restaurants sector and the 'other' services sector.
[102] See Section 2.2 for more information.

professional and support activities sector (**£6 million**, **9%**), the **real estate sector** (**£6 million**, **8%**), and the **production sector** (**£9 million**, **13%**)[103].

In terms of the number of FTE jobs supported, the results indicate that the visitor spending generated by the University's activities supported a total of **570** FTE jobs across the UK economy in 2020-21, of which **365** are located in the South East (presented in the bottom panel of Figure 23). In addition, the impact in terms of gross value added was estimated at **£36 million** across the UK economy as a whole, of which **£17 million** was generated within the South East (see the middle panel of Figure 23).

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[103] Again, for more detail on what industries are included in this high-level sector classification, please refer to Table 20 in Annex A2.1.

Figure 23   Total economic impact associated with the University's contribution to tourism in 2020-21, by region and sector

By region

Output, £m

Region	Value
North East	£1m
North West	£2m
Yorkshire & the Humber	£2m
East Midlands	£2m
West Midlands	£2m
East of England	£3m
London	£8m
South East	£44m
South West	£2m
Wales	£1m
Scotland	£2m
Northern Ireland	£1m
Total	£69m

Economic output, £m

GVA, £m

Region	Value
North East	£1m
North West	£1m
Yorkshire & the Humber	£1m
East Midlands	£1m
West Midlands	£1m
East of England	£2m
London	£3m
South East	£22m
South West	£1m
Wales	£1m
Scotland	£1m
Northern Ireland	£0m
Total	£36m

GVA, £m

FTE employment

Region	Value
North East	10
North West	15
Yorkshire & the Humber	15
East Midlands	15
West Midlands	20
East of England	25
London	35
South East	365
South West	20
Wales	10
Scotland	15
Northern Ireland	10
Total	570

# of full-time equivalent employees

By sector

Output, £m

Sector	Value
Agriculture	£0m
Production	£9m
Construction	£2m
Distr., transport, hotels & restaurants	£34m
Information & communication	£3m
Financial & insurance	£3m
Real estate	£6m
Professional & support activities	£6m
Government, health & education	£2m
Other services	£5m
Total	£69m

Economic output, £m

GVA, £m

Sector	Value
Agriculture	£0m
Production	£3m
Construction	£1m
Distr., transport, hotels & restaurants	£17m
Information & communication	£1m
Financial & insurance	£1m
Real estate	£5m
Professional & support activities	£3m
Government, health & education	£1m
Other services	£3m
Total	£36m

GVA, £m

FTE employment

Sector	Value
Agriculture	5
Production	35
Construction	5
Distr., transport, hotels & restaurants	345
Information & communication	15
Financial & insurance	10
Real estate	10
Professional & support activities	75
Government, health & education	30
Other services	35
Total	570

# of full-time equivalent employees

Note: Monetary estimates are presented in 2020-21 prices, rounded to the nearest £1 million, and may not add up precisely to the totals indicated. Employment estimates are rounded to the nearest 5, and again may not add up precisely to the totals indicated. *Source: London Economics' analysis*

Working together for a greener future for the maritime industry

The University of Southampton's Centre for Maritime Futures, hosted by the Faculty of Engineering and Physical Sciences, is a partnership with Shell Shipping & Maritime that aims to transform the energy shipping industry to be safer, cleaner, and more efficient through groundbreaking digital and technological advances.

The shipping industry is essential to the world economy as the majority of globally traded goods are transported by sea. Currently, this vital activity produces over 1,000 million tonnes of CO_2 every year, which amounts to around three per cent of all greenhouse emissions produced by human activity. This presents a difficult challenge in delivering the UN International Maritime Organisation's goal to reduce greenhouse emissions from international shipping by 50 per cent by 2050.

Building on decades of expertise and collaboration, the Centre for Maritime Futures launched in 2019 with a gift of £1.5m from Shell Shipping & Maritime. It sits at the intersection of three of the University's key institutes, the Southampton Marine and Maritime Institute, the Centre for Machine Intelligence, and the Alan Turing Institute, the UK's national AI Institute. Working together these three institutes provide immediate connections to key people, facilities, and external stakeholders in maritime and digital technologies, to address the challenges facing the future of shipping.

Applying machine learning to reduce emissions

This partnership between academia and industry has borne fruit in applying machine learning techniques to data already being recorded by ships to improve fuel efficiency.

Researchers from the University of Southampton and Shell Shipping & Maritime collaborated on the development of the *Just Add Water (JAWS) app*. The app helps ships' captains respond to changing sea conditions to optimise the amount of fuel and power needed in any given situation, reducing fuel consumption, and lowering emissions.

The new modelling technique was developed by Dr Amy Parkes during her PhD in the Maritime Engineering research group (completed in 2021), where her time was divided between Southampton and Shell.

The JAWS app interprets depths and angles of a ship known as the draught and trim. The software uses historic, high-frequency data from the vessel to determine the optimal conditions on previous voyages, which enables the system to advise on how best to enhance draft and trim. It also monitors and reports live fuel and emissions savings back to managers, to give real-time insight into the benefits of deploying this technology across a fleet.

Engineers trialed the system on a fleet of over a dozen 300m-long liquefied natural gas (LNG) carriers for 12 months, cumulatively recording savings of carbon dioxide emissions, equivalent to a fuel saving of $90m.

The JAWS software is now available to hundreds of LNG carriers around the world thanks to an agreement between Shell and shipping technology provider Kongsberg Maritime.

Looking to the future

Currently, researchers Dr Adam Sobey and Professor Dominic Hudson are working to apply machine learning techniques to a fuel-saving air lubrication system in a new partnership with Silverstream Technologies.

The two-year partnership is optimising the performance of the company's Silverstream System, which reduces frictional resistance between a vessel's hull and the water to currently deliver fuel savings of between five and 10 per cent.

Researchers at the University of Southampton continue to look for ways to work in partnership with industry to improve the sustainability of the shipping industry. Projects include work on developing future fuels, and technologies, digitalisation and modelling techniques to optimise operational efficiency. The Centre will continue to work across the University's disciplines and institutes, with industry partners and policymakers, to address the global shipping sector's challenges.

7 The total economic impact of the University of Southampton on the UK economy in 2020-21

The total economic impact on the UK economy associated with the University of Southampton's activities in 2020-21 was estimated to be approximately **£4.138 billion** (Table 19). In terms of the components of this impact:

- The University of Southampton's **research and knowledge exchange activities** accounted for **£2.072 billion** (**50%**) of this impact;
- The value of the University of Southampton's teaching and learning activities stood at **£682 million** (**16%**);
- The impact of the University of Southampton's **educational exports** was estimated at **£553 million** (**13%**);
- The impact generated by the **operating and capital spending of the University of Southampton** stood at **£763 million** (**18%**); and
- The remaining **£69 million** (**2%**) was associated with the University's **contribution to tourism**.

> **The total economic impact associated with the University of Southampton's activities in 2020-21 stood at £4.14 billion.**

Table 19   Total economic impact of the University of Southampton's activities in the UK in 2020-21 (£m and % of total)

Type of impact		£m	%
	Impact of research and knowledge exchange	**£2,072m**	**50%**
	Research activities	£904m	22%
	Knowledge exchange activities	£1,168m	28%
	Impact of teaching and learning	**£682m**	**16%**
	Students	£319m	8%
	Exchequer	£362m	9%
	Impact of exports	**£553m**	**13%**
	Tuition fee income	£331m	8%
	Non-tuition fee income	£222m	5%
	Impact of the University's spending	**£763m**	**18%**
	Direct impact	£561m	14%
	Indirect and induced impact	£202m	5%
	Impact of tourism	**£69m**	**2%**
	Direct impact	£25m	1%
	Indirect and induced impact	£44m	1%
Total economic impact		**£4,138m**	**100%**

Note: All estimates are presented in 2020-21 prices, and rounded to the nearest £1m. Totals may not add up precisely due to rounding.
Source: London Economics' analysis

Compared to the University of Southampton's total operational costs of approximately **£546 million** in 2020-21 [104], the total impact of the University of Southampton's activities on the UK economy was estimated at **£4.138 billion** [105], which corresponds to a **benefit to cost ratio of 7.4:1**. This compares

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[104] Compared to the **£561 million** of direct impact of the University of Southampton's expenditures included in Section 5 in this section, the **£546 million** of operating expenditure here *excludes* capital expenditure (**£37 million**) but *includes* depreciation costs (**£29 million**) and movements in pension provisions (**-£7 million**).

[105] In addition to this total impact on the UK economy as a whole, *some* of the strands of impact considered in the analysis can be disaggregated by sector and region (and can be measured in economic output as well as GVA and (FTE) employment). In aggregate,

to an average benefit-to-cost ratio among Russell Group institutions of approximately **5.5:1**, and corresponds to a **33%** increase in the University of Southampton's impact of since 2015-16 (on a comparable basis, in real terms[106]).

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approximately **£2.5 billion** (**62%**) of the University of Southampton's total impact can be disaggregated in this way. For more information, see A2.4.

[106] See London Economics (2017). The analysis of the economic impact of all Russell Group institutions (including the University of Southampton) was based on the 2015-16 academic year.

Improving rail and critical transport infrastructure for the 21st century

Transport is currently the leading source of climate warming emissions in the UK. Rail is far more energy efficient than roads, even with mass electrification. Thus, increasing the proportion of passengers and goods carried by train is a crucial part of the UK government's commitment to reach "Net Zero" carbon targets.

Research from the University of Southampton's School of Engineering has contributed to improved design and maintenance of rail and other transport infrastructure systems. It has helped deliver significant cost and carbon savings and increased reliability and capacity.

Enabling construction through groundwater control

Effective control of groundwater for deeper excavations and tunnels is crucial for reducing rail construction costs and protecting the environment and adjacent infrastructure.

Vacuum dewatering techniques developed by Professors William Powrie and David Richards have shaped design guidance on groundwater control published by the Construction Industry Research and Information Association (CIRIA). Specialists have applied these improved techniques to major infrastructure projects such as Crossrail, HS2, the new River Humber gas pipeline and the Thames Tideway Super Sewer.

Improving the performance of railway track systems

Research led by William solved persistent, localised maintenance problems on HS1, which links London and the Channel Tunnel. For example, it underpinned a targeted intervention to install under-sleeper pads, which reduce the stress on all track components by improving the load distribution, along five metres of track. This saved approximately £100,000 in reduced maintenance costs - six times the investment in this single intervention.

William chaired 12 design workshops for HS2. He ensured the programme and its supply chain benefited from the University's latest research on railway earthworks and retaining walls. The HS2 programme will save around £100m due to this research.

From its research findings, the University published *A Guide to Track Stiffness* in 2016 for technical staff working on rail networks. It is widely used by those responsible for the maintenance, refurbishment, and renewal of the UK railway system.

Ensuring economic design of noise mitigation measures

Railway noise and vibration affect many people who live close to railway lines. Consequently, major rail projects such as HS2 are required to incorporate, often costly, noise mitigation measures. The University of Southampton's Institute of Sound and Vibration Research (ISVR) investigates the underlying causes of noise and vibration to develop practical, cost-effective solutions.

Until recently, noise from slab tracks, often used for high-speed railways such as HS2, was believed to be much greater than that from conventional ballasted tracks. A team of researchers led by Professor David Thompson showed that the difference was smaller than previously thought. This finding reduced the need for noise mitigation measures on HS2, saving the project £65m and reducing the risk of delay to the programme.

In collaboration with Deutsche Bahn and other European partners, Southampton researchers also developed a cost-efficient alternative to field tests for testing rail dampers. This reduced costs by about 90 per cent and the time needed for the procedure from six months to one week. This opened the rail damper market to small- and medium-sized enterprises and removed the need for traffic restrictions resulting from installing dampers purely for testing purposes.

Aiding cost-efficient electrification

While rail is much more carbon efficient than roads, constructing electric railway infrastructure involves energy and materials that produce emissions in the process, known as 'embedded carbon'. The cost and disruption of such projects can also be politically sensitive, making them vulnerable to cuts if they overrun on time or budget.

Research by William, David (Richards), and Dr Anthony Blake helped the rail industry to adopt a cost-efficient method for specifying overhead line equipment foundations. This resulted in significant savings in materials, programme time and carbon.

Network Rail translated this method into a new specification, which they made mandatory for use on all their projects from March 2018. It saved an estimated £600m over the following three years, with associated research on reducing clearances from high voltage equipment saving an additional £50m. It has also reduced levels of embedded and emitted carbon.

Without the research, the Great Western Electrification Project and the Midland Main Line, which were both suspended due to cost overruns, would have been unlikely to restart. The estimated cost to the economy of scrapping these two electrification projects would have exceeded £5.5bn.

The University of Southampton continues to contribute essential research for the delivery of many of the UK's most high-profile infrastructure projects and the economic and environmental benefits they aim to generate.

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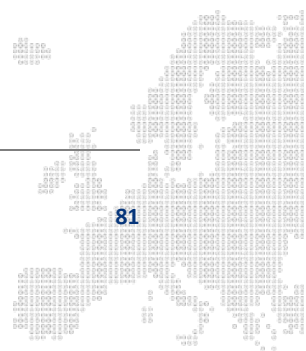
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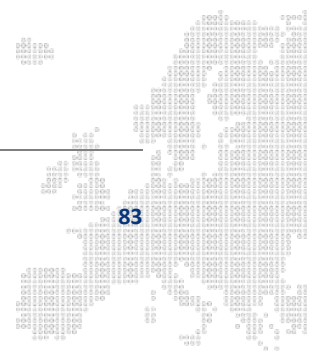
Annex 2   Technical Annex

A2.1   Industry classifications for multi-regional Input-Output analysis

Table 20 provides an overview of the high-level industry classifications used throughout the multi-regional Input-Output analysis.

Table 20   Industry grouping used as part of the multi-regional Input-Output analysis

Industries included in original UK Input-Output table	High-level industry group [and UK SIC Codes]
Crop and animal production, hunting and related service activities	Agriculture [1-3]
Forestry and logging	
Fishing and aquaculture	
Mining and quarrying	Production [5-39]
Manufacture of food products, beverages, and tobacco products	
Manufacture of textiles, wearing apparel and leather products	
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	
Manufacture of paper and paper products	
Printing and reproduction of recorded media	
Manufacture of coke and refined petroleum products	
Manufacture of chemicals and chemical products	
Manufacture of basic pharmaceutical products and pharmaceutical preparations	
Manufacture of rubber and plastic products	
Manufacture of other non-metallic mineral products	
Manufacture of basic metals	
Manufacture of fabricated metal products, except machinery and equipment	
Manufacture of computer, electronic and optical products	
Manufacture of electrical equipment	
Manufacture of machinery and equipment n.e.c.	
Manufacture of motor vehicles, trailers and semi-trailers	
Manufacture of other transport equipment	
Manufacture of furniture; other manufacturing	
Repair and installation of machinery and equipment	
Electricity, gas, steam, and air conditioning supply	
Water collection, treatment and supply	
Sewerage; waste collection, treatment, and disposal activities; materials recovery; remediation activities and other waste management services	
Construction	Construction [41-43]
Wholesale and retail trade and repair of motor vehicles and motorcycles	Distribution, transport, hotels, and restaurants [45-56]
Wholesale trade, except of motor vehicles and motorcycles	
Retail trade, except of motor vehicles and motorcycles	
Land transport and transport via pipelines	
Water transport	
Air transport	
Warehousing and support activities for transportation	
Postal and courier activities	
Accommodation and food service activities	
Publishing activities	Information and communication [58-63]
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	
Telecommunications	
Computer programming, consultancy and related activities; information service activities	
Financial service activities, except insurance and pension funding	Financial and insurance [64-66]
Insurance, reinsurance and pension funding, except compulsory social security	
Activities auxiliary to financial services and insurance activities	
Real estate activities excluding imputed rents	Real estate [68.1-2-68.3]
Imputed rents of owner-occupied dwellings	
Legal and accounting activities; activities of head offices; management consultancy activities	Professional and support activities [69.1-82]
Architectural and engineering activities; technical testing and analysis	
Scientific research and development	

Advertising and market research	
Other professional, scientific, and technical activities; veterinary activities	
Rental and leasing activities	
Employment activities	
Travel agency, tour operator reservation service and related activities	
Security and investigation activities; services to buildings and landscape activities; office administrative, office support and other business support activities	
Public administration and defence; compulsory social security	Government, health & education [84-88]
Education	
Human health activities	
Social work activities	
Creative, arts and entertainment activities; libraries, archives, museums, and other cultural activities; gambling and betting activities	Other services [90-97]
Sports activities and amusement and recreation activities	
Activities of membership organisations	
Repair of computers and personal and household goods	
Other personal service activities	
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	

Note: 'n.e.c.' = not elsewhere classified

Source: London Economics' analysis, based on Office for National Statistics (2020a) and UK SIC Codes (see Office for National Statistics, 2016)

A2.2 Impact of the University of Southampton's teaching and learning activities

A2.2.1 Qualifications and counterfactuals considered in the econometric analysis

Our econometric analysis of the earnings and employment returns to higher education qualifications (described in more detail in Annex A2.2.2) considered **five different higher education qualification groups** (i.e. five **'treatment' groups**) within the National Qualifications Framework: three at postgraduate level (higher degree (research), higher degree (taught) and 'other' postgraduate qualifications[107]) and two at undergraduate level (first degrees and 'other' undergraduate qualifications[108]).

Table 21 presents these different postgraduate and undergraduate level qualifications (i.e. treatment groups) considered in the analysis, along with the associated **counterfactual group** used for the marginal returns analysis in each case. As outlined in Section 3.4.1, we compare the earnings of the group of individuals in possession of the higher education qualification to the relevant counterfactual group, to ensure that we assess the economic benefit associated with the qualification itself (rather than the economic returns generated by the specific characteristics of the individual in possession of the qualification). This is a common approach in the literature and allows for the removal of other personal, regional, or socioeconomic characteristics that might influence *both* the determinants of qualification attainment as well as earnings/employment.

For the analysis of marginal returns, postgraduate degree holders are compared to first degree holders, while for individuals holding first degrees or 'other undergraduate' level qualifications, the counterfactual group consists of individuals holding 2 or more GCE 'A' Levels as their highest qualification. For the purposes of estimating the returns to all higher education qualifications, the highest level of professional

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[107] This relates to Labour Force Survey variables a) HIQUAL11 and HIQUAL15 value labels 'Level 7 Certificate' and b) HIQUAL4, HIQUAL5, HIQUAL8, HIQUAL11 and HIQUAL15 value labels 'Postgraduate Certificate in Education', 'Other postgraduate degree or professional qualification' and 'Don't know', for individuals who selected 'Higher degree' (other than Masters or Doctorate degree).

[108] This relates to Labour Force Survey variables HIQUAL4, HIQUAL5, HIQUAL8, HIQUAL11 and HIQUAL15 value label 'other higher education below degree'. Additionally, Diplomas of Higher Education, Level 4 Certificates, and Level 6 Diplomas are included. Interviewers are instructed to use 'other higher education below degree' only if the respondent states that they have 'something from higher education but they do not know what it is'. It is therefore not possible to provide examples of typical qualifications that would normally fall under this category. The response option serves the purpose of confirming that higher education qualifications have been achieved but that the respondent is unaware of the actual qualification title itself.

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or vocational qualification that an individual may be in possession of is Level 3 (for both those in possession of higher education qualifications (the treatment group) and those individuals not in possession of higher education qualifications (the control group)).

Table 21   Treatment and comparison groups used to assess the marginal earnings and employment returns to higher education qualifications

Treatment group – highest academic qualification	Comparison group - highest academic qualification	Treatment and comparison groups – highest possible vocational/professional qualification
Higher degree (research)	First degree	Level 3 vocational
Higher degree (taught)	First degree	Level 3 vocational
Other postgraduate	First degree	Level 3 vocational
First degree	2 or more GCE 'A' Levels	Level 3 vocational
Other undergraduate	2 or more GCE 'A' Levels	Level 3 vocational
2 or more GCE 'A' Levels	5 or more GCSEs at A*-C	Level 3 vocational

Source: London Economics

In addition to the analysis of higher education qualifications, we also included a separate specification comparing the earnings associated with GCE 'A' Levels to possession of 5 or more GCSEs at grades A*-C. This additional analysis was undertaken to provide an indication of the fact that the academic 'distance travelled' by a (small) proportion of students in the 2020-21 University of Southampton cohort is **greater** than might be the case compared to those in possession of levels of prior attainment 'traditionally' associated with higher education entry. Similarly, for other students within the cohort, the academic 'distance travelled' is **lower** than the traditional prior attainment level (e.g. a small proportion of students intending to undertake a first degree had previously already completed a sub-degree level (i.e. 'other undergraduate') qualification).

In instances where the level of prior attainment for students at the University of Southampton was higher or lower than the 'traditional' counterfactual qualifications outlined in Table 21, the analysis used a **'stepwise' calculation of additional lifetime earnings**. For example, to calculate the earnings and employment returns for a student **in possession of an 'other undergraduate' qualification undertaking a first degree at the University of Southampton**, we *deducted* the returns to undertaking an 'other undergraduate' qualification (relative to the possession of 2 or more GCE 'A' Levels) from the returns to undertaking a first degree (again relative to the possession of 2 or more GCE 'A' Levels). Similarly, to calculate the returns for a student **in possession of 5 or more GCSEs at grades A*-C undertaking a first degree at the University of Southampton**, we *added* the returns to achieving 2 or more GCE 'A' Levels (relative to the possession of 5 or more GCSEs at grades A*-C) to the returns to undertaking a first degree (relative to the possession of 2 or more GCE 'A' Levels)[109].

A2.2.2   Marginal earnings and employment returns to higher education qualifications

Marginal earnings returns

To estimate the impact of qualification attainment on earnings, using information from the Labour Force Survey, we estimated a standard **Ordinary Least Squares** linear regression model, where the dependent

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[109] In some instances, this stepwise calculation would result in *negative* lifetime returns to achieving higher education qualifications. As this seems illogical and unlikely in reality, any negative returns in these instances were set to zero. Hence, the analysis implicitly assumes that all calculated gross returns (*before* the deduction of any foregone earnings or other costs) can only be greater than or equal to zero (i.e. there can be no wage or employment *penalty* associated with any higher education qualification attainment, irrespective of the level of prior education attainment).

variable is the natural logarithm of hourly earnings, and the independent variables include the full range of qualifications held alongside a range of personal, regional, and job-related characteristics that might be expected to influence earnings. In this model specification, we included individuals who were employed on either a full-time or a part-time basis. This approach has been used widely in the academic literature.

The basic specification of the model was as follows:

$$ln\ (\omega_i) = \alpha + \beta X_i + \epsilon_i \qquad \text{for } i = 1 \text{ to n}[110]$$

where ln(ω_i) represents the natural logarithm of hourly earnings, ϵ_i represents an error term, α represents a constant term, and X_i provides the independent variables included in the analysis, as follows:

- Gender;
- Age;
- Age squared;
- Ethnic origin;
- Region of usual residence;
- Qualifications held;
- Marital status;
- Number of dependent children under the age of 16;
- Full-time / part-time employment;
- Temporary or permanent contract;
- Public or private sector employment;
- Workplace size;
- Interaction terms; and
- Yearly Dummies.

Using the above specification, we estimated earnings returns in aggregate and **for men and women separately**. Further, to analyse the benefits associated with different education qualifications over the lifetime of individuals holding these qualifications, the regressions were **estimated separately across a range of specific age bands** for the working age population, depending on the qualification considered. Further note that the analysis of earnings premiums was undertaken at a national (UK-wide) level. However, to adjust for differences across the Home Nations, these UK-wide earnings premiums were then combined with the relevant differential direct costs facing the individual and/or the public purse for students domiciled in the different Home Nations.

To estimate the impact of higher education qualifications on labour market outcomes using this methodology, we used information from **pooled Quarterly UK Labour Force Surveys between 2004 and 2021**. The selection of information over this period is the longest time for which information on education and earnings is available on a relatively consistent basis.

The resulting estimates of the marginal wage returns to higher education qualifications are presented in Table 22. In the earnings regressions, the coefficients relating to the different higher education qualifications provide an indication of the additional effect on hourly earnings associated with possession of the respective higher education qualification relative to the counterfactual level of qualification. To take an example, the analysis suggests that men aged between 31 and 35 in possession of a first degree achieve

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[110] Where *i* is an individual LFS respondent.
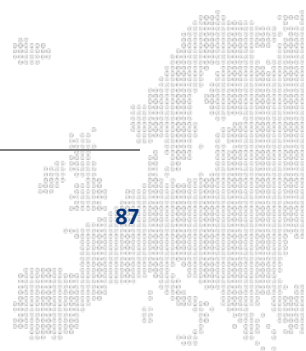
a **22.4%** hourly earnings premium compared to comparable men holding only 2 or more GCE 'A' levels as their highest level of attainment. The comparable estimate for women aged between 31 and 35 stands at **25.6%**.

In addition to estimating marginal earnings returns on average across *all subjects* of study, we repeated the econometric analysis to estimate these returns *separately by subject*[111]. Combining these subject-level returns with the number of students in the 2020-21 cohort of University of Southampton students by subject, we then calculated **subject mix adjustment factors** (separately by gender and qualification level). These adjustment factors were then applied to the above average marginal wage returns (across all subjects) to **adjust for the specific subject composition of the University of Southampton's student cohort**.

Table 22   Marginal earnings returns to higher education qualifications (in all subjects), in % (following exponentiation), by gender and age band

Qualification level	Age band									
	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
Men										
2 or more GCE A-levels[1]	8.9%	5.1%	9.9%	17.4%	24.1%	17.8%	24.9%	16.2%	19.2%	14.6%
Other undergraduate[2]			-3.9%		7.5%	11.6%	16.6%	8.4%	7.7%	
First degree[2]		9.9%	16.0%	22.4%	20.9%	26.4%	18.4%	24.2%	22.9%	22.6%
Other postgraduate[3]		10.2%	12.1%	9.3%	4.4%	4.9%				
Higher degree (taught)[3]		9.6%	11.3%	8.1%	9.4%	11.7%	13.2%	13.3%	13.8%	14.8%
Higher degree (research)[3]			17.8%	17.7%	21.0%	20.9%	25.6%	28.8%	27.9%	47.1%
Women										
2 or more GCE A-levels[1]	8.3%	5.1%	10.3%	13.0%	17.8%	19.0%	13.8%	14.9%	13.8%	12.4%
Other undergraduate[2]			5.5%	10.6%	12.2%	14.3%	17.2%	23.1%	19.0%	17.4%
First degree[2]		9.9%	17.2%	25.6%	32.3%	30.2%	31.8%	31.9%	25.7%	20.3%
Other postgraduate[3]		8.7%	8.3%	11.5%	9.9%	9.5%	10.3%	13.4%	11.4%	11.6%
Higher degree (taught)[3]		8.0%	5.8%	9.4%	12.2%	16.5%	20.3%	15.5%	28.4%	17.7%
Higher degree (research)[3]		15.5%	19.2%	20.7%	31.3%	27.6%	39.1%	39.8%	38.3%	38.5%

Note: Regression coefficients have been exponentiated to reflect percentage wage returns. In cases where the estimated coefficients are not statistically significantly different from zero (at the 10% level), the coefficient is assumed to be zero; these are displayed as gaps in the table.
1 Returns to holding 2 or more GCE 'A' levels compared to 5 or more GCSEs at A*-C.
2 Returns to first degrees and 'other' undergraduate qualifications are estimated relative to individuals holding 2 or more GCE 'A' levels as their highest qualification.
3 Returns to higher degree (taught), higher degree (research), and 'other' postgraduate qualifications are estimated relative to undergraduate degrees.
Source: London Economics' analysis of pooled Quarterly Labour Force Survey data for 2004-2021Q4

Marginal employment returns

To estimate the impact of qualification attainment on employment, we adopted a **probit model** to assess the likelihood of different qualification holders being in employment or otherwise. The basic specification defines an individual's labour market outcome to be either in employment (working for payment or profit

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[111] The HESA Common Aggregation Hierarchy (CAH) was used to classify subject areas. The following subject groups were distinguished: (1) Medicine & dentistry, (2) Subjects allied to medicine, (3) Biological and sports sciences, (4) Psychology, (5) Veterinary sciences, (6) Agriculture, food & related subjects, (7) Physical sciences, (8) General and other sciences, (9) Mathematical sciences, (10) Engineering & technology, (11) Computing, (12) Geographical and environmental studies, (13) Architecture, building & planning, (14) Humanities and liberal arts (nonspecific), (15) Social sciences, (16) Law, (17) Business and management, (18) Communications and media, (19) Language and area studies, (20) Historical, philosophical and religious studies, (21) Creative arts and design, (22) Education and teaching, (23) Combined and general studies.

for more than 1 hour in the reference week (using the standard International Labour Organisation definition) or not in employment (being either unemployed or economically inactive)). The specification of the probit model was as follows:

$$Probit(EMPNOT_i) = \alpha + \gamma Z_i + \epsilon_i \qquad \text{for } i = 1 \text{ to } n[112]$$

The dependent variable adopted represents the binary variable $EMPNOT_i$, which is coded 1 if the individual is in employment and 0 otherwise[113]. We specified the model to contain a constant term (α) as well as a number of standard independent variables including the qualifications held by an individual (represented by Z_i in the above equation) as follows:

- Gender;
- Age;
- Age squared;
- Ethnic origin;
- Region of usual residence;
- Qualifications held;
- Marital status;
- Number of dependent children under the age of 16; and
- Yearly Dummies.

Again, ϵ_i represents an error term. Similar to the methodology for estimating earnings returns, the described probit model was estimated in aggregate and **separately for men and women**, with the analysis further split by respective **age bands**, and adjusted for the specific **subject mix** of students in the 2020-21 cohort of UK domiciled students attending the University of Southampton. Further, and again similar to the analysis of earnings returns, employment returns were estimated at the national (i.e. UK-wide) level.

The resulting estimated marginal employment returns to higher education qualifications (again on average across *all subjects* of study (i.e. before adjusting for the University of Southampton's specific subject mix)) are presented in Table 23. In the employment regressions, the relevant coefficients provide estimates of the impact of the qualification on the probability of being in employment (expressed in percentage points). Again, to take an example, the analysis estimates that a man aged between 31 and 35 in possession of a first degree is **2.3 percentage points** more likely to be in employment than a man of similar age holding only 2 or more GCE 'A' levels as his highest level of education. The corresponding estimate for women stands at **4.4 percentage points**.

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[112] Where *i* is an individual LFS respondent.
[113] The probit function reflects the cumulative distribution function of the standard normal distribution.
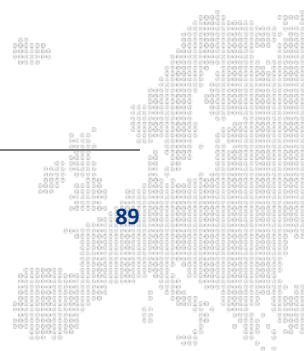
Table 23   Marginal employment returns to higher education qualifications (in all subjects), in percentage points, by gender and age band

Qualification level	Age band									
	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
Men										
2 or more GCE A-levels[1]	-2.3		2.8	1.5	1.7	1.4	1.5			
Other undergraduate[2]			-2.7							
First degree[2]		-1.6	1.4	2.3	2.2	1.9	1.5	3.7	2.4	
Other postgraduate[3]		5.5		1.9		1.6	1.8	3.0		-5.8
Higher degree (taught)[3]			-1.1						2.4	2.8
Higher degree (research)[3]						2.1		4.3	7.9	8.9
Women										
2 or more GCE A-levels[1]		3.4	3.5	2.4		2.1	3.3	3.6		
Other undergraduate[2]				2.4	4.0					
First degree[2]		2.6	3.6	4.4	6.3	4.8	4.0	3.0	2.8	
Other postgraduate[3]		5.3	1.3	3.0	2.5	5.6	4.7	3.6	3.4	
Higher degree (taught)[3]			-1.8			3.7	2.1	3.3	5.7	4.1
Higher degree (research)[3]			-2.8	3.5		4.9	6.9	6.9	10.3	12.5

Note: In cases where the estimated coefficients are not statistically significantly different from zero (at the 10% level), the coefficient is assumed to be zero; these are displayed as gaps in the table.
[1] Returns to holding 2 or more GCE 'A' levels compared to 5 or more GCSEs at A*-C.
[2] Returns to first degrees and 'other' undergraduate qualifications are estimated relative to individuals holding 2 or more GCE 'A' levels as their highest qualification.
[3] Returns to higher degree (taught), higher degree (research) and 'other' postgraduate qualifications are estimated relative to undergraduate degrees.
Source: London Economics' analysis of pooled Quarterly Labour Force Survey data for 2004-2021Q4

A2.2.3   'Age-decay' function

Many existing economic analyses considering the lifetime benefits associated with higher education qualifications to date (e.g. Walker and Zhu, 2013) have focused on the returns associated with the 'traditional path' of higher education qualification attainment – i.e. progression directly from secondary level education and completion of a three or four year undergraduate degree from the age of 19 onwards (completing by the age of 21 or 22). These analyses assume that there are **direct costs** (tuition fees etc.), as well as an **opportunity cost** (the foregone earnings whilst undertaking the qualification full-time) associated with qualification attainment. More importantly, these analyses make the implicit assumption that any and all of the estimated earnings and/or employment benefit achieved accrues to the individual.

However, **the labour market outcomes associated with the attainment of higher education qualifications on a part-time basis are fundamentally different than those achieved by full-time students**. In particular, part-time students typically undertake higher education qualifications several years later than the 'standard' full-time undergraduate (e.g. the estimated average age at enrolment amongst students in the 2020-21 cohort completing postgraduate taught degrees with the University of Southampton on a part-time basis is **33**, compared to **24** for corresponding full-time students); generally undertake their studies over an extended period of time; and often combine their studies with full-time employment. Table 24

presents the assumed average age at enrolment, study duration, and age at completion for students in the 2020-21 University of Southampton cohort[114].

Table 24   Average age at enrolment, study duration, and age at completion for students in the 2020-21 University of Southampton cohort

Qualification level	Full-time students			Part-time students		
	Age at enrolment	Duration (years)	Age at completion	Age at enrolment	Duration (years)	Age at completion
Other undergraduate	19	1	20	37	2	39
First degree	19	3	22	37	3	40
Other postgraduate	28	1	29	32	2	34
Higher degree (taught)	24	1	25	33	3	36
Higher degree (research)	25	4	29	34	6	40

Note: All values have been rounded to the nearest integer. There were no students in the 2020-21 cohort of University of Southampton students undertaking first degrees on a part-time basis.
Source: London Economics' analysis based on University of Southampton HESA data

Given these characteristics, we adjust the methodology when estimating the returns to part-time (and later full-time) education attainment at the University of Southampton, namely through the use of an **'age-decay' function**. This approach assumes that possession of a particular higher education qualification is associated with a certain earnings or employment premium, and that this entire labour market benefit accrues to the individual *if* the qualification is attained before the age of 24 (for undergraduate qualifications) or 29 (for postgraduate qualifications).

However, as the age of attainment increases, it is expected that a declining proportion of the potential value of the estimated earnings and employment benefit accrues to the individual[115]. This calibration ensures that those individuals completing qualifications at a relatively older age will see relatively lower earnings and employment benefits associated with higher education qualification attainment (and perhaps reflect potentially different motivations amongst this group of learners). In contrast, those individuals attaining qualifications earlier in their working life will see a greater economic benefit (potentially reflecting the investment nature of qualification acquisition).

Table 25 presents the assumed age-decay adjustment factors which we apply to the marginal earnings and employment returns to full-time and part-time students undertaking qualifications at the University of Southampton in the 2020-21 cohort. To take an example, we have assumed that a student undertaking a postgraduate taught degree on a full-time basis achieves the full earnings and employment premium identified in the econometric analysis (for their entire working life). However, for a part-time postgraduate taught degree student, we assume that because of the late attainment (at age 35 (on average)), these students recoup only **77%** of the corresponding full-time earnings and employment premiums from that age (of attainment).

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[114] The assumed average age at enrolment is based on the number of individuals in the cohort assumed to *complete* a given qualification at the University of Southampton (based on the assumption that some students might complete a different qualification than initially intended, or instead only complete several standalone credits/modules associated with the intended qualification (see Section 3.2 for more information)). In particular, the age at enrolment per qualification (based on the HESA data provided by the University of Southampton) is calculated as the weighted average age at enrolment across students in the 2020-21 cohort expected to *complete* the given qualification (weighted by the number of students starting different qualification aims and completing each given qualification, separately by study mode).
The assumed average duration of study for both full-time and part-time students (by qualification level) is based on separate information provided by the University of Southampton.
[115] E.g. Callender et al. (2011) suggest that the evidence points to decreasing employment returns with age at qualification: older graduates are less likely to be employed than younger graduates three and a half years after graduation; however, there are no differences in the likelihood of graduates undertaking part-time and full-time study being employed according to their age or motivations to study.

Table 25   Assumed age decay adjustment factors for students in the 2020-21 University of Southampton cohort

Age	Other undergraduate	First degree	Other postgraduate	Higher degree (taught)	Higher degree (research)
18	100%	100%	100%	100%	100%
19	100%	100%	100%	100%	100%
20	100%	100%	100%	100%	100%
21	100%	100%	100%	100%	100%
22	100%	100%	100%	100%	100%
23	100%	100%	100%	100%	100%
24	98%	98%	100%	100%	100%
25	95%	95%	100%	100%	100%
26	93%	93%	100%	100%	100%
27	90%	90%	100%	100%	100%
28	88%	88%	100%	100%	100%
29	85%	85%	97%	97%	97%
30	83%	83%	94%	94%	94%
31	80%	80%	91%	91%	91%
32	78%	78%	89%	89%	89%
33	75%	75%	86%	86%	86%
34	73%	73%	83%	83%	83%
35	70%	70%	80%	80%	80%
36	68%	68%	77%	77%	77%
37	65%	65%	74%	74%	74%
38	63%	63%	71%	71%	71%
39	60%	60%	69%	69%	69%
40	58%	58%	66%	66%	66%
41	55%	55%	63%	63%	63%
42	53%	53%	60%	60%	60%
43	50%	50%	57%	57%	57%
44	48%	48%	54%	54%	54%
45	45%	45%	51%	51%	51%
46	42%	42%	49%	49%	49%
47	40%	40%	46%	46%	46%
48	37%	37%	43%	43%	43%
49	35%	35%	40%	40%	40%
50	32%	32%	37%	37%	37%
51	30%	30%	34%	34%	34%
52	27%	27%	31%	31%	31%
53	25%	25%	29%	29%	29%
54	22%	22%	26%	26%	26%
55	20%	20%	23%	23%	23%
56	17%	17%	20%	20%	20%
57	15%	15%	17%	17%	17%
58	12%	12%	14%	14%	14%
59	10%	10%	11%	11%	11%
60	7%	7%	9%	9%	9%
61	5%	5%	6%	6%	6%
62	2%	2%	3%	3%	3%
63	0%	0%	0%	0%	0%
64	0%	0%	0%	0%	0%
65	0%	0%	0%	0%	0%

Note: Shaded areas indicate relevant average graduation age per full-time / part-time student at each level of study at the University of Southampton:

■ Full-time students   ■ Part-time students

Source: London Economics' analysis based on University of Southampton HESA data

Note that the application of the 'age-decay' function implies that, for *all* qualification levels at the University of Southampton, the estimated employment and earnings returns for part-time students are lower than the returns for comparable full-time students. These differences reflect the (relatively limited) wider economic literature on the returns to part-time study[116].

A2.2.4 Estimating the gross graduate premium and gross public purse benefit

The gross graduate premium associated with qualification attainment is defined as the **present value of enhanced post-tax earnings** (i.e. after income tax, National Insurance and VAT are removed, and following the deduction of foregone earnings) relative to an individual in possession of the counterfactual qualification. To estimate the value of the gross graduate premium, it is necessary to extend the econometric analysis (presented above; see Annex A2.2.2) by undertaking the following elements of analysis (separately by qualification level, gender, and study mode):

1. We estimated the employment-adjusted **annual earnings** achieved by individuals in the counterfactual groups (i.e. 2 or more GCE 'A' Levels or a first degree).
2. We inflated these baseline or counterfactual earnings using the marginal earnings premiums and employment premiums (presented in Table 22 and Table 23 in Annex A2.2.2), adjusted to reflect late attainment (as outlined in Annex A2.2.3), to produce **annual age-earnings** profiles associated with the possession of each particular qualification.
3. We adjusted these age-earnings profiles to account for the fact that earnings would be expected to increase in real terms over time (at an assumed rate of **0.8%** per annum (based on average earnings growth rate forecasts estimated by the Office for Budget Responsibility (2020 and 2021)[117]).
4. Based on the earnings profiles generated by qualification holders, and income tax and National Insurance rates and allowances for the relevant academic year[118], we computed the future stream of net earnings (i.e. post-tax)[119]. Using similar assumptions, we further calculated the stream of (employment-adjusted) foregone earnings (based on earnings in the relevant counterfactual group[120]) during the period of study, again net of tax, for full-time students only.

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[116] In general, these studies suggest that the economic returns to studying part-time are lower than the economic returns associated with studying full-time. This is in part because part-time students are often already employed when undertaking their studies, so the marginal (or additional) impact of the higher education qualification is lower. For instance, six months after graduation, graduates undertaking part-time study were three percentage points more likely to be employed than graduates undertaking full-time study, and less than half as likely (3% compared to 7%) to be unemployed. See Callender et al. (2011).

According to the same study, the salaries of graduates from part-time study grow at a slower pace compared with their full-time peers. Part-time graduates are less likely to see their salaries increase and are more likely to see their salaries stagnate between 6 months and 42 months after graduation: specifically, during this period, 78% of part-time graduates and 88% of full-time graduates saw their salaries rise, while 16% of part-time and 8% of full-time graduates experienced no change in salaries, and 6% of part-time and only 2% of former full-time students saw a drop in their salaries.

[117] Specifically, we make use of the Office for Budget Responsibility's most recent short-term forecasts (for 2019 to 2025; see Office for Budget Responsibility (2021)) as well as their most recent long-term forecasts (for 2026 to 2069; see Office for Budget Responsibility (2020)) of nominal average earnings growth. The assumed **0.8%** rate captures the average annual real earnings growth rate over the total period (adjusted from nominal to real terms based on projected (Retail Price Index) inflation over the same period (and based on the same sources).

[118] i.e. 2020-21. Note that the analysis assumes fiscal neutrality, i.e. it is asserted that, in subsequent years, the earnings tax and National Insurance income bands grow at the same rate of annual earnings growth of **0.8%**.

[119] The tax adjustment also takes account of increased VAT revenues for HMG, by assuming that individuals consume **91.5%** of their annual income, and that **50%** of their consumption is subject to VAT at a rate of **20%**. The assumed proportion of income consumed is based on forecasts of the household savings rate published by the Office for Budget Responsibility (2021), while the proportion of consumption subject to VAT is based on VAT estimates provided by the Office for Budget Responsibility (no date).

[120] The foregone earnings calculations are based on the baseline or counterfactual earnings associated with either 2 or more GCE 'A' Levels or first degrees. Specifically, as outlined in Annex A2.2.1, some students in the 2020-21 University of Southampton cohort were in possession of other levels of prior attainment. To accommodate this, as a simplifying assumption, the foregone earnings for students previously in possession of other undergraduate qualifications (other than first degrees) are based on the earnings associated with possession of 2 or more GCE 'A' Levels as the highest qualification (adjusted for the age at enrolment and completion associated with the relevant qualification obtained). In addition, the

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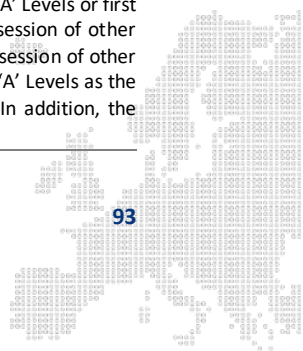
5. We calculated the **discounted** stream of additional (employment-adjusted) future earnings compared to the relevant counterfactual group (using a standard discount rate of **3.5%** as presented in HM Treasury Green Book (HM Treasury, 2022)), and the discounted stream of foregone earnings during qualification attainment (for full-time students), to generate a present value figure. We thus arrive at the **gross graduate premium** (or equivalent for other qualifications).

6. The **discounted** stream of enhanced taxation revenues minus the tax income foregone during students' qualification attainment (where relevant) derived in element 4 provides an estimate of the **gross public benefit** associated with higher education qualification attainment.

Note that the gross graduate premium and gross public benefit for students undertaking qualifications at a level equivalent to or lower than the highest qualification that they are already in possession of was assumed to be zero. For example, it is assumed that a student in possession of a taught postgraduate degree undertaking an additional postgraduate qualification at the University of Southampton will not accrue any wage or employment benefits from this additional qualification attainment (while still incurring the costs of foregone earnings during the period of study, if they studied on a full-time basis).

Further note that the analysis of gross graduate premiums and public purse benefits was undertaken at a **national** (UK-wide) level. To adjust for differences across the Home Nations, these UK-wide premiums were then combined with the relevant differential student support costs facing the individual and/or the Exchequer for students domiciled in the different Home Nations and studying in England.

The resulting gross graduate premiums and gross public purse benefits per student (by study mode, level of study, gender, and prior attainment) are presented in Table 26.

A2.2.5 Net graduate premium and net public benefit

Table 27 and Table 28 provide detailed information on the net graduate premiums and net public benefits for students associated with all higher education qualifications offered by the University of Southampton (respectively), based on the 2020-21 cohort. Each table provides detailed information on the net graduate premiums/net Exchequer benefits by student domicile, study mode, study level, prior attainment, and gender[121].

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estimated foregone earnings for students previously in possession of postgraduate qualifications are based on the level of earnings associated with first degrees.

[121] In terms of gender, it is important to note that the economic benefits associated with higher education qualifications - expressed in *monetary terms* - are generally lower for women than men, predominantly as a result of the increased likelihood of spending time out of the active labour force. However, as with the majority of the wider economic literature, the *marginal benefits* associated with higher education qualifications - expressed as either the *percentage increase* in hourly earnings or enhanced probability of employment - are often greater for women than for men (see Annex A2.2.2).

Table 26   Gross graduate premiums and Exchequer benefits per student associated with HE qualification attainment at the University of Southampton, by study mode, level, gender, and prior attainment

Level of study	Previous qualification and gender													
	GCSE		A-level		Other undergraduate		First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Gross graduate premiums														
Full-time students														
Other undergraduate			£18,000	£43,000	-£8,000	-£7,000	-£11,000	-£8,000						
First degree	£181,000	£127,000	£106,000	£91,000	£80,000	£42,000	-£30,000	-£25,000	-£30,000	-£25,000	-£30,000	-£25,000	-£30,000	
Other postgraduate					£108,000	£112,000	£5,000	£47,000	-£24,000	-£20,000	-£24,000	-£20,000	-£24,000	-£20,000
Higher degree (taught)				£205,000	£168,000		£52,000	£80,000	£16,000	£11,000	-£17,000	-£17,000		-£17,000
Higher degree (research)						£110,000	£60,000	£37,000		-£25,000	-£3,000	-£53,000		-£73,000
Part-time students														
Other undergraduate		£50,000		£30,000		£0								
First degree					£46,000	£28,000								
Other postgraduate					£88,000	£97,000	£16,000	£52,000	£0	£0	£0	£0	£0	£0
Higher degree (taught)		£170,000			£110,000	£112,000	£50,000	£73,000	£40,000	£28,000	£0	£0		£0
Higher degree (research)			£154,000				£89,000	£70,000			£51,000	£15,000		
Gross Exchequer benefits														
Full-time students														
Other undergraduate			£24,000	£40,000	-£1,000	-£1,000	-£2,000	-£1,000						
First degree	£186,000	£125,000	£121,000	£94,000	£97,000	£54,000	-£5,000	-£3,000	-£5,000	-£3,000	-£5,000	-£3,000	-£5,000	
Other postgraduate					£113,000	£101,000	£17,000	£46,000	-£13,000	-£10,000	-£13,000	-£10,000	-£13,000	-£10,000
Higher degree (taught)				£178,000	£173,000		£65,000	£74,000	£29,000	£16,000	-£7,000	-£7,000		-£7,000
Higher degree (research)						£119,000	£112,000	£58,000		£6,000	£45,000	-£17,000		-£34,000
Part-time students														
Other undergraduate		£40,000		£24,000		£0								
First degree					£43,000	£23,000								
Other postgraduate					£86,000	£81,000	£18,000	£43,000	£0	£0	£0	£0	£0	£0
Higher degree (taught)		£140,000			£111,000	£93,000	£54,000	£60,000	£42,000	£23,000	£0	£0		£0
Higher degree (research)			£155,000				£95,000	£57,000			£55,000	£12,000		

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2020-21 University of Southampton cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at University of Southampton is equal to or lower than the level of previous attainment. In these instances, the analysis implicitly assumes that all calculated gross returns (*before* the deduction of any foregone earnings or other costs) can only be larger or equal to zero (i.e. there can be no wage or employment penalty associated with any higher education qualification attainment). Hence, each grey-shaded cell displays only the assumed underlying foregone earnings. *Source: London Economics' analysis*

Table 27   Net graduate premiums per student associated with HE qualification attainment at the University of Southampton, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender													
	GCSE		A-level		Other undergraduate		First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Students from England														
Full-time students														
Other undergraduate			£14,000	£38,000	-£12,000	-£12,000	-£15,000	-£12,000						
First degree	£168,000	£114,000	£93,000	£78,000	£67,000	£29,000	-£43,000	-£38,000	-£43,000	-£38,000	-£43,000	-£38,000	-£43,000	
Other postgraduate					£101,000	£104,000	-£2,000	£39,000	-£32,000	-£28,000	-£32,000	-£28,000	-£32,000	-£28,000
Higher degree (taught)				£198,000	£161,000		£45,000	£73,000	£9,000	£3,000	-£25,000	-£24,000		-£24,000
Higher degree (research)						£101,000	£51,000	£28,000		-£34,000	-£12,000	-£62,000		-£82,000
Part-time students														
Other undergraduate		£48,000		£29,000		-£2,000								
First degree					£43,000	£26,000								
Other postgraduate					£79,000	£88,000	£7,000	£43,000	-£9,000	-£9,000	-£9,000	-£9,000	-£9,000	-£9,000
Higher degree (taught)					£97,000	£99,000	£37,000	£60,000	£26,000	£15,000	-£13,000	-£13,000		-£13,000
Higher degree (research)			£145,000				£80,000	£61,000			£43,000	£6,000		
Students from Wales														
Full-time students														
Other undergraduate			£17,000	£42,000										
First degree			£102,000	£87,000				-£29,000						
Other postgraduate							-£2,000	£39,000						
Higher degree (taught)							£48,000							
Higher degree (research)								£28,000			-£12,000	-£62,000		
Part-time students														
Other undergraduate														
First degree														
Other postgraduate								£43,000						-£9,000
Higher degree (taught)									£63,000	£30,000				
Higher degree (research)														

Level of study	Previous qualification and gender													
	GCSE		A-level		Other undergraduate		First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Students from Scotland														
Full-time students														
Other undergraduate														
First degree			£97,000	£82,000										
Other postgraduate							-£2,000	£39,000						
Higher degree (taught)							£45,000	£73,000				-£24,000		
Higher degree (research)							£50,000				-£13,000	-£63,000		
Part-time students														
Other undergraduate														
First degree														
Other postgraduate								£43,000				-£9,000		
Higher degree (taught)		£157,000					£37,000	£60,000	£26,000	£15,000		-£13,000		
Higher degree (research)														
Students from Northern Ireland														
Full-time students														
Other undergraduate														
First degree			£93,000	£78,000	£67,000	£29,000	-£43,000							
Other postgraduate							-£2,000	£39,000						
Higher degree (taught)							£45,000					-£25,000		
Higher degree (research)											-£13,000			
Part-time students														
Other undergraduate														
First degree														
Other postgraduate								£43,000						
Higher degree (taught)								£60,000		£15,000				
Higher degree (research)														

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2020-21 University of Southampton cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Southampton is equal to or lower than the level of previous attainment. In these instances, the analysis implicitly assumes that all calculated gross returns (*before* the deduction of any foregone earnings or other costs) can only be larger or equal to zero (i.e. there can be no wage or employment penalty associated with any higher education qualification attainment). Hence, each grey-shaded cell displays only the assumed underlying direct or indirect costs associated with qualification attainment. ***Source: London Economics' analysis***

Table 28   Net Exchequer benefits per student associated with HE qualification attainment at the University of Southampton, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender													
	GCSE		A-level		Other undergraduate		First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Students from England														
Full-time students														
Other undergraduate			£14,000	£8,000	-£15,000	-£13,000	-£16,000	-£16,000			-£16,000	-£16,000		-£16,000
First degree	£167,000		£103,000	£70,000	£76,000	£50,000	-£32,000	-£29,000		-£29,000				
Other postgraduate				£137,000	£161,000	£116,000	£60,000	£41,000	-£15,000	-£11,000	-£15,000	-£11,000	-£15,000	-£11,000
Higher degree (taught)			£220,000		£190,000	£161,000	£79,000	£77,000	-£2,000	£22,000	-£9,000	-£8,000	-£9,000	-£8,000
Higher degree (research)							£129,000	£78,000	£67,000	£34,000	£54,000	£4,000	-£54,000	-£40,000
Part-time students														
Other undergraduate			£27,000	£16,000		-£4,000	-£4,000	-£4,000	-£4,000	-£4,000	-£4,000	-£4,000	-£4,000	-£4,000
First degree														
Other postgraduate			£164,000	£116,000		£96,000	£56,000	£41,000	-£1,000	-£1,000	-£1,000	-£1,000	-£1,000	-£1,000
Higher degree (taught)			£160,000	£129,000	£131,000	£111,000	£65,000	£63,000	£18,000	£27,000	-£2,000	-£2,000	-£2,000	-£2,000
Higher degree (research)							£97,000	£63,000		£41,000	£56,000	£21,000	-£2,000	-£2,000
Students from Wales														
Full-time students														
Other undergraduate			£12,000	£6,000										
First degree			£96,000	£63,000			-£39,000	-£36,000						
Other postgraduate							£60,000	£41,000						-£11,000
Higher degree (taught)							£77,000	£76,000		£21,000				
Higher degree (research)							£129,000	£78,000			£54,000			
Part-time students														
Other undergraduate				£16,000				-£4,000						
First degree														
Other postgraduate							£56,000		-£1,000				-£1,000	
Higher degree (taught)					£130,000		£64,000	£62,000		£25,000				-£3,000
Higher degree (research)							£97,000							

Level of study	GCSE		A-level		Other undergraduate		First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Students from Scotland														
Full-time students														
Other undergraduate				£10,000										
First degree			£108,000	£75,000										
Other postgraduate							£60,000	£41,000						-£11,000
Higher degree (taught)							£79,000	£77,000	-£2,000	£22,000		-£8,000		
Higher degree (research)								£81,000			£56,000	£6,000		
Part-time students														
Other undergraduate								-£1,000						
First degree														
Other postgraduate								£41,000				-£1,000		
Higher degree (taught)							£65,000	£63,000				-£2,000		-£2,000
Higher degree (research)												£23,000		£0
Students from Northern Ireland														
Full-time students														
Other undergraduate			£17,000	£10,000										
First degree			£110,000	£77,000			-£25,000							
Other postgraduate							£60,000	£41,000			-£15,000			
Higher degree (taught)							£79,000	£77,000						
Higher degree (research)							£132,000				£56,000	£6,000		
Part-time students														
Other undergraduate														
First degree														
Other postgraduate								£41,000						
Higher degree (taught)							£65,000					-£2,000		
Higher degree (research)											£59,000			

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2020-21 University of Southampton cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Southampton is equal to or lower than the level of previous attainment. In these instances, the analysis implicitly assumes that all calculated gross returns (*before* the deduction of any foregone earnings or other costs) can only be larger or equal to zero (i.e. there can be no wage or employment penalty associated with any higher education qualification attainment). Hence, each grey-shaded cell displays only the assumed underlying direct or indirect costs associated with qualification attainment. *Source: London Economics' analysis*

A2.3 Impact on educational exports

A2.3.1 Additional information on the 2020-21 cohort of non-UK domiciled students studying at the University of Southampton

Table 29 presents a detailed breakdown of the 2020-21 non-UK domiciled University of Southampton cohort, by domicile, level, and mode of study.

Table 29   Non-UK domiciled students in the 2020-21 cohort of University of Southampton students, by level of study, mode of study and domicile

Level and mode of study	Domicile		
	EU	**Non-EU**	**Total**
Full-time			
Other undergraduate	0	0	**0**
First degree	330	475	**805**
Other postgraduate	5	10	**15**
Higher degree (taught)	120	2,955	**3,075**
Higher degree (research)	65	190	**255**
Total	**520**	**3,630**	**4,150**
Part-time			
Other undergraduate	0	0	**0**
First degree	0	0	**0**
Other postgraduate	10	10	**20**
Higher degree (taught)	5	5	**10**
Higher degree (research)	5	0	**5**
Total	**20**	**15**	**35**
Total			
Other undergraduate	0	0	**0**
First degree	330	475	**805**
Other postgraduate	15	20	**35**
Higher degree (taught)	125	2,960	**3,085**
Higher degree (research)	70	190	**260**
Total	**540**	**3,645**	**4,185**

Note: All numbers are rounded to the nearest 5, and the total values may not add up precisely due to this rounding.
'Other undergraduate' learning includes Certificates of Higher Education and other undergraduate-level diplomas and certificates.
'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, taught work for credit at postgraduate level, and other certificates, diplomas, and qualifications at postgraduate level.
Source: London Economics' analysis based on University of Southampton's HESA data

A2.3.2 Net tuition fee income per international student

Table 30 presents estimates of the net tuition fee income per international student in the 2020-21 University of Southampton cohort (over the entire study duration), by domicile, level of study, and mode of study.

Table 30   Net tuition fee income per international student in the 2020-21 cohort of University of Southampton students, by level of study, mode, and domicile

Level	EU domiciled students		Non-EU domiciled students	
	Full-time	Part-time	Full-time	Part-time
Other undergraduate	£6,000		£9,000	
First degree	£17,000		£27,000	
Other postgraduate	£6,000	£8,000	£30,000	£28,000
Higher degree (taught)	£6,000	£12,000	£30,000	£41,000
Higher degree (research)	£5,000	£3,000	£36,000	

Note: Gaps may arise where there are no students in the 2020-21 University of Southampton cohort expected to complete the given qualification (of the given characteristics). All estimates are presented in 2020-21, discounted to reflect net present values, and rounded to the nearest £1,000.

Source: London Economics' analysis

A2.3.3   Assumed average stay durations among international students

As outlined in Section 4.3.2, to estimate the non-tuition fee income associated with non-UK students in the 2020-21 University of Southampton cohort, we adjusted the estimates of non-tuition fee expenditure per academic year from the Student Income and Expenditure Survey (based on English-domiciled students) to reflect longer stay durations in the UK for international students.

In particular, following a similar approach as a study for the (former) Department for Business, Innovation and Skills (2011b), we assume that **EU domiciled postgraduate** and **non-EU domiciled undergraduate and postgraduate students** spend a larger amount of time in the UK than prescribed by the duration of the academic year (39 weeks), on average[122]. Hence, we assume that all international postgraduate students (both EU and non-EU domiciled) spend **52 weeks** per year in the UK (as they write their dissertations during the summer). Further, we assume that non-EU domiciled and EU domiciled undergraduate students spend an average of **42** and **39 weeks** per year in the UK (respectively). The lower stay duration for EU undergraduate students reflects the expectation that these students, given the relative geographical proximity to their home countries and the resulting relative ease and low cost of transport, are more likely to return home during holidays. These assumptions are summarised in Table 31.

Table 31   Assumed average stay durations (in weeks) for non-UK domiciled students, by study level and study mode

Level of study	Domicile	
	EU (outside UK)	Non-EU
Undergraduate	39 weeks	42 weeks
Postgraduate	52 weeks	52 weeks

Source: London Economics' analysis based on Department for Business, Innovation and Skills (2011b)

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[122] There may be significant variation around these assumed average stay durations depending on individual students' circumstances, such as country of origin, parental income etc. Further note that we have made separate adjustments to the non-tuition fee expenditures of international students in the cohort during the 2020-21 academic year to account for the increased likelihood of students returning to their home countries during the Covid-19 pandemic (see Section 4.3.2).

A2.3.4   Non-fee income per international student

Table 32 presents estimates of the non-tuition fee income per international student in the 2020-21 University of Southampton cohort (over the entire study duration), by domicile, level of study, and mode of study.

Table 32   Non-fee income per international student in the 2020-21 cohort of University of Southampton students, by level of study, mode, and domicile

Level	EU domiciled students		Non-EU domiciled students	
	Full-time	**Part-time**	**Full-time**	**Part-time**
Other undergraduate	£9,000		£10,000	
First degree	£32,000		£34,000	
Other postgraduate	£13,000	£38,000	£13,000	£38,000
Higher degree (taught)	£13,000	£56,000	£13,000	£56,000
Higher degree (research)	£57,000	£107,000	£57,000	

Note: Gaps may arise where there are no students in the 2020-21 University of Southampton cohort expected to complete the given qualification (of the given characteristics). All estimates are presented in 2020-21, discounted to reflect net present values, and rounded to the nearest £1,000.
Source: London Economics' analysis

A2.4   Total impact by region and sector (where available)

In addition to the total impact on the UK economy as a whole (presented in Section 7), it was possible to disaggregate *some* strands of the University's economic impact by sector and region (and estimate the impacts in terms of economic output *as well as* GVA and FTE employment). The strands of impact for which this disaggregation was achievable include:

- The impact of the University's **knowledge exchange activities** (estimated at **£1,168 million**, see Section 2.2);

- The impact of the University's **educational exports** (**£553 million**, see Section 4);

- The impact associated with the **operating and capital expenditure of the University** (**£763 million**, see Section 5); and

- The impact of the University's **contribution to tourism** (**£69 million**, see Section 6).

Hence, approximately **£2,553 million** (**62%**) of the University of Southampton's total impact of **£4,138 million** can be disaggregated in this way[123] (see Figure 24).

In terms of the breakdown by region, the analysis indicates that of this total of **£2,553 million**, **£1,637 million** (**64%**) was generated in the **South East**, with **£915 million** (**36%**) occurring in **other regions** across the UK.

In terms of sector, the University's activities resulted in particularly large impacts within the **production sector** (**£643 million**, **25%**), the **government, health, and education sector** (**£614 million**, **24%**), the **distribution, transport, hotel, and restaurant sector (£392 million**, **15%**), and the **professional and support activities sector** (**£308 million**, **12%**).

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[123] The remaining **£1.6 billion** of impact includes the impact of the University's **research activities** (**£904 million**, where a breakdown by region or sector is not available as it was not possible to assign the geographic location or sectors of businesses benefiting from productivity spillovers generated by the University's research); and the impact of **teaching and learning activities (£682 million**, where a breakdown by region or sector is not available due to graduate mobility (i.e. it is very difficult to determine the region/sector of employment that graduates end up in).

Figure 24   Total economic impact of the University of Southampton's activities in 2020-21, by region and sector (where possible)

By region

Output, £m

Region	
North East	£33m
North West	£83m
Yorkshire & the Humber	£69m
East Midlands	£73m
West Midlands	£81m
East of England	£100m
London	£272m
South East	£1,637m
South West	£78m
Wales	£39m
Scotland	£63m
Northern Ireland	£25m
Total	£2,553m

Economic output, £m

GVA, £m

Region	
North East	£23m
North West	£45m
Yorkshire & the Humber	£39m
East Midlands	£42m
West Midlands	£46m
East of England	£58m
London	£122m
South East	£846m
South West	£47m
Wales	£26m
Scotland	£37m
Northern Ireland	£18m
Total	£1,351m

GVA, £m

FTE employment

Region	
North East	275
North West	525
Yorkshire & the Humber	500
East Midlands	520
West Midlands	535
East of England	655
London	1,035
South East	10,385
South West	595
Wales	375
Scotland	400
Northern Ireland	235
Total	16,035

# of full-time equivalent employees

By sector

Output, £m

Sector	
Agriculture	£20m
Production	£643m
Construction	£63m
Distr., transport, hotels & restaurants	£392m
Information & communication	£93m
Financial & insurance	£129m
Real estate	£224m
Professional & support activities	£308m
Government, health & education	£614m
Other services	£67m
Total	£2,553m

Economic output, £m

GVA, £m

Sector	
Agriculture	£9m
Production	£204m
Construction	£25m
Distr., transport, hotels & restaurants	£210m
Information & communication	£54m
Financial & insurance	£57m
Real estate	£180m
Professional & support activities	£177m
Government, health & education	£393m
Other services	£42m
Total	£1,351m

GVA, £m

FTE employment

Sector	
Agriculture	200
Production	1,265
Construction	230
Distr., transport, hotels & restaurants	3,345
Information & communication	505
Financial & insurance	385
Real estate	270
Professional & support activities	2,805
Government, health & education	6,525
Other services	475
Total	16,005

# of full-time equivalent employees

Note: Monetary estimates are presented in 2020-21 prices, discounted to reflect net present values (where applicable), rounded to the nearest £1 million, and may not add up precisely to the totals indicated. Employment estimates are rounded to the nearest 5, and again may not add up precisely to the totals indicated. *Source: London Economics' analysis*

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