University of Glasgow

THE ECONOMIC IMPACT OF THE UNIVERSITY OF GLASGOW

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Executive Summary

The aggregate economic impact of the University of Glasgow

The total economic impact on the UK economy associated with the University of Glasgow's activities in 2018-19 was estimated at approximately **£4.4 billion** (see Table 1)[1]. In terms of the components of this impact, the value of the University's **research activities** stood at **£1.8 billion** (**42%** of total), while the impact generated by the **operating and capital expenditures of the University** stood at **£1.2 billion** (**27%**). The impact of the University's **teaching and learning activities** accounted for **£734 million** (**17%**). The remaining **14%** of economic impact (**£631 million**) was associated with the University's **educational exports**.

The total economic impact associated with the University of Glasgow's activities in 2018-19 stood at £4.4 billion.

Table 1 Total economic impact of the University of Glasgow's activities in the UK in 2018-19 (£m and % of total)

Type of impact	£m	%
Impact of research	**£1,833m**	**42%**
Net direct impact	£96m	2%
Spillover impact	£1,737m	40%
Impact of teaching and learning	**£734m**	**17%**
Students	£401m	9%
Exchequer	£333m	8%
Impact of exports	**£631m**	**14%**
Tuition fee income	£320m	7%
Non-tuition fee income	£310m	7%
Impact of the University's spending	**£1,202m**	**27%**
Direct impact	£706m	16%
Indirect and induced impacts	£496m	11%
Total economic impact	**£4,399m**	**100%**

Note: All estimates are presented in 2018-19 prices, rounded to the nearest £1m, and may not add up precisely to the totals indicated.
Source: London Economics' analysis

Compared to the University's total operational costs of approximately **£757 million** in 2018-19[2], the total impact of the University of Glasgow's activities on the UK economy was estimated at **£4.4 billion**, which corresponds to a **benefit to cost ratio of 5.8:1**. This compares to an average benefit-to-cost ratio among Russell Group institutions of approximately **5.5:1**, and corresponds to a **14%** increase in the University's impact of since 2015-16 (on a like-for-like basis, in real terms[3]).

[1] All estimates here are presented in terms of economic output (equivalent to income/turnover). The impact of the University's educational exports and institutional expenditures can also be converted into gross value added (GVA) and full-time (FTE) employment, and these additional findings are provided within the relevant sections throughout this report.
[2] This relates to the University's total operating expenditure, excluding capital expenditure.
[3] See London Economics (2017). The analysis of the economic impact of all Russell Group institutions (including the University of Glasgow) was based on the 2015-16 academic year.

The impact of the University's research

To estimate the **direct** economic impact associated with the University of Glasgow's research, we used information on the total research-related income accrued by the University in 2018-19 (including income from research grants and contracts as well as quality related recurrent research grant funding provided by the Scottish Funding Council). The total research-related income accrued by the University in 2018-19 stood at **£253 million**. Approximately **30%** (**£76 million**) of this income was received from the UK Research Councils, with an additional **23%** (**£58 million**) received through recurrent research grant funding from the Scottish Funding Council, **23%** (**£59 million**) from UK charities, and **12%** (**£31 million**) from other UK sources. In addition, **8%** (**£21 million**) of the University's research-related income was derived from EU research grants and contracts, and the remaining **3%** (**£8 million**) was from non-EU sources.

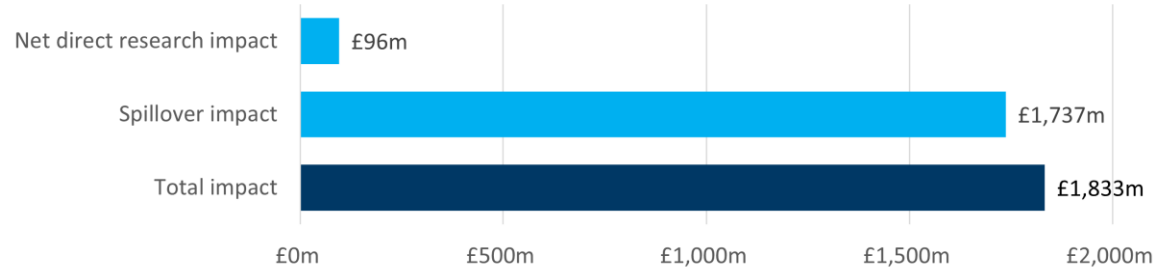
The impact of the University of Glasgow's research activities in 2018-19 stood at £1.8 billion.

To arrive at the net impact of the University's research activities, we deducted the public costs of funding the University's research (including funding from the UK Research Councils, the Scottish Funding Council, and from UK central government bodies, Local Authorities, and health and hospital authorities). Together, these public costs amounted to **£157 million**, resulting in a **net direct research impact** of **£96 million**.

Existing academic literature[4] suggests that there are significant **productivity spillovers** generated from public investment in university research. Applying estimates from the literature, our analysis implies a spillover multiplier of approximately **6.9** associated with the University of Glasgow's research income in 2018-19. In other words, **every £1 million invested in research at the University results in productivity spillovers of £6.9 million across the UK economy**. Combining the **net direct impact** of the University's research activities (**£96 million**) with the resulting **productivity spillovers** accrued by other organisations across the UK (**£1,737 million**), the total impact of research conducted by the University in 2018-19 was estimated at **£1,833 million**.

Comparing this total impact to the **£253 million** of total research income received by the University in 2018-19, this suggests that **for every £1 million of its research income, the University's research activities generated a total of £7.2 million in economic impact across the UK**.

Figure 1 Impact of the University of Glasgow's research activities in 2018-19 (£m)



Note: All estimates are presented in 2018-19 prices, rounded to the nearest £1m, and may not add up precisely to the totals indicated.
Source: London Economics' analysis

[4] See Haskel and Wallis (2010), and Haskel et al. (2014).

The impact of the University's teaching and learning activities

The impact of the University's teaching and learning activities estimates the **enhanced employment and earnings benefits to graduates**, and the **additional taxation receipts to the Exchequer** associated with higher education qualification attainment at the University of Glasgow[5]. The analysis is adjusted for the characteristics of the **8,280** UK domiciled students who started a qualification (or standalone module/credit) at the University in 2018-19.

Incorporating both the benefits and costs to students/graduates, the analysis suggests that the **net graduate premium** achieved by representative Scottish domiciled students in the 2018-19 cohort completing a **full-time first degree** at the University of Glasgow (with Scottish Highers as their highest level of prior attainment) stands at approximately **£89,000** (in 2018-19 money terms, on average across men and women). Taking account of the benefits and costs to the public purse, the corresponding **net Exchequer benefit** associated with these students stands at **£65,000**.

The net graduate premiums and net Exchequer benefits (by gender, study mode, study level, domicile, and prior attainment, and adjusted for the subject mix of the cohort) were combined with information on the number of UK domiciled students in the 2018-19 cohort and expected completion rates. The aggregate economic impact generated by the University of Glasgow's teaching and learning activities associated with the 2018-19 cohort stood at **£734 million**, of which **£401 million** (**55%**) is accrued by students undertaking qualifications at the University of Glasgow, and **£333 million** (**45%**) is accrued by the Exchequer.

The total economic impact of teaching and learning generated by the 2018-19 cohort of University of Glasgow students stands at £734 million.

Table 2 Impact of the University of Glasgow's teaching and learning activities associated with the 2018-19 cohort (£m), by type of impact, domicile, and level of study

Beneficiary and study level	Domicile				
	Scotland	England	Wales	Northern Ireland	Total
Students	**£332m**	**£57m**	**£2m**	**£9m**	**£401m**
Undergraduate	£222m	£35m	£2m	£7m	**£266m**
Postgraduate	£110m	£22m	£1m	£2m	**£135m**
Exchequer	**£271m**	**£51m**	**£2m**	**£9m**	**£333m**
Undergraduate	£154m	£24m	£1m	£7m	**£186m**
Postgraduate	£117m	£27m	£1m	£3m	**£147m**
Total	**£603m**	**£108m**	**£4m**	**£19m**	**£734m**
Undergraduate	£376m	£59m	£3m	£14m	**£452m**
Postgraduate	£227m	£49m	£2m	£5m	**£282m**

Note: All estimates are presented in 2018-19 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

[5] The analysis is based on a detailed econometric analysis of the Labour Force Survey. The analysis considers the impact of higher education qualification attainment on earnings and employment; however, as no information is specifically available on the particular institution attended, the analysis is not specific to University of Glasgow alumni. Rather, the findings from the econometric analysis are adjusted to reflect the characteristics of the 2018-19 cohort of University of Glasgow students (e.g. in terms of mode of study, level of study, subject mix, domicile, gender, average age at enrolment, duration of qualification, and average completion rates).

The impact of the University's educational exports

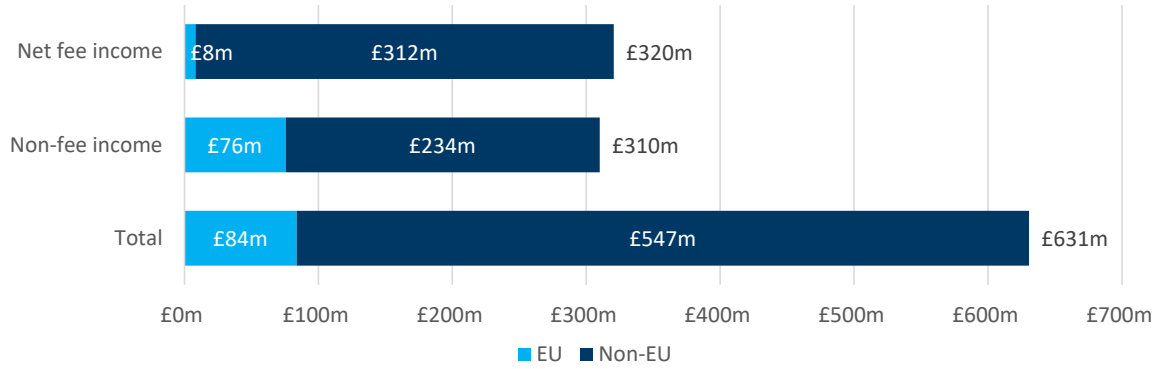
The University of Glasgow attracts a large number of international students, and the University's higher education offer represents a tradeable activity with imports and exports like any other tradeable sector. The economic impact of the University's contribution to educational exports is based on the **direct** injection of **tuition fee and non-tuition fee income** from the University's international students, as well as the resulting **indirect and induced impacts** generated throughout the UK economy. The analysis focuses on the cohort of **5,870** non-UK domiciled students who started qualifications (or modules/credits) at the University of Glasgow in 2018-19 (including **1,210** (**21%**) EU domiciled and **4,660** (**79%**) non-EU domiciled students).

Combining the tuition fee income (net of any Exchequer cost/University cost of funding international students) and non-tuition fee income associated with international students in the 2018-19 cohort, the **total export income (i.e. direct impact)** generated by this cohort stood at **£239 million**. Approximately half of this income (**£122 million**) was generated from international students' non-tuition fee spending, while the other half (**£116 million**) was generated from international students' (net) tuition fees accrued by the University of Glasgow.

The impact of the export income generated by the 2018-19 University of Glasgow cohort stood at £631 million.

The total (direct, indirect, and induced) impact associated with this export income was estimated using economic multipliers derived from a (multi-regional) Input-Output model, estimating the extent to which the direct export income generates additional activity throughout the UK economy. We thus 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 2018-19 University of Glasgow cohort amounts to **£631 million**. Of this total, **£320 million** was associated with international students' (net) **tuition fees**, and **£310 million** was associated with these students' **non-tuition fee expenditures** over the duration of their studies at the University of Glasgow.

Figure 2 Impact of the University's educational exports associated with international students in the 2018-19 cohort (£m), by domicile and type of income



Note: All estimates are presented in 2018-19 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

The impact of the University's expenditure

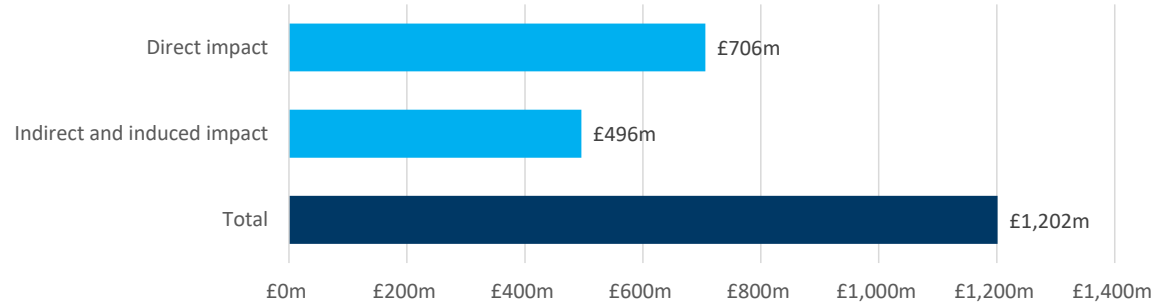
As a final strand of economic impact, the University of Glasgow's physical footprint supports jobs and promotes economic growth throughout the UK economy. This is captured by the **direct, indirect, and induced impact** associated with the University's expenditures.

The **direct impact** of the University's physical footprint was based on the operating and capital expenditures of the University. In 2018-19, the University of Glasgow incurred a total of **£706 million** of expenditure. This includes **£355 million** of staff costs, **£260 million** of other (non-staff) operating expenses[6], and **£91 million** of capital expenditure incurred in that academic year.

As with the impact of the University's educational exports, the direct increase in economic activity resulting from the expenditures of the University generates additional rounds of spending throughout the economy (through the University's supply chains, and the spending of its staff). Applying the relevant economic multipliers, the **total direct, indirect, and induced impact** associated with the expenditures of the University of Glasgow in 2018-19 was estimated at **£1,202 million**.

The impact of the University of Glasgow's expenditure on the UK economy in 2018-19 stood at £1.2 billion.

Figure 3 Impact associated with the University's expenditure in 2018-19 (£m)



Note: All estimates are presented in 2018-19 prices, rounded to the nearest £1m, and may not add up precisely to the totals indicated.
Source: London Economics' analysis

[6] The total operational expenditure (excluding capital expenditure) of the University of Glasgow in 2018-19 stood at **£757 million**. From this, we excluded **£33 million** in depreciation costs (from non-staff expenditure) and **£109 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).

1 Introduction

Background

Since 2010, the University of Glasgow has made significant progress – nationally and internationally. Expanding and diversifying its community, the University has welcomed students and staff from 147 nations, with the number of students and academic staff increasing by approximately 30% over the last decade. With firm roots in its local community since its foundation, in the last decade, the University has seen more than 8,000 students from the most economically deprived backgrounds graduate and prosper. The University has also simultaneously contributed to the life chances, health and cultural wellbeing of the Glasgow region and the West of Scotland through the development of major new facilities for cancer and virus research, the training of medical professionals, and the conservation of internationally recognised archives and collections. This programme of investment is set to continue with a £1bn redevelopment of the campus. Fundamentally international in its outlook, the impact of the University stretches across the planet. With research income having more than doubled over the decade, and making major contributions to global academic endeavours, the University has won the Queen's Anniversary Prize twice, which recognises the excellence, innovation and public benefit inherent in the University's world-leading research work.

Underpinned by core values relating to **ambition and excellence**, **integrity and truth**, **curiosity and discovery**, and an **inclusive community**, the University has set out to achieve a number of ambitious goals by 2025 encompassed by its **World Changers Together** strategy.[7] Summarised along three core themes (**Community**, **Connectivity** and **Challenge**), the University is seeking to further develop the critical role and its long-standing commitment to its **community** through a people centred and globally engaged partnership vision. Secondly, though the creation of collaborative space, investment in the digital realm and the adoption of technologies to facilitate frictionless and flexible work and study, the University aims to contribute to the emerging challenge of **connectivity**, which as a result of the global pandemic, has never been more important. Finally, focusing on **challenge**, the University's research will be focused on offering solutions to global priorities, preparing students for an increasingly challenging and changing world, as well as building a sustainable future through its education, research and actions.

Focusing on the 2018/19 academic year, this report provides a baseline for the many achievements of the University, to understand its economic and social contribution to Glasgow, Scotland and the United Kingdom, as well as a means to assess much of its progress in the coming years.

Report structure

London Economics were commissioned to assess the **economic impact of the University of Glasgow in the United Kingdom**, focusing on the 2018-19 academic year. The University 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's **research activities**;
- The economic contribution of the University's provision of **teaching and learning**;
- The impact of the University's contribution to **educational exports**; and
- The impact of the University's **operating and capital expenditures**.

[7] University of Glasgow (2021)

In addition, though not monetised, we consider the University's **wider economic, social, cultural, and environmental contributions**. 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's world-leading research activities. This is estimated by combining information on the research-related income accrued by the University in 2018-19 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 Glasgow. Through an assessment of the lifetime benefits and costs associated with educational attainment, we estimate the net economic benefits of the University's teaching and learning activity to the University's students and the public purse (through enhanced taxation receipts), focusing on the cohort of **8,280** UK domiciled students who started higher education qualifications at the University in 2018-19.

In addition to these UK domiciled students, there were a further **5,870** international students in the 2018-19 cohort of University of Glasgow 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's 2018-19 cohort of international students[8].

Given that the University is a major employer and supports its core activities through significant expenditures, the University of Glasgow's 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 in 2018-19.

Section 6 of this report summarises our main findings on the main findings on the **aggregate economic impact** of the University of Glasgow in 2018-19. Finally, **Section 7** outlines the University's **wider economic, social, cultural, and environmental contributions**.

[8] It is important to note that the estimates of the impact of educational exports for the 2018-19 are likely to significantly differ from subsequent academic years following the UK's exit from the European Union. A study by London Economics on behalf of the Department for Education (see Department for Education, 2021) estimated that the combined policy changes resulting from Brexit (including the removal of tuition fee support for EU domiciled students and the de-coupling of EU and Home fees (so that EU students pay the same fees as non-EU students)) will result in a **57%** decline in the number of EU domiciled students entering UK higher education each year. This decline is likely to be larger for EU students studying in Scotland, given that EU students studying in Scotland were previously eligible for tuition fee grants covering their entire tuition fee. While the expected decline in the number of EU students might be partially offset by the higher tuition fees charged to EU students post-Brexit, the decline in the total non-fee income derived from EU students is expected to result in a significant reduction in the impact of the University of Glasgow's educational exports in subsequent academic years.

2 The impact of the University of Glasgow's research

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

2.1 Direct research impact

To estimate the **direct impact** generated by the University of Glasgow's research activities, we used information on the total research-related income accrued by the University in the 2018-19 academic year, including:

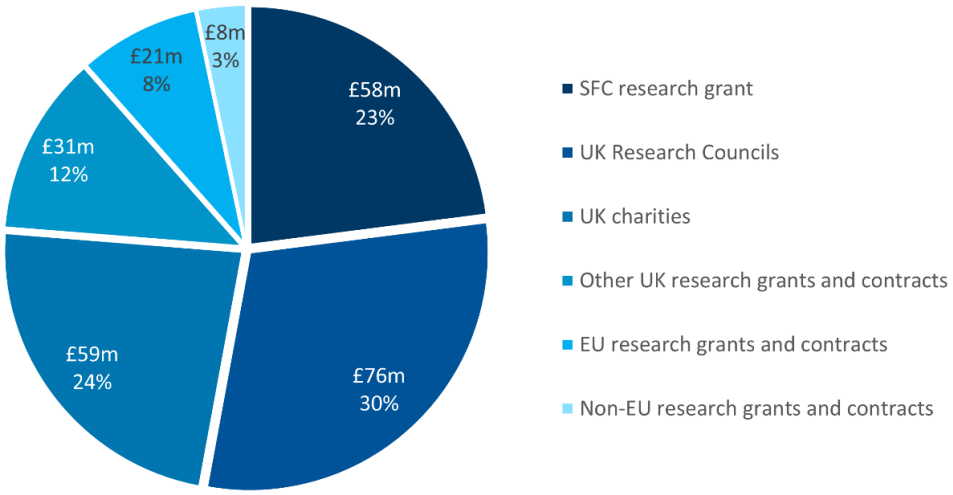
- Income from **research grants and contracts** provided by:
  - **UK sources**, including the UK Research Councils; UK-based charities; central government bodies, Local Authorities, and health and hospital authorities; industry and commerce; and other UK sources;
  - **EU sources**, including government 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 by the Scottish Funding Council (SFC)[9].

Aggregating across these sources, the total research-related income accrued by the University in the 2018-19 academic year stood at **£253 million** (see Figure 4). As a result, the research income received by the University of Glasgow accounted for a significant proportion (**9%**) of the total gross domestic expenditure on research and development (GERD) in Scotland in 2018 (**£2,706 million**)[10].

The University received its research-related income from a variety of different sources both nationally and internationally. Approximately **30%** (**£76 million**) of this income was received from the UK Research Councils, with an additional **23%** (**£58 million**) received through recurrent research grant funding from the Scottish Funding Council, **23%** (**£59 million**) from UK charities, and **12%** (**£31 million**) from other UK sources[11]. In addition, in terms of funding from international sources, **8%** (**£21 million**) of the University's research-related income was derived from EU research grants and contracts, and the remaining **3%** (**£8 million**) was from non-EU sources.

[9] This includes funding from the Scottish Funding Council through its main quality research grant, research postgraduate grant, and knowledge transfer grant.
[10] See Scottish Government (2020). GERD comprises R&D undertaken by the business enterprise, higher education, government, and private non-profit sectors. GERD covers all R&D performed in Scotland, irrespective of who pays for it, including funding from abroad; however, it excludes R&D performed outside of Scotland, even if it is funded from Scotland.
[11] This income from 'other UK sources' includes **£23 million** from UK central government bodies, Local Authorities, and health and hospital authorities; **£6 million** from UK industry and commerce; and **£2 million** from other sources.

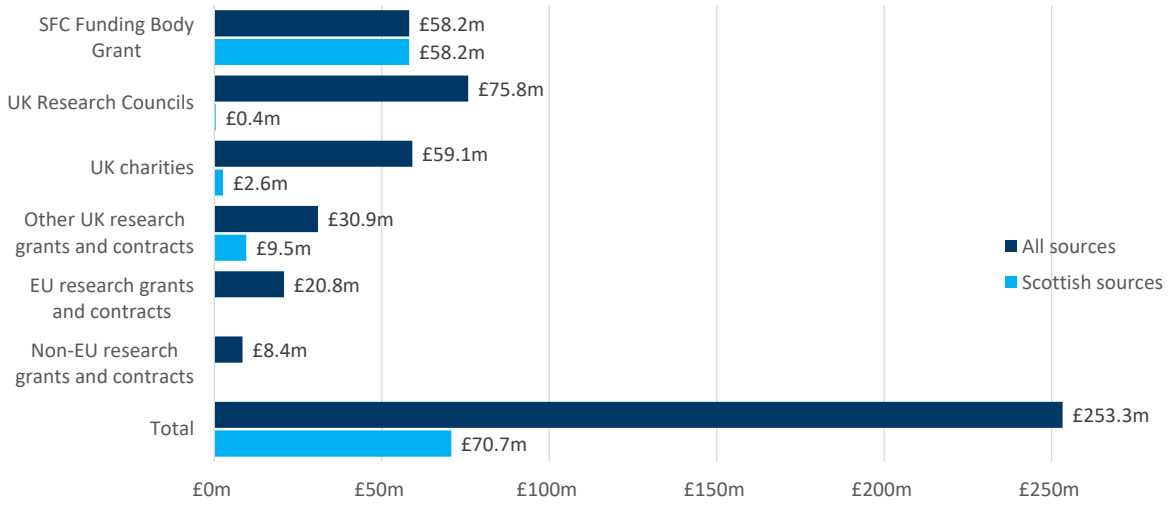
Figure 4 Research income received by the University of Glasgow in 2018-19, £m by source



Note: All values are presented in 2018-19 prices, rounded to the nearest £1 million, and may not add up precisely to the totals indicated.
Source: London Economics' analysis based on data provided by the University of Glasgow

Of the **£253 million** of total research income, **28%** (**£71 million**) was from Scottish sources, as shown in Figure 5. This income from Scottish sources included research grants provided by the Scottish Funding Council (**£58.2 million**), the Royal Society of Edinburgh (**£0.4 million**, included in funding from UK Research Councils), Scottish charities (**£2.6 million**), and other Scottish sources (**£9.5 million**[12]).

Figure 5 Research income received by the University of Glasgow in 2018-19, £m by source and all vs. Scottish sources



Note: All values are presented in 2018-19 prices, rounded to the nearest £0.1 million, and may not add up precisely to the totals indicated.
Source: London Economics' analysis based on data provided by the University of Glasgow

[12] This includes **£8.4 million** from the Scottish Government, Scottish Local Authorities, and health and hospital authorities; **£0.5 million** from Scottish industry; and **£0.7 million** from other sources.

To arrive at the **net direct impact** of the University of Glasgow's research activities on the UK economy, we deducted the costs to the public purse of funding the University's research activities in 2018-19 from the above total research income. These public costs include the funding provided by the UK Research Councils (**£76 million**), recurrent research grants provided by the Scottish Funding Council (**£58 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 (**£157 million**) from the above total research-related income (**£253 million**), we estimate that the **net direct impact** associated with the University of Glasgow's research activity in the 2018-19 academic year stood at **£96 million**.

2.2 Productivity spillovers

In addition to the direct impact of research, the wider academic literature indicates that investments in research and development (R&D) and other intangible assets may induce **positive externalities**. The term 'externality' describes 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[13]. For example, spillovers are enabled through direct R&D collaborations between universities and firms (such as Knowledge Transfer Partnerships), the publication and dissemination of research, or through university graduates entering the labour market and passing on their knowledge to their employers.

Of particular interest in the context of research conducted by universities, a study by Haskel and Wallis (2010)[14] investigates **spillovers from publicly funded R&D 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[15, 16], 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[17]. 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)**.

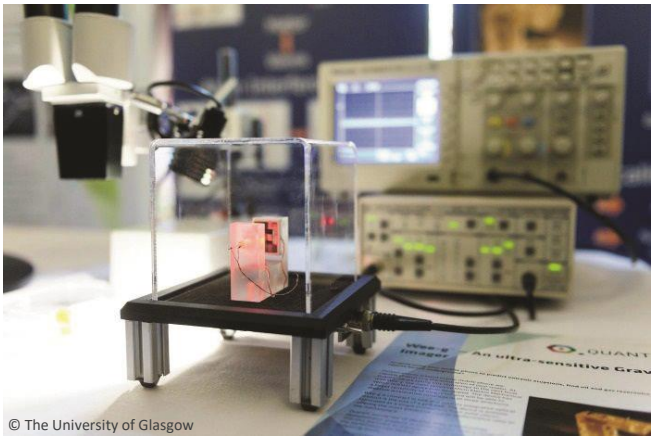
[13] Note that there are clearly also significant economic and social spillovers to the public sector associated with university research. However, despite their obvious importance, these have been much more difficult to estimate robustly, and are not included in this analysis.
[14] Also see Imperial College London (2010) for a summary of Haskel and Wallis's findings.
[15] The authors use data on government expenditure published by the Department for Business, Innovation and Skills for the financial years between 1986-87 and 2005-06.
[16] This is undertaken by regressing total factor productivity growth in the UK on various measures of public sector R&D spending.
[17] Note that the authors' regressions only test for correlation, so that their results could be subject to reverse causation (i.e. it might be 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.

QuantIC

The quantum technology sector is a potential billion-dollar industry for the United Kingdom. QuantIC, the University of Glasgow-led quantum imaging hub, is **supporting quantum science out of the research lab and into the commercial world**. With applications in healthcare, security, energy, and defence, QuantIC is giving the UK a head-start in the international race to industrialise quantum technologies.

As part of the £270 million investment into the UK National Technologies Programme, the Engineering and Physical Sciences Research Council (EPSRC) funded a national network of four Quantum Technologies Hubs across the UK, of which QuantIC is one. **QuantIC brings together researchers from the universities of Glasgow, Bristol, Edinburgh, Heriot-Watt, Oxford, and Strathclyde with more than 40 industry partners**.

Quantum imaging in Glasgow


© The University of Glasgow

The ambitious vision of QuantIC is to pioneer a family of multidimensional cameras operating across a range of wavelengths, time-scales, and length-scales, **creating a new industrial landscape for imaging systems and their applications in the UK**. Since QuantIC was created in December 2014, the hub has built on existing partnerships and industrial collaborations with global industry leaders to shape the research landscape with industry priorities.

The University of Glasgow's world-leading research in optics, physics, and engineering made it the ideal location to house QuantIC and facilitate collaboration between interdisciplinary research teams. The University has internationally recognised leaders in quantum science, which has attracted a strong network of industry partners. QuantIC researchers also have access to the James Watt Nanofabrication Centre (JWNC), a centre of technical expertise and equipment that has provided technology solutions to over 300 companies in 28 countries.

Collaborating for competitive advantage

QuantIC has built a dedicated £3 million Innovation Space above the JWNC to facilitate academic and industrial collaborations by offering free use of optical laboratory and office space to SMEs, start-ups, and companies to support the development of the photonics sector. The Hub's commitment to helping companies innovate is highlighted by the £4 million Partnership Resource Fund, which was set up to bring together industry with academic partners to develop new or enhanced products, services, processes, or increase their capability.

QuantIC also **supports skills development** through their QuantIC Industrial Studentship Programme. Over £490,000 has been awarded across 12 industry-led projects including Amazon, M Squared Lasers, and QinetiQ, which is helping to nurture the next generation of quantum engineers.

MIRAGE Consortium

The £6 million MIRAGE consortium brought together four Scottish manufacturers with Professor Iain Thayne and Dr Matt Steer in the School of Engineering, supported by Scottish Enterprise and Scotland's Innovation Centre for Sensing and Imaging. The consortium aimed to **place Scotland at the forefront of the £7 billion global sensors and imaging systems market, to deliver significant economic growth and onshore highly skilled research and manufacturing jobs from Asia**. The initiative, the first of its kind in Scotland, was created to share knowledge and expertise, exchange ideas, and improve collaborative practices.

Collaborating with Scottish Businesses

The four companies in the consortium - Cascade Technologies, Gas Sensing Solutions Ltd (GSS), Compound Semiconductor Technologies Global (CSTG), and Amethyst Research Ltd - utilised the semiconductor materials growth expertise of Dr Matt Steer. This allowed them to create cutting-edge mid-infrared sensors in high volumes with greater sensitivity, lower cost, reduced energy use, and a longer lifespan than existing products. The collaboration **supported the production of materials integral to manufacturing a variety of goods that use sensors, ranging from asthma inhalers to infrared cameras**.

Outcomes

- For **Cascade Technologies**, MIRAGE has progressed their journey towards becoming a supply chain for Quantum Cascade Lasers, and work continues on the delivery of devices. It has resulted in **increased revenue potential with cost reduction of current products**.
- MIRAGE helped **CSTG** develop mid-infrared laser chips for applications in worldwide sensing, imaging, telecoms, and data-centre markets. The collaboration provided CSTG with access to expertise and materials required to **develop a new chip at the forefront of the sector, and to create a globally competitive supply chain in Scotland**. CSTG now manufacture lasers in high volumes, and six specialist engineering jobs have been created.
- **GSS launched two new products developed during the MIRAGE project**. These can detect leaks in food packaging to potentially reduce waste, and monitor CO2 levels in patients' breath to identify potential problems. The low power capability makes products ideal for use in wearables to inform users of potentially dangerous levels of CO2. The new products are an integral part of the company's growth plans to improve outcomes for their global customer base.
- MIRAGE partners provided **Amethyst Research Ltd** with knowledge and manufacturing processes to develop their III-V infrared detectors. Amethyst's progress **attracted a prime contractor interested in taking the technology towards commercialisation**.

MIRAGE has been responsible for over 40 new high skilled jobs, and it is expected to deliver a £56 million boost to the Scottish economy over 10 years. The partners of the consortium continue to operate in partnership activities and proposal building outside of the original MIRAGE project.

Another study by Haskel et al. (2014) provides additional insights 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[18]. 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)[19], interacted with measures of industry research activity, and total factor productivity within the different market sectors[20]. 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)**.

To estimate the productivity spillovers associated with the University of Glasgow'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 in 2018-19 (again see Figure 4). More specifically, we assign the multiplier of **12.7** to the research funding that the University received from **UK Research Councils and UK charities**[21] in 2018-19 (equal to **£135 million**), and the multiplier of **0.2** to **all other research funding** received by the University in that academic year (**£118 million**)[22]. We thus infer a weighted average spillover multiplier associated with the University of Glasgow's research activities of approximately **6.9** – i.e. **every £1 million invested in the University's research activities generates an additional annual economic output of £6.9 million across the UK economy**. We thus estimate that the research conducted by the University of Glasgow in 2018-19 resulted in total market sector productivity spillovers of **£1,737 million**.

2.3 Aggregate impact of the University's research

Combining the direct economic impact of the University's research (**£96 million**) with the estimated productivity spillovers associated with this research (**£1,737 million**), we estimate that the total economic impact associated with the University of Glasgow's research activities in 2018-19 stood at approximately **£1,833 million** (see Figure 6).

The impact of the University of Glasgow's research activities in 2018-19 stood at £1.8 billion.

Comparing this total impact to the **£253 million** of total research income received by the University in 2018-19, this suggests that **for every £1 million of its research income, the University's research**

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

[19] 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 estimated the impact of research *funding* by the Research Councils on private sector productivity, Haskel et al. 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.

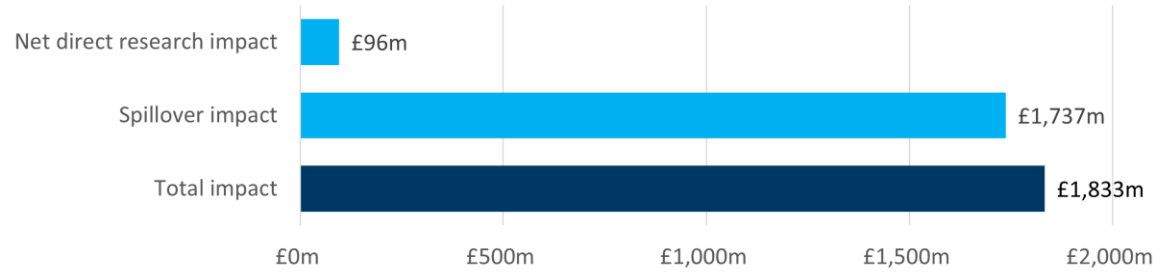
[20] In particular, the authors regress the three-year natural log difference of total factor productivity on the three-year and six-year lagged ratio of total research performed by the Research Councils, government, and the Higher Education Funding Councils over real gross output per industry. To arrive 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.

[21] The vast majority of funding provided to the University of Glasgow by UK charities relates to projects commissioned through an open competitive process.

[22] 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.

activities generated a total of £7.2 million in economic impact across the UK. Focusing on the research income received from public sources in Scotland (**£67 million** in 2018-19[23]), the ratio of the **total economic impact of the University of Glasgow's research activities to the public research funding from Scottish sources stands at 27.4**.

Figure 6 Total impact of the University of Glasgow's research activities in 2018-19, £m



All values are presented in 2018-19 prices, rounded to the nearest £1 million, and may not add up precisely to the total indicated.
Source: London Economics' analysis

[23] This includes **£58.2 million** in SFC research grants, **£0.4 million** in funding from the Royal Society of Edinburgh, and **£8.4 million** from the Scottish Government, Scottish Local Authorities, and health and hospital authorities.

The University of Glasgow's knowledge transfer activities

In addition to the research undertaken in 2018-19, the University of Glasgow was also involved in a range of wider **knowledge dissemination activities**. Using information from the Higher Education Business and Community Interaction Survey (HE-BCI), Table 3 presents a ranking of the number of **disclosures and patents** filed by different UK higher education institutions in 2018-19 (focusing on the top 25 universities in terms of the number of disclosures or patents filed). The table demonstrates that, in 2018-19, the University of Glasgow was in the **top 5 universities** in terms of the number of new patents granted (**94**) and the number of patents filed by an external third party naming the University as an inventor (**120**). In addition, the University also ranked within the top 25 universities in terms of the number of disclosures filed (**67**), new patent applications filed (**35**), and the cumulative number of patents held (**256**) in the 2018-19 academic year. In other words, the University of Glasgow is one of the top UK universities for generating intellectual property from its research.

Table 3 Disclosures and patents filed in 2018-19, top 25 universities

Rank	# of disclosures filed in year		# of new patent applications filed in year		# of patents granted in year		Cumulative patent portfolio		# of external patents filed naming the HEI as an inventor	
1	The University of Oxford	367	The University of Oxford	217	The University of Oxford	434	The University of Oxford	3,941	The University of Leicester	578
2	The University of Birmingham	239	The University of Cambridge	214	University College London	198	University College London	2,396	University of Nottingham	458
3	Imperial College	233	Imperial College	153	**The University of Glasgow**	**94**	Imperial College	1,512	King's College London	295
4	The University of Cambridge	194	The University of Edinburgh	121	The University of Cambridge	85	The University of Cambridge	993	The University of Cambridge	188
5	Coventry University	171	The University of Birmingham	103	Newcastle University	73	The University of St Andrews	849	**The University of Glasgow**	**120**
6	The University of Manchester	156	The University of Leeds	78	The University of Leeds	71	The University of Leicester	767	The University of Manchester	118
7	Royal College of Art	123	University College London	75	The University of Birmingham	65	The University of Dundee	638	The University of Kent	99
8	The University of Liverpool	112	Queen's University Belfast	62	The University of Edinburgh	64	Queen's University Belfast	606	The University of Birmingham	91
9	Swansea University	102	The University of Sheffield	56	Imperial College	63	The University of Birmingham	576	Cardiff University	83
10	The University of Warwick	99	The University of Southampton	56	The University of Manchester	61	Institute of Cancer Research	570	The University of York	65
11	University of Nottingham	94	Cardiff University	50	University of Nottingham	57	The University of Manchester	569	The University of Brighton	47
12	Queen Mary University of London	94	Queen Mary University of London	49	The University of St Andrews	57	King's College London	558	The University of St Andrews	46
13	King's College London	87	The University of Manchester	48	King's College London	49	The University of Leeds	494	University of the West of England	39
14	The University of Sheffield	86	King's College London	40	The University of Liverpool	48	Queen Mary University of London	487	Queen Mary University of London	38
15	University College London	84	The University of Leicester	40	The University of Southampton	48	The University of Edinburgh	478	The University of Oxford	33

Rank	# of disclosures filed in year		# of new patent applications filed in year		# of patents granted in year		Cumulative patent portfolio		# of external patents filed naming the HEI as an inventor	
16	Cardiff University	81	University of Nottingham	39	Cardiff University	37	Cardiff University	335	The University of Liverpool	31
17	The University of Southampton	70	The University of Bath	36	Queen Mary University of London	29	The University of Strathclyde	332	The Robert Gordon University	25
18	Newcastle University	69	**The University of Glasgow**	**35**	The University of Leicester	25	The University of Liverpool	317	University of Hertfordshire	23
19	The University of Strathclyde	68	Newcastle University	35	The University of Central Lancashire	22	University of Nottingham	317	The University of Bristol	20
20	**The University of Glasgow**	**67**	The University of Warwick	32	University of Plymouth	22	The University of Sheffield	281	The University of Exeter	17
21	The University of East Anglia	66	The University of Central Lancashire	29	The University of Surrey	22	Heriot-Watt University	275	Queen's University Belfast	12
22	Queen's University Belfast	64	The University of Bristol	28	The University of Greenwich	18	**The University of Glasgow**	**256**	The University of East Anglia	9
23	Birmingham City University	64	The University of East Anglia	26	Queen's University Belfast	16	The University of Southampton	251	The University of Edinburgh	8
24	The University of Bristol	63	The University of Liverpool	26	The University of Strathclyde	15	Ulster University	236	Ulster University	8
25	University of Durham	57	The University of Strathclyde	24	The University of Bradford	13	The University of Surrey	211	The University of Bradford	7

Source: London Economics' analysis of HE-BCI data (see Higher Education Statistics Agency, 2020b)

3 The impact of the University'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 the University of Glasgow'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 Glasgow, 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 2018-19 cohort of UK domiciled University of Glasgow students

The analysis of the economic impact of the University of Glasgow's teaching and learning activities is based on the **2018-19 cohort of UK domiciled students**. In other words, instead of the University's entire student body of **30,805** students in 2018-19 (*irrespective* of when these individuals may have started their studies), the analysis in this section focuses on the **8,280** UK domiciled[24] students **starting higher education qualifications (or standalone modules/credits) in the 2018-19 academic year**[25].

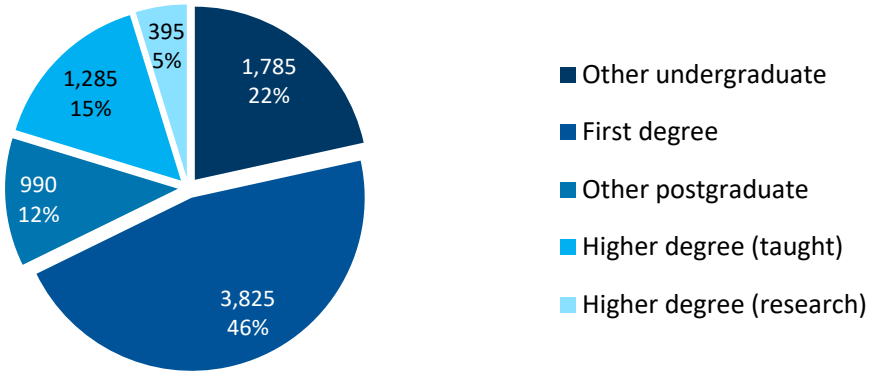
In terms of **level of study** (Figure 7), **46%** (**3,825** students) in this cohort were undertaking **first degrees**, with a further **1,285** students (**15%**) undertaking **postgraduate taught degrees**, and **395** students (**5%**) enrolled in **postgraduate research degrees**. An additional **1,785** students (**22%**) were enrolled in **other undergraduate qualifications**, and the remaining **990** (**12%**) were undertaking **other postgraduate qualifications**[26].

[24] It is likely that a proportion of EU and non-EU domiciled students undertaking their studies at the University of Glasgow 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 Glasgow.

[25] We received HESA data on a total of **14,585** first-year students from the University of Glasgow. Of these, we excluded **435** students whose gender was indicated as 'other', and **5,870** non-UK domiciled students (who are instead considered as part of the analysis of **educational exports** (Section 4)).

[26] 'Other undergraduate' learning includes Certificates of Higher Education, Diplomas of Higher Education, other undergraduate-level diplomas and certificates, and undergraduate-level credits. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, Postgraduate Diplomas in Education, taught work for credit at postgraduate level, and other certificates, diplomas, and qualifications at postgraduate level. Note that these 'other undergraduate' or 'other postgraduate' categories include students who might be undertaking an additional module or lifelong learning course alongside their primary programme (on a part-time basis), and who are counted as separate instances within the HESA data.

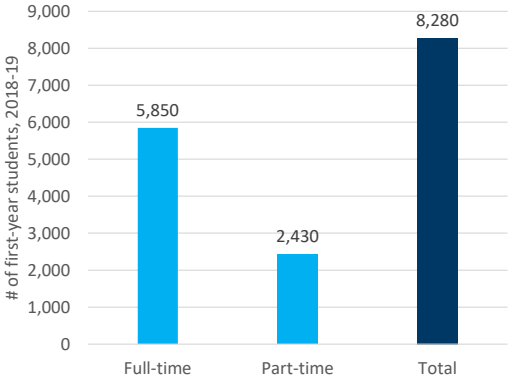
Figure 7 UK domiciled students in the 2018-19 cohort of University of Glasgow students, by level of study



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, Diplomas of Higher Education, other undergraduate-level diplomas and certificates, and undergraduate-level credits. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, Postgraduate 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 Glasgow HESA data

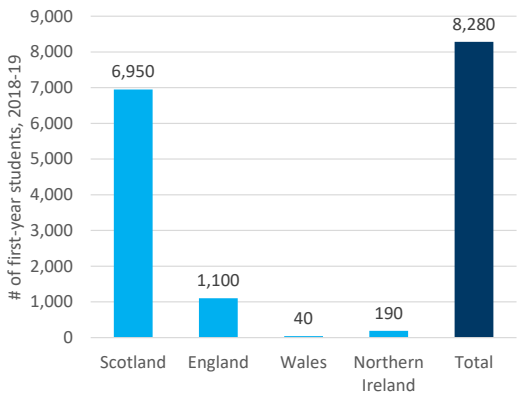
In relation to **mode of study** (Figure 8), **5,850** (**71%**) of students in the cohort were undertaking their studies with the University of Glasgow on a full-time basis, while the remaining **2,430** (**29%**) were enrolled on a part-time basis. As shown in Table 4, the majority of full-time students were undertaking first degrees (**64%**) or postgraduate taught degrees (**18%**). In contrast, the majority of part-time students in the cohort were undertaking other undergraduate (**72%**) or other postgraduate (**12%**) learning[27].

Figure 8 UK domiciled students in the 2018-19 cohort of University of Glasgow 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 Glasgow HESA data

Figure 9 UK domiciled students in the 2018-19 cohort of University of Glasgow 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 Glasgow HESA data

In terms of **domicile** (Figure 9), the majority (**6,950**, **84%**) of UK domiciled students in the cohort were from Scotland, with the remaining **1,330** (**16%**) students domiciled outside of Scotland (Including **1,100** students from England, **190** from Northern Ireland, and **40** from Wales).

[27] Note again that these 'other undergraduate' or 'other postgraduate' categories include students who might be undertaking an additional module or lifelong learning course alongside their primary programme (on a part-time basis), and who are counted as separate instances within the HESA data.

Open Glasgow

Glasgow has 56 of the most deprived areas in Scotland, and the University's **Widening Participation (WP) programmes** are targeting these areas to break down the barriers for less affluent potential students. **The University works with all schools across the west of Scotland, partnering with colleges and Local Authorities to support school leavers and adult learners to prepare for, apply to, and succeed at university.** The Widening Participation team works annually with more than 30,000 targeted pupils across the 160 secondary schools in the west of Scotland, and the summer schools target pupils across all of Scotland's 360 secondary schools.

Unlocking potential

Student performance on the WP programmes is used as evidence of ability and potential and allows adjusted offers of entry to be made based on an applicant's full individual circumstances, not just school grades. **The profiles students gain on the programmes are used by universities across Scotland to aid entry for disadvantaged applicants, and the University of Glasgow programmes benefit the whole sector, not just Glasgow.** Dr Neil Croll, Head of Widening Participation at Glasgow explains, *"We are deeply committed to widening access and to offering a world-class education to anyone who has talent and ambition, regardless of economic circumstance or social background – this doesn't just benefit those students, it makes our University more diverse and reflective of the society we serve."*

Real results

The University made the headlines in 2018 when it revealed that nearly 20% of Scottish entrants to its School of Medicine were from the most deprived areas of Scotland - numbers that were touted as unprecedented among the UK's 34 medical schools. This level has been maintained since.

Joint working with academic Schools across the University is essential to the success of the WP initiatives. In this way, the **Reach Programme** identifies potential student candidates for study in Law, Medicine, Veterinary Medicine, Dentistry, Accounting and Finance, Engineering, and Education. The team works with S4/S5/S6 students across the seven subjects, both in schools and on the University campus, offering summer schools, workshops, and support to maintain the right grades to be accepted into the University's courses.

The University has built strong partnerships with Local Authorities and a network of contact teachers in schools, who identify students with potential to participate in the programmes. Many of these students would otherwise not progress to university.

Table 4 UK domiciled students in the 2018-19 cohort of University of Glasgow students, by level of study, mode, and domicile

Level and mode of study	Domicile				
	Scotland	England	Wales	Northern Ireland	Total
Full-time					
Other undergraduate	35	0	0	0	**35**
First degree	3,005	575	25	125	**3,735**
Other postgraduate	675	15	0	10	**695**
Higher degree (taught)	780	245	10	15	**1,050**
Higher degree (research)	235	90	0	10	**335**
Total	**4,730**	**925**	**35**	**160**	**5,850**
Part-time					
Other undergraduate	1,645	85	0	20	**1,750**
First degree	90	0	0	0	**90**
Other postgraduate	260	25	0	0	**290**
Higher degree (taught)	175	50	0	5	**235**
Higher degree (research)	45	15	0	0	**60**
Total	**2,220**	**180**	**5**	**25**	**2,430**
Total					
Other undergraduate	1,680	85	0	20	**1,785**
First degree	3,100	575	25	125	**3,825**
Other postgraduate	935	40	0	10	**990**
Higher degree (taught)	960	295	10	25	**1,285**
Higher degree (research)	280	105	0	10	**395**
Total	**6,950**	**1,100**	**40**	**190**	**8,280**

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, Diplomas of Higher Education, other undergraduate-level diplomas and certificates, and undergraduate-level credits. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, Postgraduate 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 Glasgow HESA data

In addition to the above key information on the composition of the 2018-19 UK domiciled cohort of University of Glasgow students by level, mode, and domicile, we further considered data on the breakdown of this cohort by:

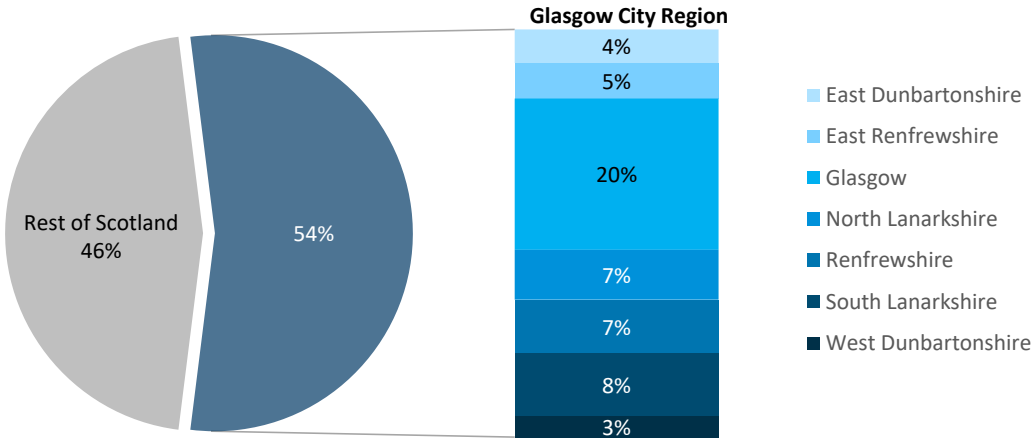
- **Detailed region of domicile** (i.e. students from the Glasgow City Region[28] vs. from the rest of Scotland);
- **School type** (i.e. students from state schools or colleges vs. students from independent schools);
- **Previous participation in the University of Glasgow's access programme** (designed to widen participation into higher education, such as the Top-Up Programme, Reach Scotland Programme, or the Glasgow Summer School); and
- **Scottish Index of Multiple Deprivation (SIMD) quintile**[29], based on the area of the postcode district domicile of the University's students (where areas are ranked from most deprived (Quintile 1) to least deprived (Quintile 5)).

[28] The Glasgow City Region consists of eight councils, including East Dunbartonshire, West Dunbartonshire, Renfrewshire, East Renfrewshire, Glasgow City, North Lanarkshire, South Lanarkshire, and Inverclyde.
[29] The SIMD assesses the extent to which an area is deprived across seven domains, including income, employment, education, health, access to services, crime, and housing.

All of this information is provided for students in the 2018-19 University of Glasgow cohort who were undertaking **first degrees only** (but excluding other qualification levels).

In terms of **region of domicile**, as presented in Figure 10, among Scottish domiciled first degree students in the 2018-19 cohort, **the majority were from the local area surrounding the University of Glasgow**. Specifically, **54%** of students were domiciled in the Glasgow City Region, including **20%** from Glasgow City itself, **8%** from South Lanarkshire, **7%** from each of North Lanarkshire and Renfrewshire, and **12%** (combined) from East Dunbartonshire, West Dunbartonshire and East Renfrewshire[30].

Figure 10 Scottish domiciled first degree students in the 2018-19 cohort by detailed domicile



Source: London Economics' analysis of data provided by the University of Glasgow

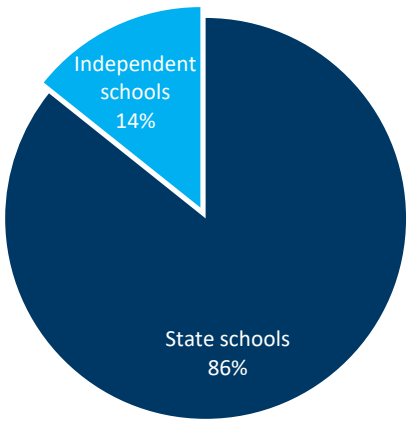
In terms of **school type**, as shown in Figure 11, of all UK domiciled first degree students in the cohort, the **vast majority (86%) had previously attended state schools or colleges**, whereas only **14%** enrolled with the University from independent schools.

In terms of participation in access programmes, **23% of Scottish domiciled first degree students in the cohort enrolled with the University of Glasgow after previously having participated in one of the University's access programmes** (see Figure 12), highlighting the way in which these programmes help widen access to higher education.

Finally, in terms of **SIMD quintile**, **27% of Scottish domiciled first degree students in the cohort were from the most deprived areas of Scotland** (SIMD Quintiles 1 and 2), with another **16%** domiciled in areas in SIMD Quintile 3 (see Figure 13).

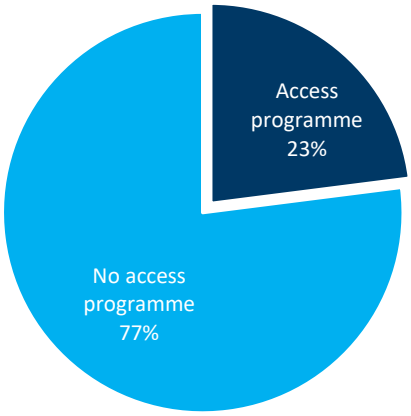
[30] Note that there were no students from Inverclyde in the 2018-19 cohort.

Figure 11 UK domiciled first degree students in the 2018-19 cohort by school type



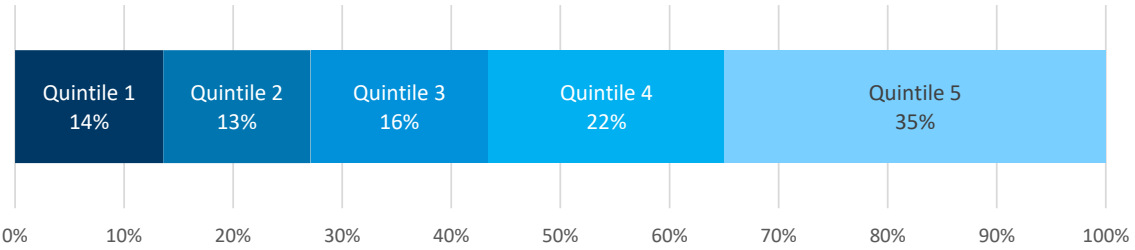
Note: The figure excludes any students whose school type could not be determined or was recorded as 'not applicable.
Source: London Economics' analysis of data provided by the University of Glasgow

Figure 12 Scottish domiciled first degree students in the 2018-19 cohort by access programme participation



Source: London Economics' analysis of data provided by the University of Glasgow

Figure 13 Scottish domiciled first degree students in the 2018-19 cohort by SIMD quintile



Note: The figure excludes any students for whom the SIMD quintile could not be determined.
Source: London Economics' analysis of data provided by the University of Glasgow

3.2 Adjusting for completion rates

The previous section provided an overview of the number of students *starting* qualifications or modules at the University of Glasgow in the 2018-19 academic year. However, to aggregate individual-level impacts of the University'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 Glasgow on the completion outcomes of the **2012-13 and 2013-14 cohorts** of University of Glasgow students (8 years after the initial enrolment enrolment) - broken down by study mode, study intention, and study completion[31]. In other words, these completion data include the number of students (across the two cohorts) 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

[31] 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) and 'other postgraduate' level (for students who originally intended to complete higher degrees or other postgraduate qualifications)[32]).

Table 5 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 Glasgow in 2018-19, **84%** complete the first degree as intended, while the remaining **16%** only 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, **94%** complete the qualification as intended, **1%** complete a postgraduate research degree, while the remaining **5%** only 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). 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 5 Assumed completion rates of University of Glasgow students

Completion outcome	Study intention				
	Other undergraduate	First degree	Other postgraduate	Higher degree (taught)	Higher degree (research)
Full-time students					
Other undergraduate	100%	16%	-	0%	2%
First degree	-	84%	-	0%	0%
Other postgraduate	-	0%	99%	5%	17%
Higher degree (taught)	-	0%	0%	94%	1%
Higher degree (research)	-	-	1%	1%	80%
Total	**100%**	**100%**	**100%**	**100%**	**100%**
Part-time students					
Other undergraduate	100%	23%	0%	0%	1%
First degree	-	77%	-	-	-
Other postgraduate	-	-	94%	39%	60%
Higher degree (taught)	-	-	5%	59%	2%
Higher degree (research)	0%	-	0%	1%	37%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Note: Cells including '-' indicate instances where the completion rate is exactly zero; cells including '0%' indicate instances where the completion rate is *close to* zero.

Source: London Economics' analysis based on information on the completion outcomes of the 2012-13 and 2013-14 cohorts of students provided by the University of Glasgow

3.3 Defining the returns to higher education qualifications

The fundamental objective of the analysis of the impact of the University of Glasgow'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 14):

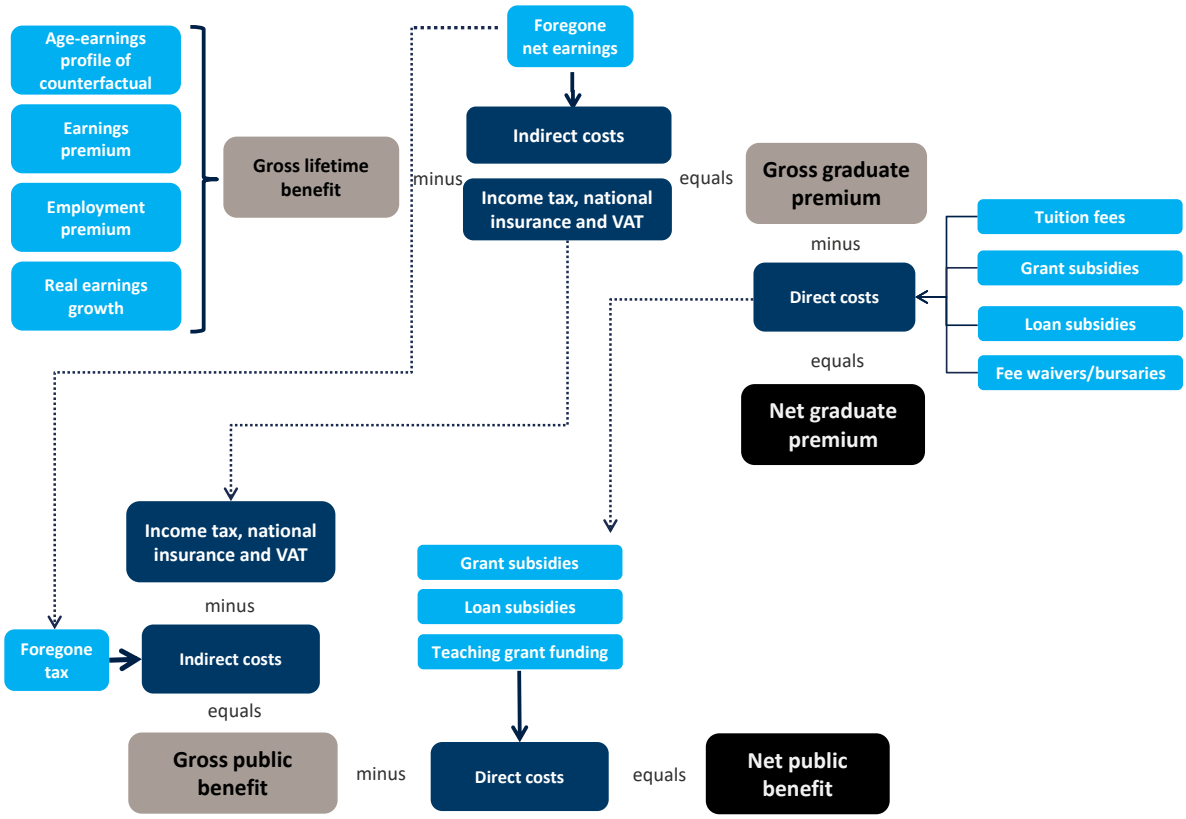
- The ***gross* graduate premium** associated with qualification attainment is defined as the **present value of enhanced after-tax earnings** (i.e. after income tax, National Insurance and

[32] 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%.

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 14 Overview of gross and net graduate premium, and gross and net Exchequer benefit



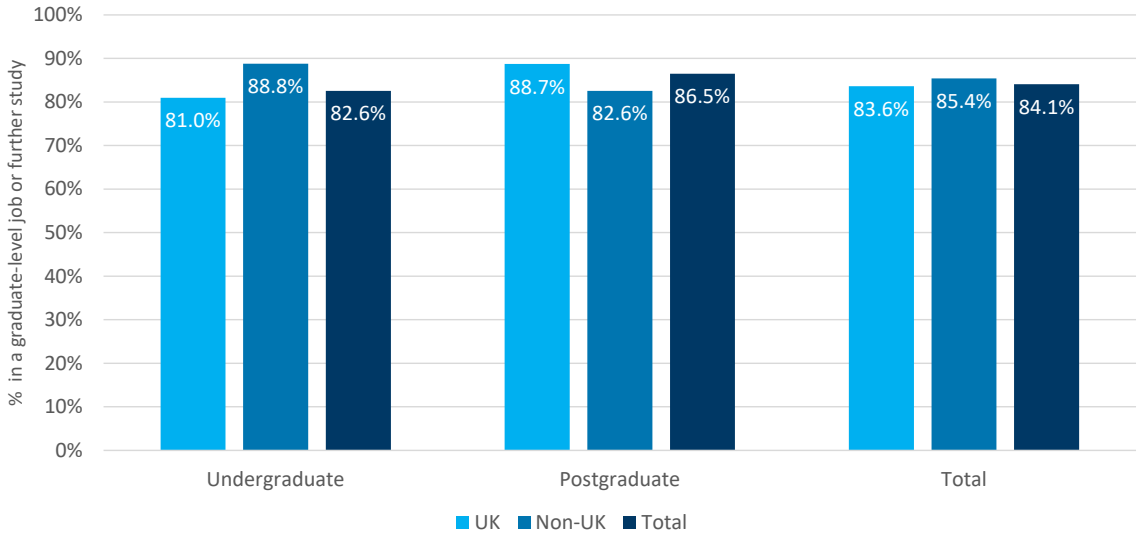
Source: London Economics' analysis based on Department for Business, Innovation and Skills (2011a)

3.4 Employability outcomes of the University of Glasgow's graduates

Before discussing the methodological approach to estimating the gross and net graduate premium and gross and net Exchequer benefit, this section presents information (from the Graduate Outcomes Survey) on the employability outcomes of the University of Glasgow's graduates.

Figure 15 presents data on the proportion of the 2017-18 graduating cohort who were in graduate-level employment or further study approximately 15 months after completing their studies at the University of Glasgow. The figure highlights the positive employment outcomes achieved by the vast majority of the University's alumni, as **84.1%** of these graduates were in graduate-level or professional occupations overall, with the corresponding proportions at undergraduate and postgraduate level standing at **82.6%** and **86.5%**, respectively.

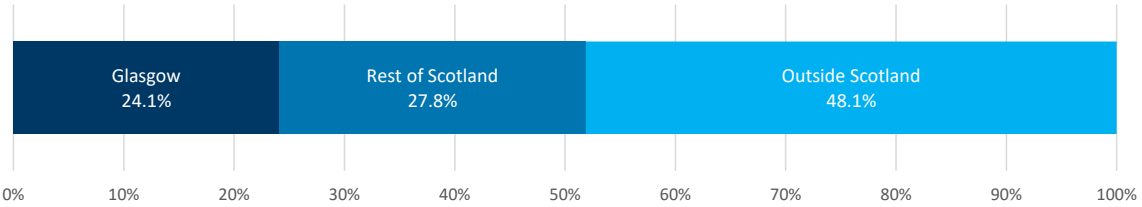
Figure 15 Proportion of University of Glasgow graduates in graduate-level or professional occupations, by level and domicile



Note: Based on the employment outcomes of the 2017-18 University of Glasgow graduate cohort, approximately 15 months after they completed their studies.
Source: London Economics' analysis based on data provided by the University of Glasgow

In terms of the geographical location of the University's graduates (Figure 16), a large proportion (**24.1%**) of the University of Glasgow's alumni are based in Glasgow[33], with another **27.8%** residing throughout the rest of Scotland – evidencing the extent to which, after completion of their studies, the University's alumni contribute to the local labour force and economy.

Figure 16 Location of the University of Glasgow's graduates



Note: Based on the location of all of the University of Glasgow's alumni as recorded in May 2021. This covers all of the University's graduates (irrespective of when they completed their studies). Based on alumni with a valid postcode only.
Source: London Economics' analysis based on data provided by the University of Glasgow

3.5 Estimating the returns to higher education qualifications

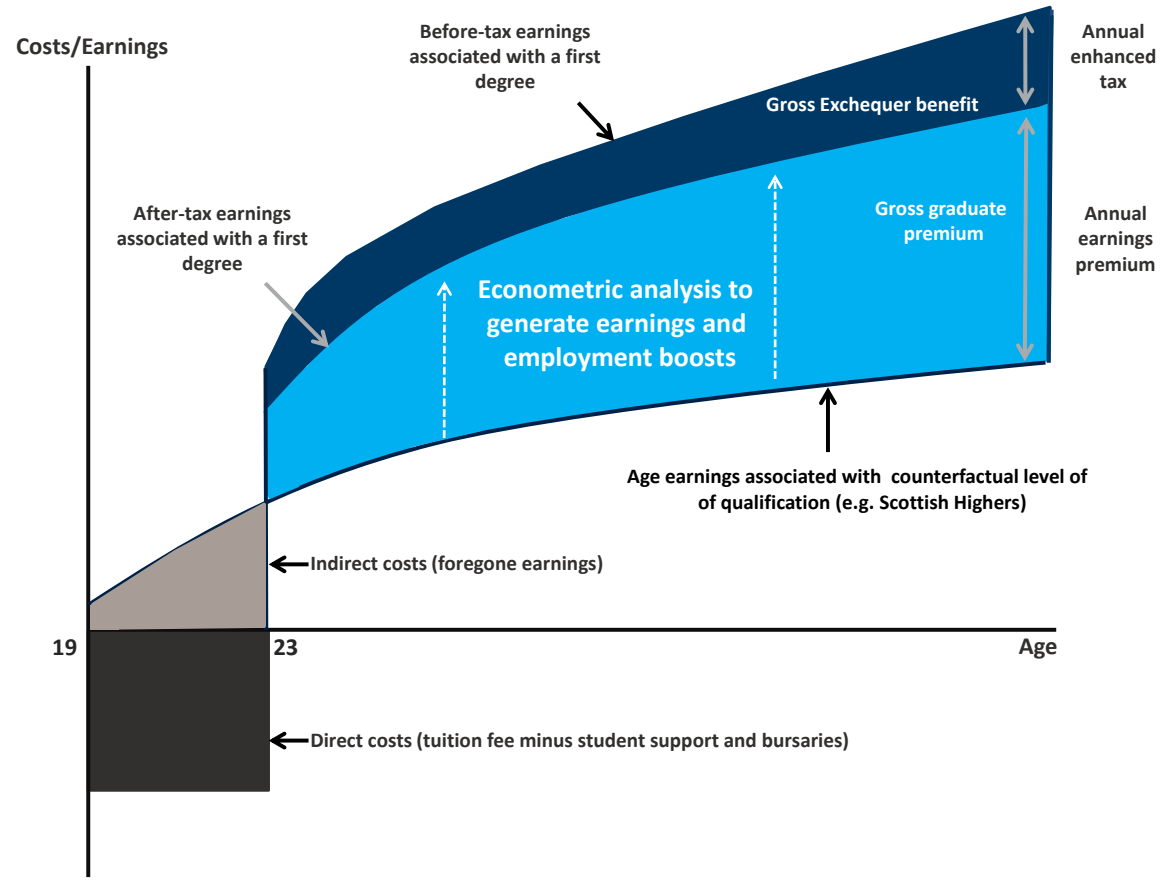
3.5.1 Estimating the gross graduate premium and gross public purse benefit

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

[33] Based on those alumni whose postcode starts with a 'G'. Note that, in contrast to the above information on employability outcomes, the data here are based on *all* of the University of Glasgow's alumni, irrespective of when they completed their studies, and are based on the postal addresses recorded by the University's Development and Alumni Office as of May 2021.

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 17 for an illustration of this). The treatment and counterfactual groups, and details of the econometric approach, are presented in Annex A2.1.1 and A2.1.2, respectively.

Figure 17 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 the University of Glasgow's HESA data for the 2018-19 cohort of students, 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 4 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 Glasgow. 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[34].

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 A2.1.4 for more detail[35]).

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, combined with administrative information on the relevant taxation rates and bands (from HM Revenue and Customs)[36], 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, Annex A2.1.4 provides more detailed information on the calculation of the gross Exchequer benefit.

3.5.2 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[37]. These direct costs refer to the **tuition fee paid by the student**[38] net of any **tuition fee support** or **maintenance support** provided by the Students Awards Agency for Scotland (SAAS, for students from Scotland), or the Student Loans Company (SLC, for students from England and Wales and Northern Ireland)[39] minus any **fee waivers or bursaries** provided by the

[34] See Annex A2.1.3 for more information.

[35] In terms of prior attainment, for a total of **1,615** students in the 2018-19 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 University of Glasgow at the same level, separately by study mode.

[36] The analysis makes use of relevant tax rates and thresholds applicable to individuals living in England, Wales, and Northern Ireland. This approach was taken for simplicity given that there is no information available on where the University's graduates live at each point throughout their working lives. However, note that there are only relatively marginal differences between the rates and thresholds for these Home Nations as compared to the Scottish tax system. In addition, approximately 48% of the University of Glasgow graduates live outside of Scotland (as of May 2021; see Figure 16 in Section 3.4). As a result, it is expected that the application of Scotland-specific income tax rates and thresholds would only have a limited effect on the estimated impact of the University's teaching and learning activities on students and the Exchequer (and the *total* impact would be unaffected, as income taxes constitute a transfer between graduates and the public purse).

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

[38] We used information provided by the University of Glasgow on average **tuition fees** per *full-time* student charged by the University in 2018-19, separately by domicile (i.e. Scotland, rest of UK, EU, and non-EU students), study mode, and study level. To arrive at the fees per *part-time* student (ensuring that the estimated fees for part-time students accurately reflect the average study intensity amongst part-time students in the 2018-19 cohort), we multiplied the respective full-time rates by the average study intensity amongst part-time students in the cohort.
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 Glasgow).

[39] The analysis makes use of *average* levels of support paid per student, separately by domicile, study mode, and 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)). Our estimates are based on publications by the SLC on student support for higher education in England, Wales, and Northern Ireland in 2018-19 (see Student Loans Company 2019a, 2019b and 2019c, respectively) and a publication by the Student Awards Agency Scotland on student support for higher education in Scotland (see Student Awards Agency Scotland, 2019). To ensure comparability across the different Home Nations, we focus only on core student support in terms of tuition fee grants, 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

University of Glasgow itself[40]. In this respect, the student benefit associated with tuition fee loan or maintenance loan support (where applicable) equals the **Resource Accounting and Budgeting charge** (RAB charge)[41], 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 Scotland, England, Wales, and Northern Ireland[42].

The **direct costs**[43] **to the public purse** include the **teaching grant funding** administered by the Scottish Funding Council (SFC)[44], the **student support** provided in the form of maintenance and 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 2018-19 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, 2018).

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. In addition, the assumed average fee loans or fee grants per student (where applicable) have been capped at the average tuition fees charged per University of Glasgow student in 2018-19 (see Footnote 38).

[40] Average fee waivers and other bursaries per student were calculated based on information provided by the University of Glasgow on the average scholarships, fee waivers, and other bursaries per *full-time equivalent* student provided by the University in 2018-19, by domicile (i.e. Scotland, rest of UK, EU and non-EU students), mode, and level of study. To arrive at estimates *per student* (in headcount terms), we then multiplied the average funding per full-time equivalent student by the assumed average study intensity (by qualification level and mode; see Footnote 38 for more information).

[41] For **undergraduate full-time** students, we have assumed a RAB charge of **53%** associated with tuition fee and maintenance loans (where applicable) for English domiciled students (based on data published by the Department for Education (2020)), approximately **40%** for Welsh domiciled students (based on information provided by the Welsh Government), **31%** for Scottish domiciled students (see Audit Scotland (2020)), and **31%** for Northern Irish students (assumed to be the same as for Scotland given the similar loan balance). EU undergraduate full-time students studying in Scotland are eligible for tuition fee grants, but there is no (fee or maintenance) loan support available for these students.

For **undergraduate part-time students**, based on the same sources, we have assumed a RAB charge of **45%** for English domiciled students, approximately **35-40%** for Welsh domiciled students, and **0%** for Northern Irish domiciled students (given that these students have a very small loan balance). There is currently no student loan funding provided to Scottish domiciled undergraduate part-time students, or to EU domiciled undergraduate part-time students studying in Scotland (so no RAB charge assumptions are required).

For the (relatively recently introduced) loans for **postgraduate taught students** from England and Northern Ireland, we have assumed a RAB charge of **0%** for both full-time and part-time students (based on the Department for Education's (2020) student loan forecasts for Master's loans for English students). For Welsh students, we have assumed a RAB charge of approximately **10-15%**. For Scottish students and EU domiciled students studying in Scotland, we assume the same **31%** RAB charge as for undergraduate full-time students (again see Audit Scotland (2020)).

Finally, for (full-time and part-time) **postgraduate research students** from England, we assumed a RAB charge of **42%** (again based on based on Department for Education (2020)). For Welsh postgraduate research students, we assumed a RAB charge of between **40-45%** across both full-time and part-time students. There were no Doctorate loans available for Scottish domiciled or Northern Irish domiciled students, or for EU students studying in Scotland.

[42] 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 Glasgow tuition fees – i.e. the net graduate premium *exceeds* the gross graduate premium per student. For example, this is the case for Scottish domiciled students undertaking full-time first degrees at the University of Glasgow in 2018-19, which is driven by the maintenance funding received by these students. This results in the net graduate premium being higher than the gross graduate premium (see the results presented in **Error! Reference source not found.** and **Error! Reference source not found.** in Annex A2.1.5).

[43] 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.

[44] This is based on published HESA financial information on the total SFC recurrent teaching grant received by the University of Glasgow in 2018-19 (see HESA, 2020a), divided by the total number of students enrolled with the University in 2018-19 (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.

3.6 Estimated net graduate premium and net Exchequer benefit

Table 6 presents the net graduate premiums and net Exchequer benefits achieved by Scottish domiciled students[45] undertaking qualifications at the University of Glasgow in the 2018-19 cohort (by study mode, on average across men and women[46]).

The net graduate premium for a representative full-time first degree student from Scotland stands at £89,000.

The analysis indicates that the **net graduate premium** achieved by a representative[47] student from Scotland in the 2018-19 cohort completing a **full-time first degree** at the University of Glasgow (with Scottish Highers (or equivalent) as their highest level of prior attainment) is approximately **£89,000** in today's money terms. At postgraduate level, the net (post)graduate premiums for a representative[48] student completing a full-time postgraduate taught or postgraduate research degree at the University of Glasgow (relative to a first degree) stand at approximately **£47,000** and **£88,000**, respectively[49].

The net public purse benefit associated with a representative full-time first degree student from England stands at £65,000.

There are also substantial **net graduate premiums** for **part-time** students. For instance, the estimate for a representative Scottish student completing a part-time postgraduate taught degree (again relative to a first degree) stands at approximately **£56,000** (compared to **£47,000** for full-time students), while the estimate for part-time postgraduate research degrees stands at **£73,000** (compared to **£88,000** for full-time students). The fact that part-time students tend to complete their studies later in life[50] (resulting in fewer years spent in the labour market post-graduation) reduces 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

[45] 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 A2.1.5.
[46] For a breakdown of the results by gender, again see Annex A2.1.5.
[47] The analysis is based on an average age at graduation of 23 for students undertaking full-time first degrees at the University of Glasgow in the 2018-19 cohort (see Annex A2.1.3 for further information).
[48] This is based on an average age at graduation in the 2018-19 cohort of 26 for full-time higher degree (taught) students and 30 for full-time higher degree (research) students.
[49] Note that the negative estimates of the net graduate premium for full-time 'other undergraduate' students (relative to Scottish Highers as their highest level of prior attainment) is driven by the fact that the estimated marginal earnings and employment returns to these qualifications – particularly for relatively young age groups - were often either relatively close to or below zero (see Annex A2.1.2), and would have resulted in *negative* lifetime returns to achieving these qualifications. As outlined in Annex A2.1.2, these negative returns were instead set to zero, since we implicitly assume that all calculated gross lifetime benefits (*before* the deduction of any foregone earnings or other costs) can only be greater than or equal to zero (so that there can be no wage or employment *penalty* associated with any higher education qualification attainment). Therefore, the negative returns to full-time 'other undergraduate' qualifications effectively capture only the direct and indirect *costs* associated with the attainment of these qualifications. Note that these negative estimates only apply to the 8% of UK domiciled students in the 2018-19 University of Glasgow cohort that are expected to complete full-time 'other undergraduate' learning.
[50] Again, see Annex A2.1.3 for more information.

(in the case of postgraduate research degrees) or higher (in the case of postgraduate taught degrees) than the net graduate premiums achieved by full-time students.

Table 6 Net graduate premium and net Exchequer benefit per English domiciled student at the University of Glasgow, 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]	-£5,000	£5,000	-£9,000	£3,000
First degree[1]	£89,000	£65,000	£65,000	£49,000
Other postgraduate[2]	£43,000	£36,000	£46,000	£32,000
Higher degree (taught)[2]	£47,000	£56,000	£48,000	£51,000
Higher degree (research)[2]	£88,000	£73,000	£123,000	£76,000

Note: All estimates constitute weighted averages across men and women (weighted by the estimated number of student completers in the 2018-19 cohort) and are presented in 2018-19 prices, discounted to reflect net present values, and rounded to the nearest £1,000.
[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 Scottish Highers (or equivalent).
[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

In terms of the benefits to the public purse, the **net Exchequer benefit** for a representative **full-time** first degree student from Scotland (again with Scottish Highers as their highest level of prior attainment) stands at approximately **£65,000** in 2018-19 money terms. At postgraduate level, 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 **£48,000** and **£123,000**[51], respectively.

Again, there are also substantial net Exchequer benefits associated with **part-time students**. For instance, the net Exchequer benefit for a representative part-time student from Scotland undertaking a postgraduate taught degree (relative to a first degree) stands at approximately **£51,000**, with the corresponding estimate for postgraduate research degrees (again relative to first degrees) standing at **£76,000**.

3.7 Total impact of the University of Glasgow's teaching and learning activities

Combining the information on the number of UK domiciled students in the 2018-19 University of Glasgow 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 Glasgow's teaching and learning activities** associated with the 2018-19 cohort in the UK stands at approximately **£734 million**.

[51] Compared to the corresponding net graduate premium for postgraduate research degree students (**£88,000**), the relatively larger net Exchequer benefit (**£123,000**) reflects the low 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 2018-19 cohort of University of Glasgow students stands at £734 million.

In terms of the split by **beneficiary**, **£401 million** (**55%**) of this impact is accrued by students undertaking qualifications at the University of Glasgow, and the remaining **£333 million** (**45%**) is accrued by the Exchequer. In terms of **study level**, **62%** (**£452 million**) of the estimated economic impact is generated by the University's undergraduate students, with the remaining **38%** (**£282 million**) generated by the University's postgraduate students. In terms of **domicile**, reflecting the composition of the University of Glasgow's student cohort, **82%** (**£603 million**) of the estimated economic benefit is associated with students from Scotland, while the remaining **18%** (**£131 million**) is generated by students from other Home Nations.

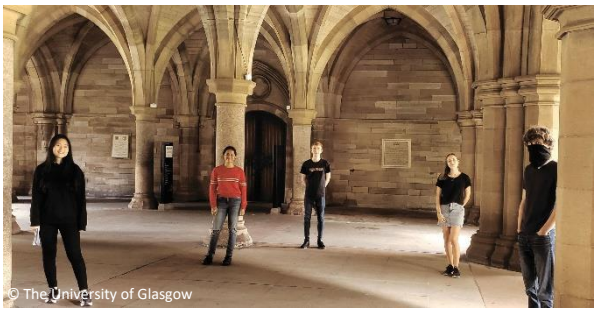
Table 7 Aggregate impact of the University of Glasgow's teaching and learning activities associated with the 2018-19 cohort (£m), by type of impact, domicile, and level of study

Beneficiary and study level	Domicile				
	Scotland	England	Wales	Northern Ireland	Total
Students	**£332m**	**£57m**	**£2m**	**£9m**	**£401m**
Undergraduate	£222m	£35m	£2m	£7m	**£266m**
Postgraduate	£110m	£22m	£1m	£2m	**£135m**
Exchequer	**£271m**	**£51m**	**£2m**	**£9m**	**£333m**
Undergraduate	£154m	£24m	£1m	£7m	**£186m**
Postgraduate	£117m	£27m	£1m	£3m	**£147m**
Total	**£603m**	**£108m**	**£4m**	**£19m**	**£734m**
Undergraduate	£376m	£59m	£3m	£14m	**£452m**
Postgraduate	£227m	£49m	£2m	£5m	**£282m**

Note: All estimates are presented in 2018-19 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 2018-19 cohort of students only. Depending on the size and composition of subsequent cohorts of University of Glasgow 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).

DigiGallus Connect – Improving digital inclusion in Glasgow



Being digitally excluded can exacerbate social and economic exclusion. Digital inclusion rates tend to be the lowest amongst the elderly population, with over half of non-internet users being over the age of 75, and 49% of non-internet users being classified as some of the most deprived individuals in society, according to the Good Things Foundation.

DigiGallus Connect is a project established and led by students from the Adam Smith Business School, which **addresses COVID-19-related isolation and loneliness through improving digital connectedness and promoting digital inclusion in the community through the power of intergenerational relations**. The project was developed with the aim of assisting vulnerable and older people, specifically within the over 50s population, who have limited access to internet and digital services.

Keeping Glasgow connected

The pandemic has fundamentally shifted our way of interacting with one another, with the vast majority of social interactions going virtual. Students at the Adam Smith Business School, aware that COVID-19 had the potential to exacerbate isolation and loneliness amongst older people in Glasgow, were keen to use their skills and knowledge to help address this. The challenge would also give them the opportunity to develop their skills and gain experience of intergenerational communication and collaboration.

DigiGallus Connect is developing and running an intergenerational mentoring programme to increase digital accessibility and confidence amongst the over 50s population in Glasgow. This programme will help support a key component of the Glasgow City Council's strategy to improve digital inclusion and participation of older people in their *Digital Glasgow Strategy*. The initiative aims to establish 100 mentee-mentor relationships, with mentors supporting their member of the community in learning how to send emails, make online video calls, increase internet usage, and ensure safe online browsing.

DigiGallus Connect will provide access to a personal device, one-to-one mentoring, and home-based internet access for those who are unable to access internet resources. Des McNulty, Assistant Vice Principal, Economic Development and Civic Engagement comments: *"As part of the University's commitment to help close the digital divide in the city of Glasgow, the student-run DigiGallus Connect project will distribute internet-connected devices to elderly residents, with management students providing digital literacy and free technology training to those that most need it – an example of one generation supporting another."*

Exploring virtual reality in the teaching environment

As the world grapples with the effects of COIVD-19 on the education sector, the **University of Glasgow has partnered with Sublime, a leading Scottish immersive technology company, to ensure that Glasgow has the capacity and knowledge to improve all aspects of remote teaching and learning**. The University's Centre for the Study of Perceptual Experience (CSPE) has been instrumental in enhancing the accessibility of learning by investing in Virtual Reality and Augmented Reality (VRAR) technology. CSPE is an interdisciplinary centre based within the College of Arts, with academics drawing on philosophy, psychology, neuroscience, psychiatry, human–computer interaction, and artistic practice to produce analytical, philosophical, and empirical research into the nature of perceptual experience.

Adapting to change

Two of CSPE's members, Professor Fiona Macpherson and Dr Neil McDonnell, have received over £1 million funding from Innovate UK to partner with Sublime to **create a VR classroom that transforms the way students learn and enhance the University and the sector's ability to adapt to any challenges that the post-COVID-19 era may pose**. Together, the project team have developed **Edify, an accessible learning platform that allows students to access the benefits of virtual reality teaching remotely and without the need for specialised hardware**. Students studying an array of topics, including history, physics, and anatomy, will be able to use popular communications platforms, such as Zoom or Microsoft Teams, to dial-in to a virtual learning environment, whether that be a 3D lab, classroom, or lecture. The new advances and Glasgow's investment in VRAR technology will directly address accessibility and physical remoteness issues, whilst also paving a path for the exploration of future learning opportunities.

The importance of higher education institutions' ability to adapt their teaching methods is more crucial than ever. Both the University of Glasgow and Sublime believe that Edify will transform the learning environment and provide vital accessibility to shared learning experiences, and the ambition is for it to evolve to become the most engaging immersive teaching platform in the UK.

New learning experiences


© The University of Glasgow

Edify is the first product resulting from Project Mobius, the partnership between CSPE and Sublime. **The three-year project will use immersive technology to create high-quality teaching apps and lectures, which will be delivered via a bespoke higher education VR platform**.

The University's plans for VR learning are ambitious. As Dr Neil McDonnell, the project's co-investigator, explains: *"Using virtual 3D environments in teaching can be extraordinarily powerful, whether those environments are accessed via VR headsets, via Zoom, or on a laptop screen. Our partnership with Sublime involves two major strands. One collects data on how using immersive technology enables student learning. The other involves developing new virtual and augmented reality programmes that can improve these learning results. We are delighted that the University will create two high tech physical VR labs, which will greatly enhance collaboration between teachers and students, both in distance learning and classroom-based learning".*

4 The impact of the University's educational exports

With the United Kingdom, and Scotland in particular, 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 Glasgow. 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 2018-19 cohort of University of Glasgow students, over the entire course of their studies[52]. 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 itself) and non-fee income (accrued by other organisations providing goods and services to international students) associated with non-UK students in the 2018-19 cohort.
- **Indirect effect ('supply chain impacts'):** The University 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 (supported by its tuition fee income) and of companies providing goods and services to the University'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[53].

The total of the direct, indirect, and induced effects constitutes the *gross* economic impact of the University's contribution to education exports. An analysis of the *net* economic impact ideally needs to account of 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[54].

[52] Note that other types of export income accrued directly by the University (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's research activity (Section 2) and the impact of the expenditures of the University (Section 5), and are thus excluded from the analysis of exports to avoid double-counting.

[53] 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 Glasgow). 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 Glasgow's own expenditures (see Section 5).

[54] 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 tuition fee and non-tuition fee income associated with the

The direct, indirect, and induced impacts are measured in terms of monetary economic output[55], gross value added (GVA)[56], and full-time equivalent (FTE) employment supported. In addition to measuring these impacts on the UK economy as a whole, the analysis is broken down by geographic region and sector.

The direct, indirect, and induced impacts 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[57]. 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[58]) with a range of regional-level data[59] to achieve a granular breakdown by sector[60] *and* region[61].

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

4.1 The 2018-19 cohort of international University of Glasgow students

Figure 18, Figure 19, and Figure 20 present information on the number of non-UK domiciled students included in the 2018-19 cohort of University of Glasgow students (by domicile, mode of study, and level of study, respectively).

In terms of domicile (Figure 18), of the total of **5,870** international students starting higher education qualifications at the University of Glasgow in 2018-19, **1,210** (**21%**) were domiciled within the European Union, while **4,660** (**79%**) were from non-EU countries. In terms of study mode (Figure

University of Glasgow's international students might otherwise have been used for other purposes). Hence, our analysis effectively estimates the direct, indirect, and induced impacts associated with the University of Glasgow's educational exports in *gross* terms.

[55] Here, economic output is equivalent to income/turnover (e.g. the direct economic output associated with international students' tuition fees is captured by the international fee income received by the University of Glasgow).

[56] 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).

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

[58] See Office for National Statistics (2020a). 2016 was the most recent year for which this information was available at the time the analysis was undertaken.

[59] 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).

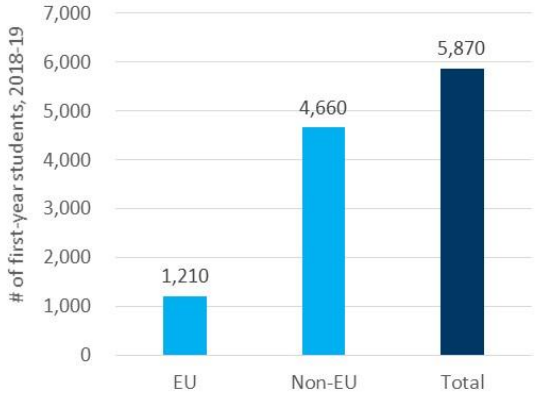
[60] In terms of sector breakdown, the original UK Input-Output tables are broken down into 64 (relatively granular) sectors. However, the (wide range of) regional-level data required to generate the multi-regional Input-Output model is not available for such a granular sector breakdown. Instead, the multi-regional Input-Output model is broken down into 10 more high-level sector groups (see Table 20 in Annex A2.2.1 for more information).

[61] 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.

19), the majority of international students in the cohort (**5,585, 95%**) were undertaking their qualifications on a full-time basis, with the remaining **285** (**5%**) studying on a part-time basis.

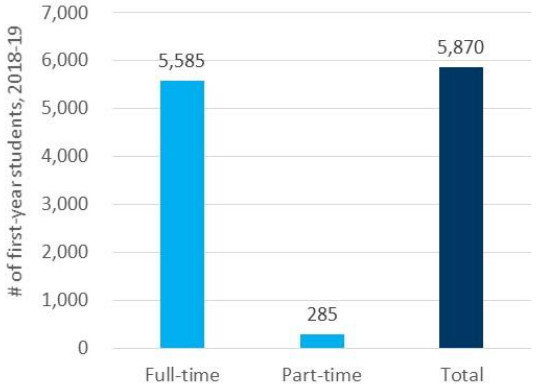
In terms of study level (Figure 20), in contrast to UK domiciled students (see Section 3.1), the majority of non-UK domiciled students in the cohort were undertaking postgraduate qualifications (**4,620**, **79%**), including **4,145** (**71%**) enrolled in postgraduate taught degrees, **415** students (**7%**) undertaking postgraduate research degrees, and **60** (**1%**) undertaking other postgraduate learning. At undergraduate level, there were **1,005** (**17%**) students undertaking first degrees, while the remaining **245** (**4%**) students were enrolled in other undergraduate learning[62].

Figure 18 Non-UK domiciled students in the 2018-19 cohort of the University of Glasgow, by domicile



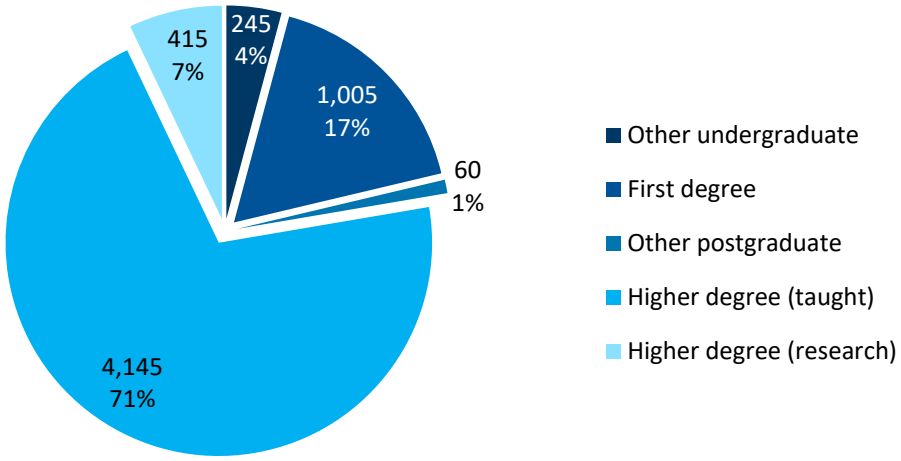
Note: All numbers are rounded to the nearest 5, and the total values may not add up precisely due to this rounding.
Source: London Economics' analysis based on the University of Glasgow's HESA data

Figure 19 Non-UK domiciled students in the 2018-19 cohort of University of Glasgow 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 Glasgow's HESA data

Figure 20 Non-UK domiciled students in the 2018-19 cohort of University of Glasgow 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 Glasgow's HESA data

[62] For more detailed information on the University's 2018-19 cohort of non-UK domiciled students, please refer to Annex A2.2.2.

The Glasgow-Malawi Joint Healthcare Project

Through forming unique collaborations and sharing its research expertise, the University of Glasgow is helping to overcome global health challenges. The University of Glasgow and Malawi's College of Medicine have recently won funding to **conduct a ground-breaking joint healthcare project in Glasgow and Malawi**. The three leading researchers on the project at the University are Professor Iain McInnes (Vice Principal and Head of the College of Medical, Veterinary & Life Sciences), Professor Paul Garside (Chair in Basic Immunology), and Professor Andy Waters (Professor in Biomedical and Life Sciences).

Understanding population health in Glasgow and Malawi

The £2 million research project, funded by the Scottish Government with matched funding from the World Bank and the Wellcome Trust, will research inflammatory and cardiac diseases in the communities of Malawi and Glasgow. It **aims to improve Malawi's healthcare as well as develop further understanding about the causes of poor health in the west of Scotland**.

In recent years, Malawi has seen an increase in non-communicable diseases such as cardiac disease, hypertension, and arthritis. This is reminiscent of Glasgow's health problems, in particular the pattern of chronic poor health and low life expectancy in some parts of the city, which has come to be known as "The Glasgow Effect."

The University of Glasgow is considered to be a centre of excellence in the study of The Glasgow Effect in the local population. Its expertise will be shared with Malawi's College of Medicine in order to establish research projects there, the results of which will then be used to improve healthcare in the country. The partnership will also see three new laboratories set up in Blantyre, Malawi. The project represents a remarkable fusion of expertise in Glasgow and Blantyre, which will allow a transformation in the way that diseases are recognised, treated, and studied in Malawi. In a true spirit of partnership, the new knowledge gained in Malawi will also feed back into work in Glasgow to improve healthcare in the Scottish population.

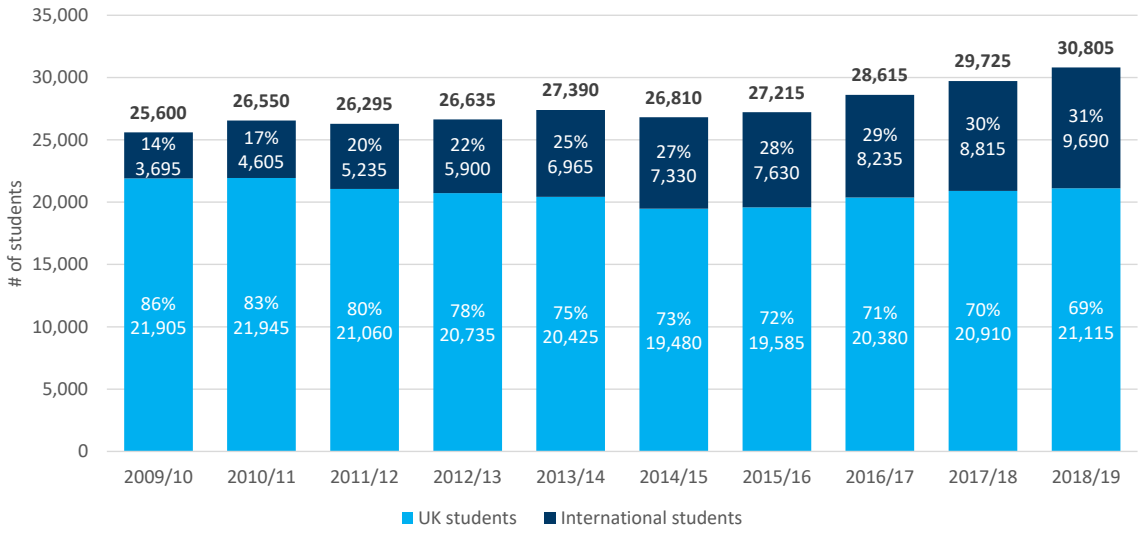
The project builds on a long, shared history between Glasgow and Malawi that began with David Livingstone, the missionary, explorer, and University of Glasgow scientist, who introduced Malawi to the outside world and championed the abolition of slavery. Blantyre in Malawi is named after Livingstone's birthplace, just outside of Glasgow. As well as continuing Livingstone's legacy, the 'Blantyre-Blantyre comparison' aims to be mutually beneficial to both communities, with the results of the Malawi research being used to inform research into Glasgow's health problems.

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

Alongside the analysis of the 2018-19 cohort of non-UK domiciled *first-year* students, we have also examined the trends in the University of Glasgow's *entire* non-UK student body over the past decade (i.e. academic years 2009-10 to 2018-19).

With the University of Glasgow being an increasingly popular destination for international students, there has been a significant increase in the number of non-UK domiciled students enrolled at the University over the last decade, increasing from **3,695** students in 2009-10 to **9,690** students in 2018-19. With the number of UK domiciled students having remained relatively constant, this has resulted in an increase in the proportion of the University of Glasgow's students that are from non-UK domiciles over the period, from **14%** in 2009-10 to **31%** in 2018-19 (see Figure 21).

Figure 21 Total students at the University of Glasgow, 2009-10 to 2018-19, by domicile

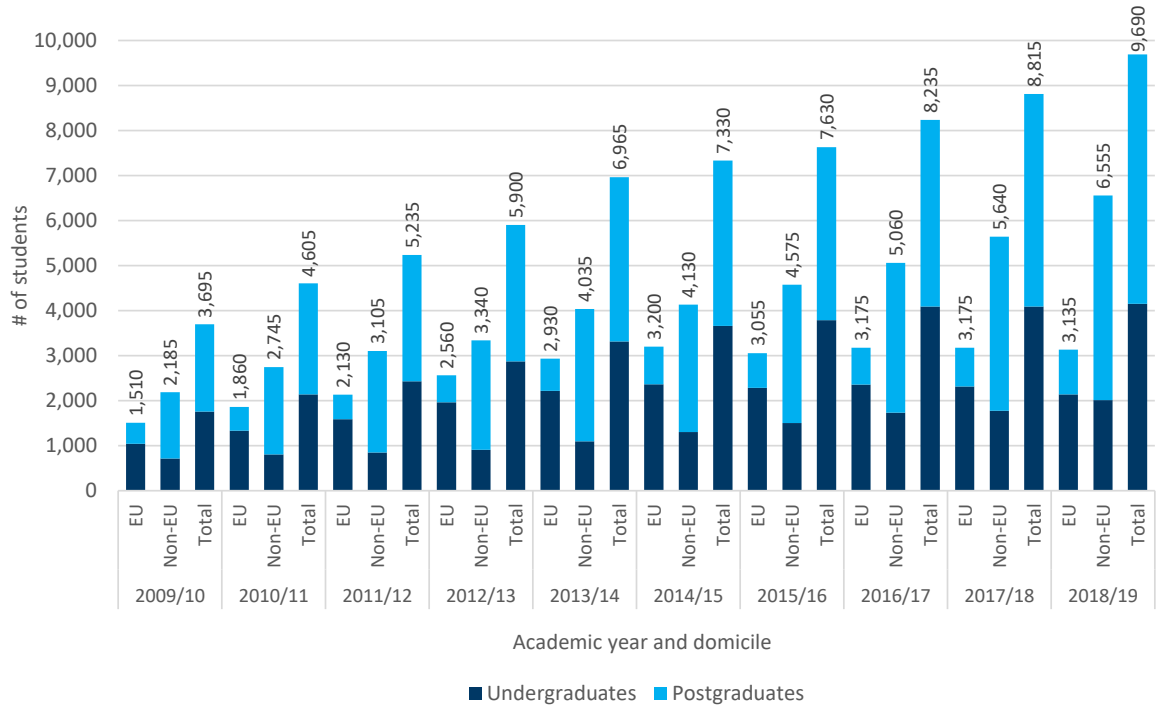


Source: London Economics' analysis based on HESA (2011, 2012,2013, 2014, 2015 and 2021)

In terms of the breakdown of these non-UK students by domicile (Figure 22), the overall increase in international students was predominantly driven by an increase in students from non-EU countries (**2,185** in 2009-10 to **6,555** in 2018-19), with a relatively smaller (but still significant) increase in students from EU countries (**1,510** in 2009-10 to **3,135** in 2018-19). This has resulted in an increase in the number of non-EU students as a proportion of the total non-UK-domiciled student population, from **59%** in 2009-10 to **68%** in 2018-19.

The increase in the number of international students studying at the University occurred across both undergraduate and postgraduate students (Figure 22), with the number of non-UK undergraduate students increasing from **1,755** in 2009-10 to **4,150** in 2018-19, and the number of non-UK postgraduate students rising from **1,940** in 2009-10 to **5,540** in 2018-19. With relatively stronger growth at postgraduate level, there has been an increase in the proportion of non-UK students undertaking postgraduate as compared to undergraduate qualifications, rising from **53%** in 2009-10 to **57%** in 2018-19.

Figure 22 Non-UK domiciled students at the University of Glasgow, 2009-10 to 2018-19, 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 2018-19 cohort, we made use of data on average tuition fees charged by the University of Glasgow in 2018-19 (by study level, mode, and domicile[63]). Assuming the same average study durations as in the analysis of the impact of the University'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 students' learning aim until completion. Expressing the total income until completion in 2018-19 prices and using the HM Treasury Green Book real discount rate of 3.5% (see HM Treasury, 2018), we arrived at an estimate of the gross tuition fee income per student (in present value terms over the total study duration).

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 Scotland[64]. These

[63] As in the analysis of the University's teaching and learning activities (see Section 3), we used information provided by the University of Glasgow on average tuition fees per *full-time* student charged by the University in 2018-19, separately by domicile (i.e. Scotland, rest of UK, EU, and non-EU students), study mode, and study level. To arrive at the fees per *part-time* student (ensuring that the estimated fees for part-time students accurately reflect the average study intensity amongst part-time students in the 2018-19 cohort), we multiplied the respective full-time rates by the average study intensity amongst part-time students in the cohort. 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 Glasgow).

[64] Note that there is no such Exchequer funding associated with non-EU students.

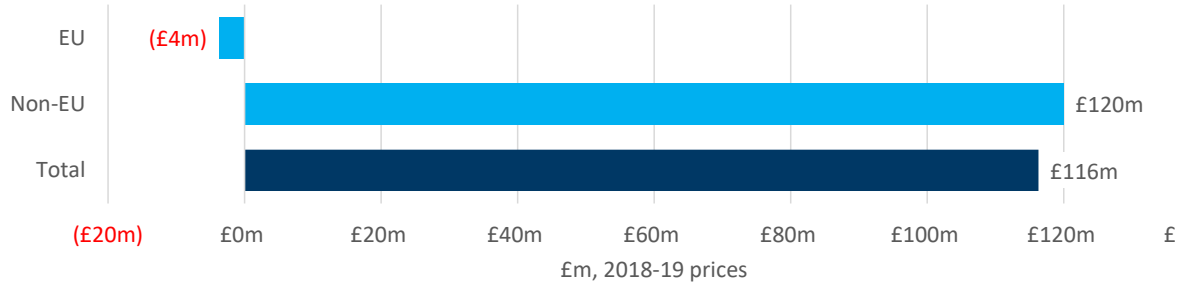
Exchequer costs include public teaching grant funding as well as the subsidies associated with the tuition fee support provided by the Student Awards Agency for Scotland (SAAS), in terms of:

- The tuition fee grant funding provided **to eligible EU domiciled full-time and part-time undergraduate students**;
- The RAB charge on **postgraduate tuition fee loans provided to eligible EU full-time and part-time postgraduate students**; and
- The **recurrent teaching grant funding** paid to the University in relation to the provision of teaching to EU domiciled students (by the Scottish Funding Council)[65].

In addition to these public purse costs, we also deducted any **fee waivers and bursaries** paid to international students by the University of Glasgow itself[66]. Again, all of these costs were calculated over students' total study duration and estimated in present value terms[67].

Combining the estimates per student with information on the number of non-UK students in the 2018-19 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 2018-19 cohort of University of Glasgow students. As presented in Figure 23, the **total net tuition fee income** generated by international students in the cohort was estimated at **£116 million**. While **£120 million** of net fee income was generated by **non-EU students**, the estimated negative net fee income associated with EU students reflects the fact that EU students' tuition fees are funded through tuition fee grants (for undergraduate students) and loans (for postgraduate taught students) provided by SAAS (so that, for these students, the cost of funding these students outweighs the (gross) tuition fee income received by the University).

Figure 23 Aggregate net tuition fee income associated with international students in the 2018-19 cohort, by domicile (£m)



Note: All estimates are presented in 2018-19 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

[65] For more information on our assumptions in relation to public student support and recurrent teaching grants, please refer to Section 3.5.2.
[66] Again, see Section 3.5.2 for more information on our assumptions in relation to fee waivers and bursaries. Note that it was not possible to distinguish fee waivers from other types of bursaries/scholarships, so we model all of the bursaries provided by the University as non-fee bursaries.
[67] For information on the estimated levels of net fee income per student, please refer to Annex A2.2.3.

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 the University of Glasgow. These costs include:

- **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[68], 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 2018-19 cohort of international students studying at the University of Glasgow, we used estimates from the **2014-15 Student Income and Expenditure Survey** (SIES)[69]. 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 itself (see Section 5))[70].
- The SIES estimates relate to English domiciled students studying in England or Wales only[71]. To take account of differences in living costs between the Home Nations, we **adjusted the estimates for average price differences between England and Scotland**, based on regional consumer price levels in Scotland relative to England[72].
- 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

[68] See Department for Business, Innovation and Skills (2011b).
[69] 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.
[70] 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 the University of Glasgow itself).
[71] To the best of our knowledge, the most recent comparable SIES estimates for Scottish domiciled students relate to the 2007-08 academic year (see Scottish Government, 2009), and have not been updated since.
[72] The Office for National Statistics (2018) provides figures for England (excluding London) and London separately. We therefore calculated an (unweighted) average of the price levels across English regions and London to obtain the English price level. The data are based on 2016 (which is the most recent year for which the information is currently available).

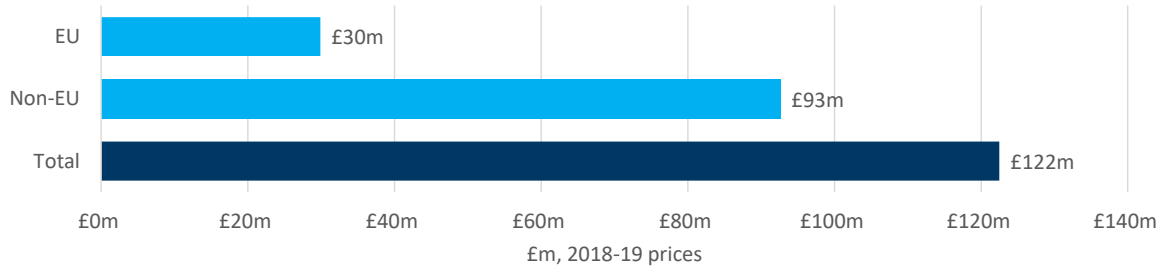
estimates for the longer **average stay durations** in the UK of non-EU students compared to EU students[73].

- 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 2018-19 cohort returned home during the third (i.e. final) term of the 2019-20 academic year, and that 50% of full-time students in the cohort returned home during the second and third terms of the 2020-21 academic year[74, 75]. 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 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 2018-19 prices[76].

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 2018-19 prices, by level of study, mode, and domicile[77].

Again combining the estimated non-tuition fee income per student with the number of international students in the 2018-19 cohort expected to complete qualifications (or credits/modules) at the University of Glasgow, the **total (off-campus) non-tuition fee expenditure** associated with international students in the 2018-19 cohort was estimated at **£122 million** (Figure 24). Of this total, **£30 million** was associated with **EU students**, whereas **£93 million** was generated by **non-EU students** in the cohort.

Figure 24 Aggregate non-fee income associated with international students in the 2018-19 cohort, by domicile (£m)



Note: All estimates are presented in 2018-19 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

[73] 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 A2.2.4.
[74] In other words, we assume that due to the Covid-19 pandemic, the subsistence expenditures of full-time international students in the 2018-19 cohort were 17% lower in 2019-20 (i.e. 50% x 33%), and 33% lower in 2020-21 (i.e. 50% x 67%) than would otherwise have been the case.
[75] 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 2018-19 academic year). As a result, the majority of students in the 2018-19 cohort of University of Glasgow students are not impacted by these Covid-19 adjustments.
[76] Inflation estimates are based on Consumer Price Index inflation estimates provided by the Office for National Statistics (2021).
[77] For information on the estimated levels of non-tuition fee income per student, please refer to Annex A2.2.5.

A greener path to equality

As an epidemiologist and geographer, Professor Rich Mitchell is interested in the way physical and social environments are linked to the health of communities. He claims that if specific changes are made to our environment, noticeable improvements in health and wellbeing result. Not only that, but these improvements are even more striking within deprived populations, and could therefore help narrow the stubborn gap between rich and poor.

A key factor Professor Mitchell's research has identified is that, all else being equal, *"people who have more green space in their neighbourhood tend to be healthier – even if they don't actually make use of that space. Environments can change, and it may be easier to do this than to try and change people's social and economic circumstances."*

With enlightened city planning, an environment can be transformed. Forests, urban parks, and woodlands may be created – and these changes can have a positive impact on large numbers of people at a time. As well as green space, access to great public transport systems and the potential for social connection are also aspects of the environment which can be improved to benefit, in particular, those in less advantaged communities. This is something that Professor Mitchell has termed 'equigenesis' – the creation of equality.

Gathering attention

The connection between natural environments and our health is a hot topic. It has grabbed the attention of many policymakers and practitioners, creating opportunity for researchers to have direct impact. Professor Mitchell's research and expertise **helped inform a Scottish Government scheme called *Good Places, Better Health***. A ground-breaking initiative, the scheme focuses on health challenges in children and the role played by their formative environment. The venture resulted in production of the Place Standard tool for Scotland, which lets individuals assess various health-related attributes of their own neighbourhood.

Professor Mitchell's research has also been influential in UK government policy as well as internationally. It was included in the Marmot Review of health inequalities and various other reviews for the Department for Environment, Food and Rural Affairs, and has been referenced by the World Health Organization. He was also the only UK scientist invited to a small US Environmental Protection Agency workshop on nature, health, and environmental protection, which resulted in published guidance for the United States.

In tandem, he is working on a Scottish Government scheme called the Natural Health Service, which aims to bring together the environmental and health sectors. Professor Mitchell and his team will help to navigate the evidence behind the relationship between health and nature.

"The long-term aim," says Professor Mitchell*, "is to help design better interventions, whether through planning, or some other kind of environmental change, to ultimately be able to create places which help us stay healthy and well."*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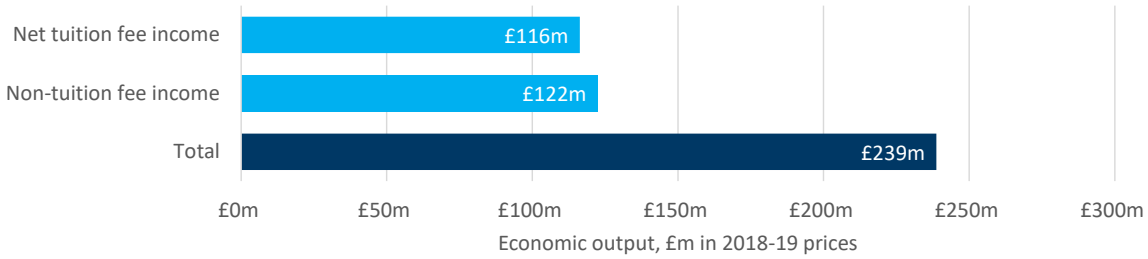
4.3.3 Total direct impact

Combining the above estimates of (net) fee and non-fee income, the total direct economic impact of the expenditures of international students in the 2018-19 University of Glasgow cohort (in economic output terms) was estimated at **£239 million** (Figure 25). Approximately half of this total (**£122 million**) was generated from international students' non-tuition fee spending, while the other half (**£116 million**) was generated from international students' tuition fees accrued by the University of Glasgow (net of any public costs of provision or fee waivers/bursaries provided by the University). In terms of student domicile, the majority of this impact (**£213 million**, **89%**) was generated by non-EU domiciled students, while **£26 million** (**11%**) was associated with EU students.

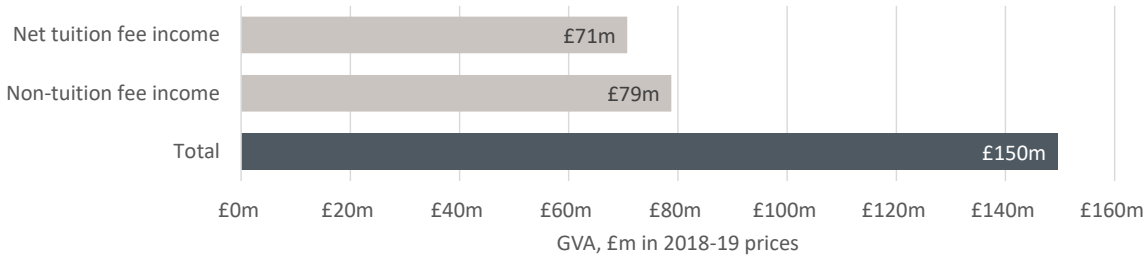
In addition to economic output (i.e. export income), it was possible to convert the above estimates into gross value added and the number of full-time equivalent jobs supported[78]. We thus estimate that the export income generated by international students in the 2018-19 University of Glasgow cohort directly generates **£150 million** in GVA (**£71 million** from international (net) fee income and **£79 million** from non-fee income), and supports **2,515 full-time equivalent jobs** (**1,510** from (net) fees and **1,005** from non-tuition fee income[79]).

Figure 25 Total direct impact associated with non-UK students in the 2018-19 University of Glasgow cohort, by type of impact

Output, £m



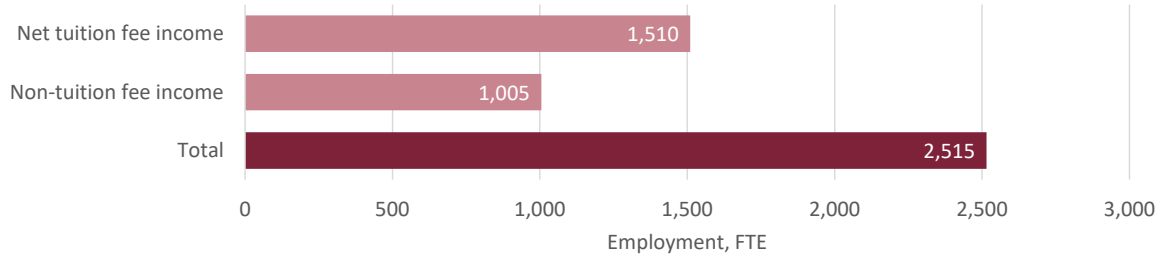
GVA, £m



[78] To estimate the direct GVA and employment associated with the (net) tuition fee income generated by the University's international students, we multiplied this income by the average ratio of GVA to output and FTE employees to output within Scotland'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's international students, we instead multiplied this income by the average ratio of GVA to output and FTE employees to output associated with the expenditure of households located in Scotland (again based on the multi-regional Input-Output model). In other words, we assume that the non-tuition fee expenditures of the University's international students support the same levels of GVA and employment (in relative/proportionate terms) as the expenditure of households located in Scotland more generally.

[79] 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 Scotland'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 Scotland (e.g. including the real estate or production sectors).

FTE employment



Note: All monetary estimates are presented in 2018-19 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'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 Glasgow, we used economic multipliers derived from the above-described multi-regional Input-Output model, 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 2018-19 cohort, including:

- **Multipliers relating to international tuition fee income (accrued by the University itself)**: The multipliers used to estimate the impact of the University's international tuition fee income were calculated based on the inter- and intra-industry flows of goods and services for Scotland's government, health, and education sector as a whole[80].
- **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 Scotland[81], and subsequently applied to the estimated off-campus non-tuition fee expenditures of overseas students in the 2018-19 cohort of University of Glasgow 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 8 presents the economic multipliers applied to the income generated by international students at the University of Glasgow (in terms of the impact on Scotland and the UK economy as a whole)[82]. In terms of economic output, the analysis assumes that every £1 million of **tuition fee expenditure** incurred by international students generates an *additional* **£1.54 million** of impact

[80] This approach is based on the fact that the tuition fee income from international students is accrued by the University of Glasgow itself. In other words, we assume that the expenditure patterns of the University are the same as for other institutions operating in Scotland's government, health, and education sector. Specifically, we apply these multipliers to the *gross* tuition fee income generated by international students in the 2018-19 University of Glasgow cohort, and then deduct the Exchequer/University cost of provision (i.e. public teaching grants, public student support, and University of Glasgow fee waivers and bursaries) to arrive at the *net* direct, indirect and induced impact associated with this income.

[81] In other words, for the purpose of applying relevant economic multipliers, we assume that international students studying at the University of Glasgow have similar expenditure patterns as Scottish households 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.

[82] While the table presents the multipliers for the impacts on Scotland and the UK as a whole, a full breakdown of the total impacts across all regions (as well as by sector) is provided in **Error! Reference source not found.**.

throughout the UK economy, of which **£0.83 million** is generated in Scotland. In addition, we assume that every £1 million of **non-fee expenditure** incurred by international students generates an additional **£1.53 million** of impact throughout the UK, of which **£0.84 million** is located in Scotland.

Table 8 Economic multipliers associated with the income from international students in the 2018-19 cohort of University of Glasgow students

Location of impact and type of income	Output	GVA	FTE employment
Tuition fee income			
Scotland	1.83	1.81	1.56
Total UK	2.54	2.46	2.02
Non-fee income			
Scotland	1.84	1.81	1.85
Total UK	2.53	2.42	2.55

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 economic impacts[83], 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 2018-19 University of Glasgow cohort amounts to **£631 million** of **economic output** (see top panel of Figure 26):

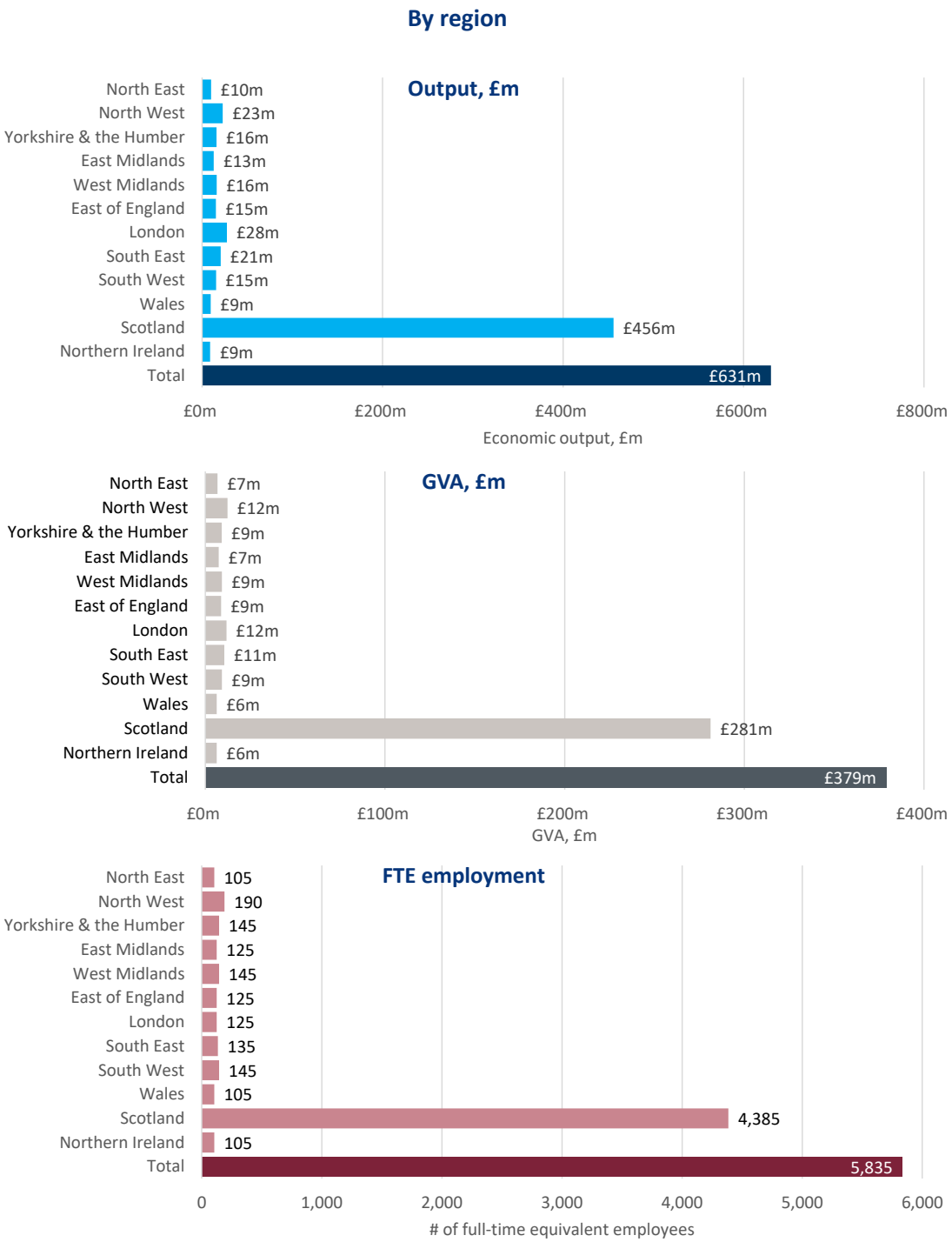
The impact of the export income generated by the 2018-19 University of Glasgow cohort stood at £631 million.

- In terms of the breakdown by type of income from international sources, **£320 million** of this impact was associated with international students' (net) **tuition fees**, and **£310 million** was associated with these students' **non-tuition fee expenditures** over the duration of their studies at the University of Glasgow.
- In terms of the breakdown by region, the majority of this impact (**£456 million**, **72%**) was generated in **Scotland**, with the remaining **£175 million** (**28%**) occurring in **other regions** across the UK.
- In terms of sector, the tuition fee and non-tuition fee income generated from the University's international students generated particularly large impacts within the **government, health, and education sector** (**£170 million** (**27%**), given that the cohort's tuition fee income is accrued as income by the University itself). In addition, there are relatively large impacts felt within the **distribution, transport, hotel, and restaurant sector** (**£115 million**, **18%**), the **production sector** (**£97 million**, **15%**), and the **real estate industry** (**£91 million**, **14%**)[84].

The impact in terms of gross value added was estimated at **£379 million** across the UK economy as a whole (with **£281 million** generated within Scotland), while the corresponding estimates in terms of employment stood at **5,835 full-time equivalent jobs** across the UK as a whole, with **4,385 jobs** supported across Scotland.

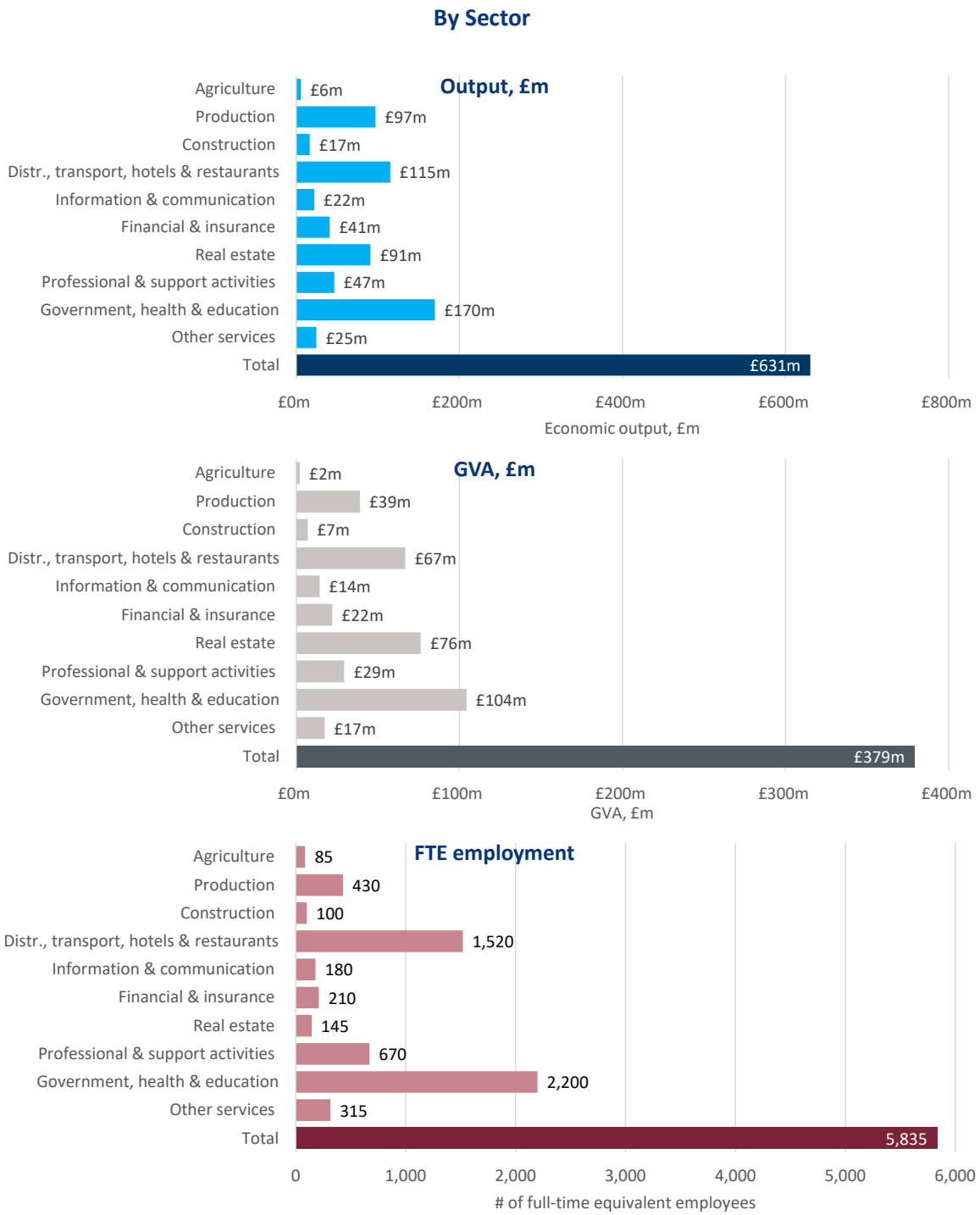
[83] Again, in terms of tuition fee income, note that we apply the relevant multipliers to the *gross* tuition fee income generated by international students in the 2018-19 University of Glasgow cohort, and then deduct the Exchequer/University cost of provision (i.e. public teaching grants, public student support, and University of Glasgow fee waivers and bursaries) to arrive at the *net* direct, indirect and induced impact associated with this income.
[84] Again, for more detail on what industries are included in this high-level sector classification, please refer to Table 20 in Annex A2.2.1.

Figure 26 Total economic impact associated with international students in the 2018-19 University of Glasgow cohort, by region and sector



Note: Monetary estimates are presented in 2018-19 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***

Figure 26 Cont. Total economic impact associated with international students in the 2018-19 University of Glasgow cohort, by region and sector



Note: Monetary estimates are presented in 2018-19 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 Glasgow'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 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 itself, by purchasing goods and services (including labour) from the economy in which it operates.
- **Indirect effect:** The university's purchases generate income for the supplying industries, which they in turn spend on their own purchases from suppliers to meet the university'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 and of businesses operating in the university'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 Glasgow. In line with the other strands of impact, the analysis focuses on the 2018-19 academic year. As with the impact of the University's educational exports, these impacts can be measured in terms of economic output, gross value added, and (full-time equivalent) employment.

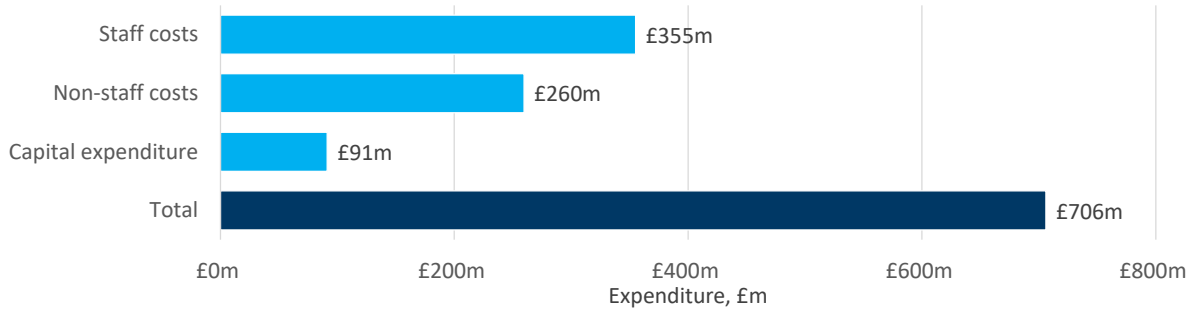
5.1 Direct impact of the University's expenditures

To measure the direct economic impact of the purchases of goods, services, and labour by the University of Glasgow, we used information on the University'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 2018-19 academic year[85].

Based on this, in terms of monetary economic **output** (measured in terms of expenditure), **the direct economic impact** associated with the University of Glasgow's expenditures stood at approximately **£706 million** in 2018-19 (see Figure 27). This includes **£355 million** of staff costs, **£260 million** of other (non-staff) operating expenses[86], and **£91 million** of capital expenditure incurred in that academic year.

[85] Based on staff and financial data published by the Higher Education Statistics Agency (see HESA (2020a) and HESA (2020c)).
[86] The total operational expenditure (excluding capital expenditure) of the University of Glasgow in 2018-19 stood at **£757 million**. From this, for the purpose of the analysis, we excluded **£33 million** in depreciation costs (from non-staff expenditure) and **£109 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).

Figure 27 Direct economic impact (in terms of output) of the University of Glasgow's expenditure in 2018-19, by type of expenditure



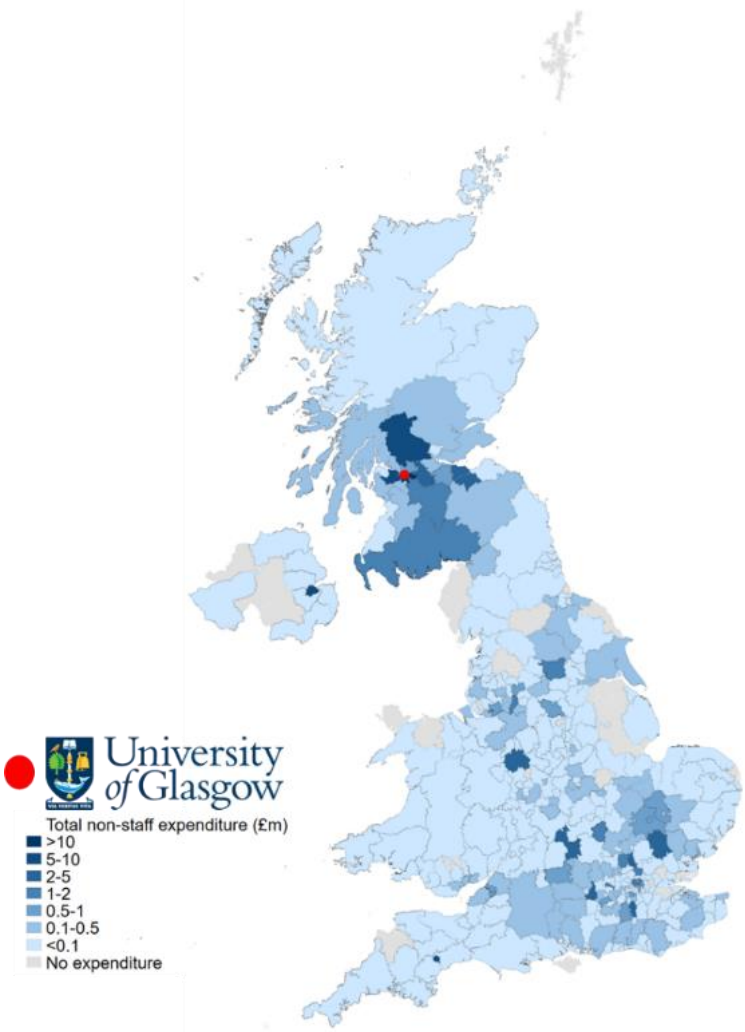
Note: We exclude a total of **£33 million** of non-staff costs associated with deprecation, and **£109 million** of staff costs associated with movements in pension provisions, as it is assumed that these are not relevant from a procurement perspective (i.e. these costs are not accounted for as income by other organisations). All estimates are presented in 2018-19 prices, and rounded to the nearest £1m.
Source: London Economics' analysis based on HESA (2020a) and data provided by the University of Glasgow

In addition to these total expenditures, we investigated the **geographical breakdown** of the University's procurement expenditures, to demonstrate the breadth of the institution's impact across Scotland and the rest of the UK.

Figure 28 presents the distribution of the University's procurement expenditures (based on invoice data for 2018-19) by Local Authority. The map illustrates a clear concentration of procurement expenditure in **Scotland** (**33%**, with **Glasgow City** accounting for **17%**) and **London** (**34%**, with the City of London Local Authority accounting for **29%**)[87]. While these two regions account for approximately two-thirds of the University's procurement expenditure, the University also spends significant amounts on goods and services from suppliers in other regions, including the **South East** (**10%**, in particular Wokingham, Reigate and Banstead, and Cherwell), the **East of England** (**6%**, in particular Welwyn Hatfield and Uttlesford), the **South West** (**5%**, particularly Exeter), and Northern Ireland (**4%**, particularly Belfast). Despite the concentration of expenditure in and around Glasgow, this analysis illustrates the wider geographical reach of the University's activities, with significant levels of expenditure occurring throughout Scotland and the rest of the UK.

[87] 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.

Figure 28 Distribution of the University of Glasgow's procurement expenditure in 2018-19, by Local Authority (of invoice address)



Note: We received data on the invoice postcodes associated with £198 million of procurement expenditure by the University in 2018-19 (which constitutes a subset of the University's total non-staff spend, as it excludes a range of expenditure on different activities and suppliers, such as expense claims, overseas agents, property leases, external salary costs and external partners). Of this total, we excluded expenditure records with missing postcodes (79 records), non-UK or invalid postcodes which could not be identified (668 records), observations from the same supplier which had both positive and negative observations of the same magnitude (3,174 records (i.e. credit notes offsetting original invoices)), and remaining records with negative expenditure (2,437 records). As a result of these exclusions, the figure is based on a total of £183 million of procurement expenditure. We used the August 2019 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 April 2019 to generate the map.
Source: London Economics' analysis based on University of Glasgow data and Office for National Statistics data. Contains National Statistics data, OS data, Royal Mail, Gridlink, LPS (Northern Ireland), ONS, NISRA data, NRS data and Ordnance Survey data © Crown copyright and database right 2021

In terms of **employment**, the University directly employed **6,280** full-time equivalent staff in 2018-19[88], corresponding to **8,015** employees in headcount terms. The University is a major employer within the Glasgow City Region (see Table 9), accounting for approximately **1%** of total employment in the Glasgow City Region, and **12%** of employment within the region's education sector.

[88] This excludes any staff on atypical contracts employed by the University of Glasgow.

Table 9 Number of employees throughout the Glasgow City Region by sector vs. University of Glasgow employees (in headcount)

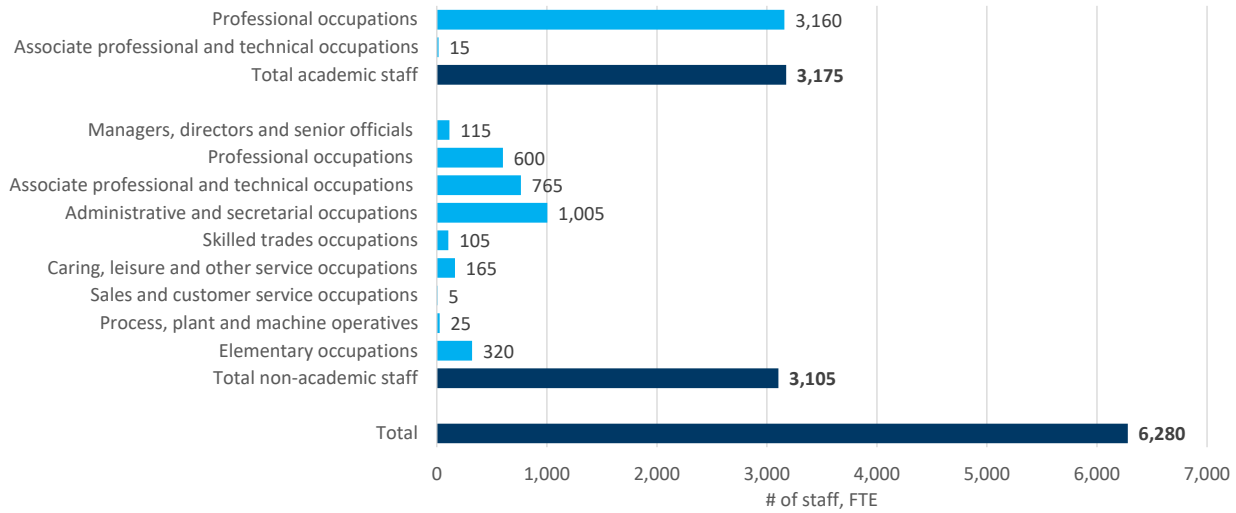
Sector	# of employees (headcount)
Health	138,000
Business administration & support services	93,000
Retail	77,000
Education	65,000
Accommodation & food services	58,000
Professional, scientific & technical	58,000
Public administration & defence	58,000
Manufacturing	52,000
Construction	51,000
Transport & storage (including postal)	37,000
Arts, entertainment, recreation & other services	35,000
Financial & insurance	34,000
Information & communication	32,000
Wholesale	21,000
Motor trades	17,000
Mining, quarrying & utilities	15,000
Property	15,000
Agriculture, forestry & fishing	2,000
Total	**855,000**
University of Glasgow	**8,015**

Note: Numbers for other industries are rounded to the nearest 1,000; numbers for the University of Glasgow are rounded to the nearest 5. Due to this rounding, numbers may not add up precisely to the totals indicated.
Source: London Economics' analysis based on HESA (2020c) and Office for National Statistics (2020e)

In terms of occupation, the University's staff are split almost equally between academic (**3,175**) and non-academic (**3,105**) staff (in FTE terms; see Figure 29). The vast majority of the University's academic staff were employed in professional occupations (**3,160**). In contrast, the occupational split for non-academic staff was more varied, with **1,005** staff in administrative and secretarial occupations, **765** in associate professional and technical occupations, **600** in professional occupations, **320** in elementary occupations, and **415** staff split across other occupational groups.

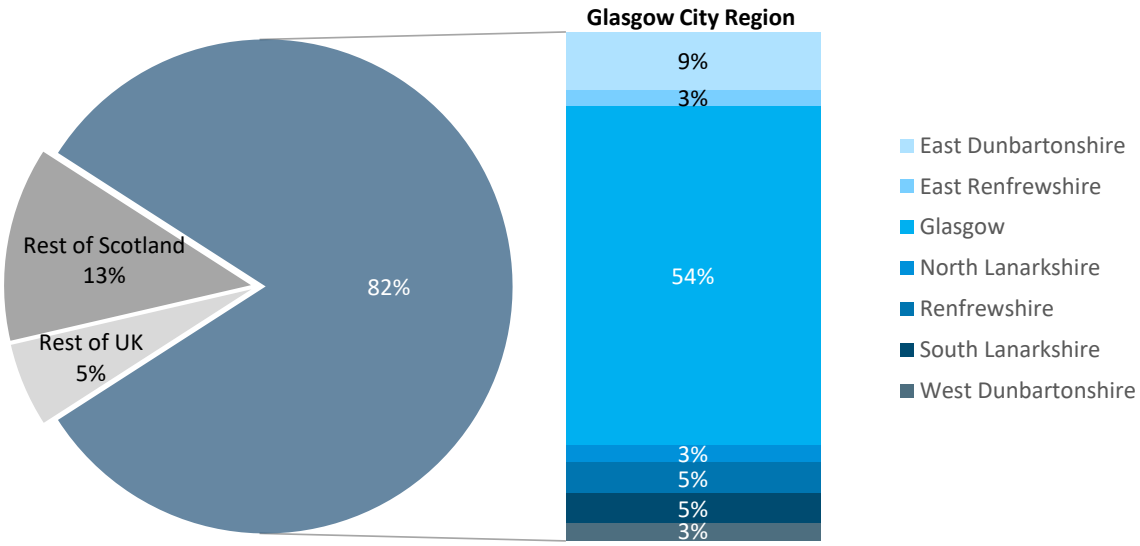
In terms of location (based on home address location; see Figure 30), further highlighting the contribution of the University to its local economy, the majority (**82%**) of the University's staff were resident in the Glasgow City Region, particularly in Glasgow City itself (**54%**) and East Dunbartonshire (**9%**).

Figure 29 Number of staff employed by the University of Glasgow in 2018-19, by occupation (in FTE)



Note: Numbers exclude staff on atypical contracts, and are rounded to the nearest 5.
Source: London Economics' analysis based on HESA (2020c)

Figure 30 Staff employed by the University of Glasgow in 2018-19, by location of home address (in FTE)



Note: The information is not based on the same data as Figure 29, but is instead based on separate staff information provided by the University of Glasgow.
Source: London Economics' analysis based on data provided by the University of Glasgow

Finally, in terms of **gross value added**, the direct contribution of the University's operations to GVA stood at **£437 million** in 2018-19[89].

[89] The level of direct GVA generated by the University's activities was calculated as the sum of staff costs, surplus on operations, interest and other finance costs, and depreciation.

The Baltic Street Adventure Playground

The Baltic Street Adventure Playground in the heart of Dalmarnock, an area of high deprivation, is providing a lifeline for local families, giving children a safe place to play and providing hot, healthy meals. Established in the wake of the 2014 Commonwealth Games as a child-led supervised adventure playground, it has grown to become an important community resource. **Researchers from the University of Glasgow's Adam Smith Business School are working closely with the Playground to support and develop the sustainability of their Community Food Hub**.

Feeding the children who attend the Playground has become a core aspect of supporting local families. Fresh produce is grown in the community garden, tended by the children, with the help of community growers. Alistair McCall, part of the core team behind the project, explains that for most local families it can be hard to buy fruit and vegetables at a reasonable price, making it harder to incorporate them into their children's daily diets. Thanks to the expertise of the community growers from Propagate, a Glasgow-based collective that offers support in community growing space and aims to make gardening fun and educational for children, this has **sparked their interest in food from seed to plate**.

Researchers from the University of Glasgow's Adam Smith Business School are working closely with the Playground to **evaluate the sustainability of their Community Food Hub**. Dr Helen Traill is part of the research team with expertise in collaborative and community-led approaches to community food, along with colleagues Dr Stephanie Anderson, Professors Deirdre Shaw, Andrew Cumbers, and Robert McMaster. Thanks to European Union/Scottish Government Social Innovation funding, the team have been able to work alongside the Playground to expand their community food hub to support the families and residents of Dalmarnock and surrounding areas.

The Playground also encourages members of the community to regularly sit down together to enjoy nutritious meals, **helping to break down barriers and encourage relationship-building between generations**. To develop this goal of improving intergenerational relationships, the children also take freshly prepared, nutritious food to older residents who are house-bound or struggle to leave their homes. Some of this food is gathered fresh from the garden, while the majority of it is received from FareShare, a food redistribution charity. The impressive food storeroom is stacked with fresh produce and non-perishables, and local community members are free to visit during open hours and take what they need, creating a truly open community resource.

More generally, the Playground has been invaluable in assisting the local community to overcome the problems associated with living in a 'food desert'. This means that, without access to a vehicle, people would have to walk at least 20 minutes to reach the nearest shop. However, with funding from the project to provide a minibus, they are now able to **support the mobility of local people and facilitate local deliveries of fresh food**.

These initiatives have not gone unnoticed by the local community. In summer 2019, the number of people visiting the garden on a daily basis doubled to an average of 500 a day. During the six weeks of the 2019 summer holidays, the Playground hosted an impressive 7,000 attendees and prepared 15,000 much-needed meals. Thanks to the mutually beneficial relationship that has developed between the University and the Playground, the team have managed to gain rich data from their qualitative research, which will be used to inform future interventions and has the potential to influence policy decision-making.

5.2 Indirect and induced impacts of the University's expenditures

As with the economic impact of the University's educational exports (see Section 4), the assessment of the indirect and induced economic impacts associated with the expenditures of the University of Glasgow is again based on economic multipliers derived from the above-discussed multi-regional Input-Output model[90]. In particular, we applied the estimated average economic multipliers associated with organisations in Scotland's government, health, and education sector. This mirrors the approach used to assess the impact of the University's international tuition fee income, since this income was accrued (and subsequently spent) by the University itself. Again, this approach asserts that the spending patterns of the University of Glasgow reflect the average spending patterns across organisations operating in Scotland's government, health, and education sector.

These multipliers (for Scotland and the UK as a whole[91]) are presented in Table 10, indicating that every £1 million of operational or capital expenditure incurred by the University of Glasgow generates an *additional* **£1.54 million** of impact throughout the UK economy, of which **£0.83 million** is generated in Scotland[92]. In terms of employment, we assume that, for every **1,000** (FTE) staff employed directly by the University, an additional **1,020** staff are supported throughout the UK, of which **560** are located in Scotland.

Table 10 Economic multipliers associated with the expenditures of the University of Glasgow

Location of impact	Output	GVA	FTE employment
Scotland	1.83	1.81	1.56
Total UK	2.54	2.46	2.02

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's international tuition fee income (see Table 8 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 Glasgow'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 Glasgow's activities between different agents in the UK economy. Specifically, we deducted:

- The total research income received by the University in 2018-19 (**£253 million**), to avoid double-counting with the estimated impact of the University's research activities (Section 2);
- **£1 million** in University of Glasgow fee waivers and other bursary spending for UK domiciled students[93], as this was included (as a benefit) in the analysis of the University's teaching and learning activities (Section 3); and

[90] See Section 4 for more information.
[91] Again, in addition to the impacts on Scotland 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.
[92] This exactly matches the assumed multipliers associated with the University's international tuition fee income (see Table 8 in Section 4.4).
[93] The University'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's spending to correctly take account of the fact that these bursaries are a transfer from the University to its students, and not an additional benefit to the UK economy.

- The direct, indirect, and induced impacts generated by the University's (gross) international fee income associated with the 2018-19 cohort of non-UK students (**£337 million**[94]), to avoid double-counting with the impact of the University's educational exports (Section 4).

5.4 Aggregate impact of the University's spending

Figure 31 presents the estimated total direct, indirect, and induced impacts associated with expenditures incurred by the University of Glasgow in 2018-19 (after the above-described adjustments have been made). The aggregate impact of these expenditures was estimated at approximately **£1,202 million** in economic output terms (see top panel of Figure 31):

The impact of the University of Glasgow's expenditure on the UK economy in 2018-19 stood at £1.2 billion.

- In terms of region, as with the impact of exports (Section 4), the majority of this impact (**£865 million**, **72%**) was generated in **Scotland**, with **£336 million** (**28%**) 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 (**£547 million**, **46%**[95]), there are also large impacts felt within other sectors, e.g. including the **production sector** (**£159 million**, **13%**)[96], the **distribution, transport, hotel, and restaurant sector** (**£156 million**, **13%**), and the **real estate sector** (**£107 million**, **9%**)

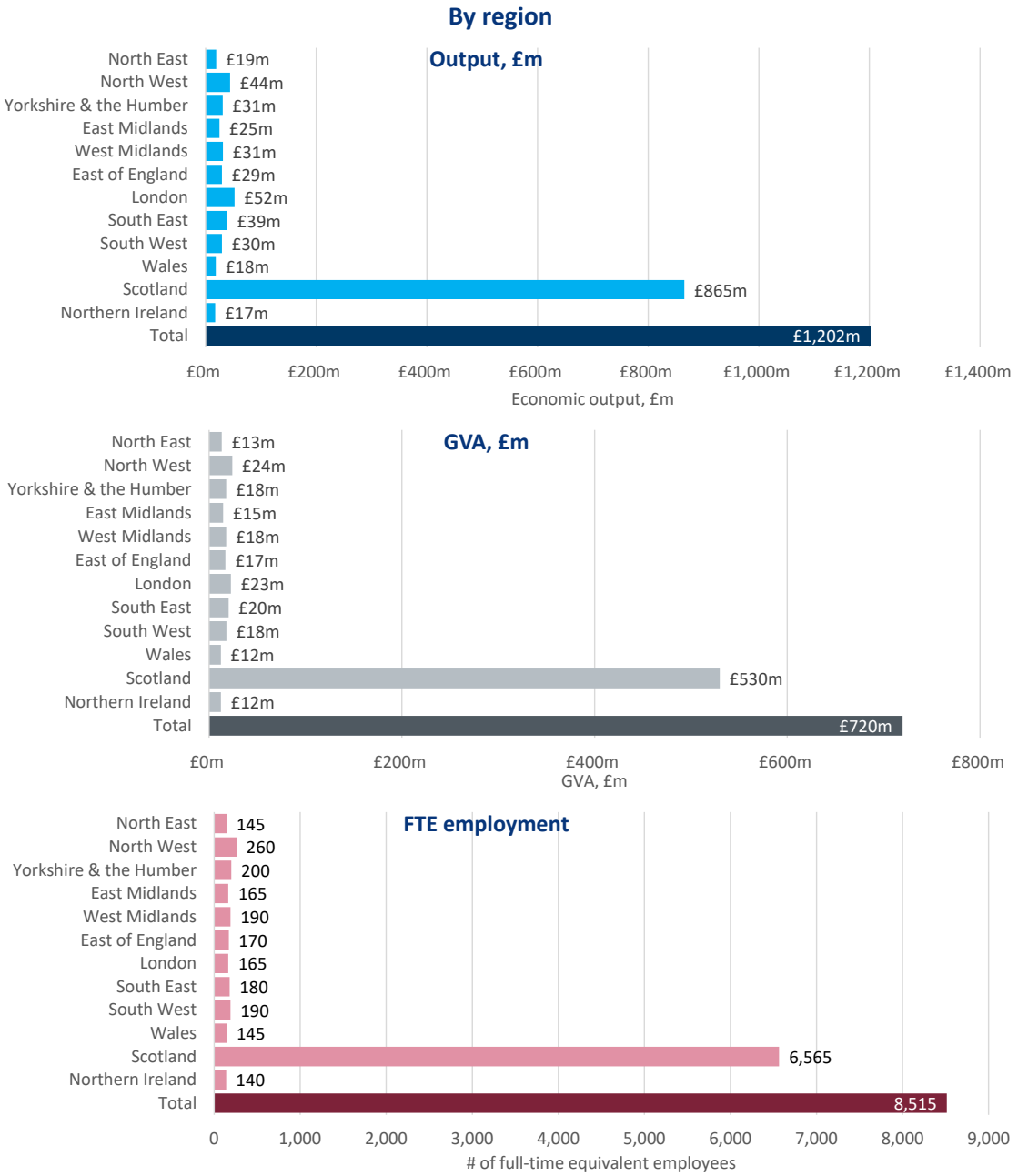
In terms of the number of jobs supported (in FTE), the results indicate that the University's spending supported a total of **8,515** FTE jobs across the UK economy in 2018-19 (of which **6,565** are located in Scotland). In addition, the impact in terms of gross value added was estimated at **£720 million** across the UK economy as a whole (with **£530 million** generated within Scotland).

[94] This is slightly larger than the above impact of the *net* tuition fee income associated with international students in the 2018-19 cohort (**£320 million**; see Section 4.4), as the value deducted here relates to the impact of the University's *gross* international fee income *before* the deduction of the Exchequer/University funding costs associated with these students (since these costs are already deducted when estimating the impact of the University's educational exports).

[95] 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 (net of the above adjustments to avoid any double-counting).

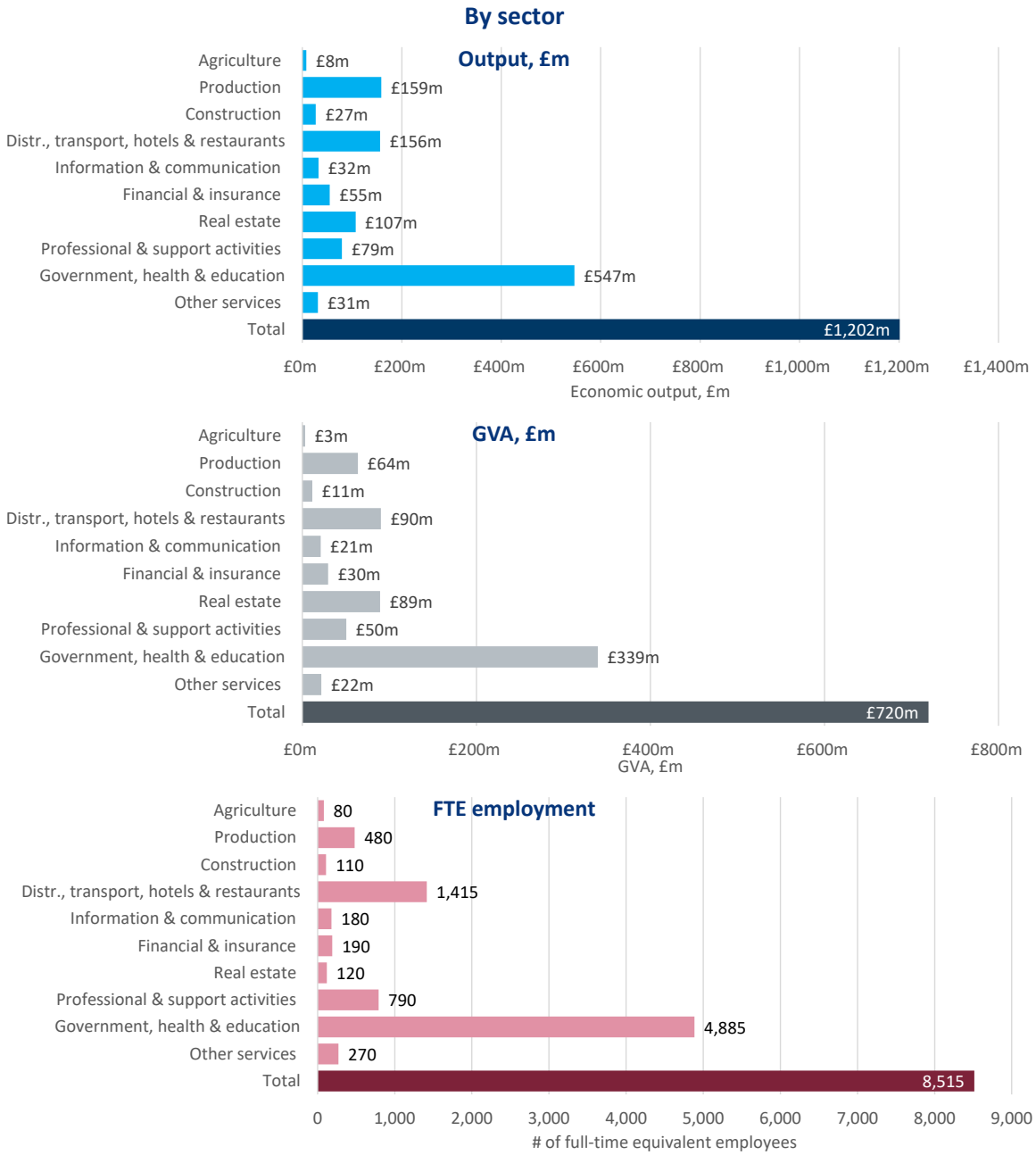
[96] Again, for more detail on what industries are included in this high-level sector classification, please refer to Table 20 in Annex A2.2.1.

Figure 31 Total economic impact associated with the University of Glasgow's expenditure in 2018-19, by region and sector



Note: Monetary estimates are presented in 2018-19 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

Figure 31 Cont. Total economic impact associated with the University of Glasgow's expenditure in 2018-19, by region and sector



Note: Monetary estimates are presented in 2018-19 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

Campus Development Programme: Partnering to deliver social value and community benefits

The University of Glasgow's Campus Development Programme is a £1 billion investment in the estate over ten years to expand its world-class facilities and campus, with a mix of modern research, teaching and public spaces. The first building delivered as part of the programme was the **James McCune Smith Learning Hub**, which opened in April 2021. The building provides a state-of-the-art learning and teaching facility, with capacity for more than 2,500 students. The Hub also includes a high-quality conference venue, delivering economic and cultural benefits to the wider city, and will serve as the venue for the University's summer schools.

Multiplex is the main contractor and delivery partner of the programme. The strategy to procure a single programme delivery partner represented a new approach for the University, which has traditionally gone out to tender for each new building. The partnership approach had several benefits: promoting collaboration and strengthening the relationship between the University and its partner; offering greater cost certainty and value for money, and the flexibility for the University to alter its requirements; and providing a single point of responsibility and interface management between projects. In addition, the University and its partner **adopted a shared vision for the wider benefits that a programme of this magnitude could deliver for both the local economy and the community**.

This shared vision underpinned one of the key objectives in the delivery of the James McCune Smith Learning Hub, which was to **realise social value within the community**. To deliver this, Multiplex worked in partnership with several organisations, including the Department for Work and Pensions, to **make employment opportunities on the project accessible to those farthest from the jobs market**. Multiplex also works with Street & Arrow, a social enterprise run by Police Scotland's Violence Reduction Unit, which **supports ex-offenders to get back into work by offering twelve-month work programmes that provide employment and mentoring**. Street & Arrow operated the food truck that provided onsite catering during construction of the building, and Multiplex have also begun offering work placement and employment opportunities to those who have completed programmes with Street & Arrow.

Another key objective was to **break down barriers typically faced by local small and medium enterprises (SMEs) and social enterprises in bidding for contracts on a project of this scale**. This was facilitated through a Supply Chain Networking Event, held at the inception of the project, which aimed to make the contracts arising from the project accessible to prospective contractors. Over 50 such organisations have subsequently been supported into Multiplex's supply chain.

In December 2020, Multiplex published the *James McCune Smith Learning Hub Social Value & Community Report*, which detailed the economic and social benefits associated with the project, estimating that **for every £1 spent on the project, £1.87 of social and economic value has been generated**. The project resulted in the creation of **47 new roles, 71 apprenticeships/traineeships, 8 graduate roles, 46 work placements and 64 qualifications**.

6 Total economic impact of the University of Glasgow

The total economic impact on the UK economy associated with the University of Glasgow's activities in 2018-19 was estimated at approximately **£4.4 billion** (Table 11). In terms of the components of this impact:

The total economic impact associated with the University of Glasgow's activities in 2018-19 stood at £4.4 billion.

- The University's **research activities** accounted for **£1.8 billion** (**42%**) of this impact;
- The value of the University's teaching and learning activities stood at **£734 million** (**17%**);
- The impact of the University's **educational exports** was estimated at **£631 million** (**14%**); and
- The impact generated by the **operating and capital spending of the University** stood at **£1.2 billion** (**27%**).

Table 11 Total economic impact of the University of Glasgow's activities in the UK in 2018-19 (£m and % of total)

Type of impact		£m	%
	Impact of research	**£1,833m**	**42%**
	Net direct impact	£96m	2%
	Spillover impact	£1,737m	40%
	Impact of teaching and learning	**£734m**	**17%**
	Students	£401m	9%
	Exchequer	£333m	8%
	Impact of exports	**£631m**	**14%**
	Tuition fee income	£320m	7%
	Non-tuition fee income	£310m	7%
	Impact of the University's spending	**£1,202m**	**27%**
	Direct impact	£706m	16%
	Indirect and induced impacts	£496m	11%
Total economic impact		**£4,399m**	**100%**

Note: All estimates are presented in 2018-19 prices, and rounded to the nearest £1m. Totals may not add up precisely due to rounding.
Source: London Economics' analysis

Compared to the University's total operational costs of approximately **£757 million** in 2018-19[97], the total impact of the University of Glasgow's activities on the UK economy was estimated at **£4.4 billon**[98], which corresponds to a **benefit to cost ratio of 5.8:1**. This compares to an average benefit-to-cost ratio among Russell Group institutions of approximately **5.5:1**, and corresponds to a **14%** increase in the University's impact of since 2015-16 (on a like-for-like basis, in real terms[99]).

[97] Compared to the **£706 million** of direct impact of the University's expenditures included in Section 5 and in Table 11 in this section, the **£757 million** of operating expenditure here *excludes* capital expenditure (**£91 million**) but *includes* depreciation costs (**£33 million**) and movements in pension provisions (**£109 million**).
[98] 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, approximately **£1.8 billion** (**42%**) of the University's total impact can be disaggregated in this way. For more information, see Annex 3.
[99] See London Economics (2017). The analysis of the economic impact of all Russell Group institutions (including the University of Glasgow) was based on the 2015-16 academic year.

7 The University of Glasgow's social, cultural, and environmental impacts

7.1 Introduction

This report primarily focuses on estimating the economic impact of the University of Glasgow. The traditional approach to estimating the economic impact of higher education institutions focuses on their role in generating economic activity through the purchase of goods and services, the hiring of employees and their subsequent expenditure, the impact of research activity, as well as the economic impact associated with skills and qualification acquisition as identified in the labour market. Assessments of these economic impacts typically focus on estimating the monetary value of an institution's contribution at a local, regional or national level.

However, there are also a number of wider economic and non-economic societal benefits associated with higher education institutions, which take into consideration broader contributions to inclusive regional economic development, addressing inequalities and improving social mobility, improving population health and wellbeing, supporting sustainability, and contributing to the local community's sense of place and cultural vitality.

The three core themes at the heart of the University of Glasgow's '**World Changers Together**' strategy – **Community**, **Connectivity**, **Challenges** – reflect the commitment to being an institution that connects people to some of the 'grand challenges' of our age: sustainability, inequality, and wellbeing. The COVID-19 pandemic has exacerbated these challenges and strengthened the need to "build back better" in Glasgow and beyond. Consequently, the strategic theme of **Community** recognises that the University cannot support a more innovative, inclusive and sustainable recovery alone. The importance of strong partnerships with individuals, communities, groups and institutions at a local, national and global level is therefore key to ensuring that the post-COVID economic and social recovery becomes a reality.

As a **Civic Anchor Institution** (CAI), the University is an inclusive employer of a diverse number of people who largely live and spend locally. It is also a consumer and procurer of a range of local goods and services, including a £1 billion campus redevelopment. Campus facilities contribute towards the city's 'sense of place', supporting culture and tourism through hosting events and conferences, as well as attracting international students and visitors to the city. The University also supports local community and partnership working to promote inclusive innovation, and deploys its research strengths and assets to address local and global challenges (such as health, inequality and sustainability).

The impact and value of the range of the University of Glasgow's activity demonstrating its contribution to inclusive prosperity and wellbeing is not easily captured through the assignment of monetary values contained in a traditional economic assessment. Therefore, this section of the report demonstrates, through the presentation of case studies, the contribution that the University makes to the wider economic, social, and cultural prosperity of Glasgow through its role as a CAI.

7.2 Inclusive Economic Growth

Knowledge Exchange & Partnership Working

Innovation has a key role to play in supporting the post-COVID recovery through the development of new processes, products and services that support productivity. Universities play a fundamental part in the innovation ecosystem through the impact of their R&D spend; research and knowledge exchange

activities; entrepreneurial and incubation activities; staff and student idea creation and business start-ups; attracting inward investment; and contributing to the development of high-growth sectors that support the creation of new industries.

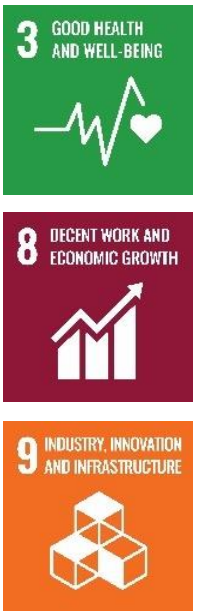
A key example of the contribution that the University and its partners have made towards the latter is the development of the field of **Precision Medicine** within Scotland, which has attracted substantial investment into the region and presents an opportunity for Scotland to position itself as a global centre of excellence for developing and delivering Precision Medicine (see overleaf).

The establishment of the **Clinical Innovation Zone** (CIZ), the success of which the Precision Medicine Living Laboratory is seeking to build upon, proved invaluable at the onset of the COVID-19 pandemic in supporting the rapid creation of a national COVID-19 testing facility, set up by the University and the UK Department for Health & Social Care. The rapid response of the **Lighthouse Lab** team is a leading example of the advantages of collaborative working, which supported the creation of an estimated 650 high-value jobs. The University is also keen to support local employment opportunities, working closely with the further education sector and Skills Development Scotland to help develop a pre-employment training scheme for the residents of Govan, where the Lighthouse Lab is located.

As well as working in partnership with other large institutions in the region to attract inward investment and build critical mass in innovative sectors, the University has also developed collaborative partnerships with local businesses to engage in knowledge transfer between industry and academia, using research findings and insights to help businesses develop new processes, products and services, access new markets, and improve their growth prospects. One example of this is the **MIRAGE consortium** (see Section 2.2), in which academics from the University of Glasgow's School of Engineering worked with four Scottish businesses with the aim of placing Scotland at the forefront of £7 billion global sensors and imaging systems market, delivering significant economic growth, and onshoring highly skilled research and manufacturing jobs. The initiative was the first of its kind in Scotland and has led to a number of positive outcomes for the companies involved as well as the Scottish economy.

Universities also have an important role to play in developing **place-based innovation ecosystems** with their regions through the provision of training and education focused specifically on developing entrepreneurship, leadership and management capabilities. Part of the University of Glasgow's vision for its £1 billion campus development is to establish an **Innovation Zone** that will provide facilities on campus for externally facing partnership activities, including start-ups, scale-ups, spinouts, and co-location of industry partners. This will be supported by a programme of intra- and entrepreneurship training and development, which will help to strengthen capabilities and innovative capacity within the region.

Investing Together in Healthcare



The University of Glasgow has developed a long-standing partnership with NHS Greater Glasgow & Clyde, Glasgow City Council and Glasgow City Region City Deal to improve the health of people in Scotland, and to bring innovation and growth to Glasgow.

Precision Medicine – an approach which enables researchers to identify and develop treatments that are 'precise' and effective to the individual characteristics of each patient – has been identified as an area of significant strength in Scotland. The Department of Business, Energy and Industrial Strategy (BEIS) Science and Innovation Audit, *Precision Medicine Innovation in Scotland*, demonstrated that Precision Medicine has the potential to be transformative for Scotland and the United Kingdom's life science clusters. The audit highlighted the opportunity Precision Medicine represents for Scotland to attract inward investment and develop expertise that can be exported globally.

Investments at the Queen Elizabeth University Hospital (QEUH) have established Glasgow as a world leader in Precision Medicine. By taking a collaborative and partnership approach, spaces have been created which bring together academia, industry and the NHS.

Living Laboratory – A Game Changer

In 2020 Glasgow was awarded £38 million to create the Precision Medicine Living Laboratory – an internationally leading project focused on translating cutting-edge science and innovation into a real-world clinical setting. The government funding was awarded through UK Research and Innovation's flagship Strength in Places Fund, supported by additional funding from industrial partners, and a significant investment through the Glasgow City Region City Deal and Glasgow City Council.

Working together, the consortium of public and private partners, led by the University of Glasgow, will create a cluster of Precision Medicine excellence in Govan, creating a facility which will have unparalleled interactions between academia, industry and the health service. The Living Lab is projected to deliver 446 high-value jobs and £136 million gross value added (GVA) over an 8-year period.

The Centre is also attracting academics and businesses to relocate from elsewhere in Europe to be based in Glasgow, as part of this world-leading beacon of science and innovation.

The Glasgow Precision Medicine Ecosystem

The Living Lab will build on the success of the Clinical Innovation Zone (CIZ). Based at the QEUH, CIZ is a unique space in Scotland where industry, academia and the NHS work alongside each other on Precision Medicine projects.

It is also home to the University's £32 million Imaging Centre of Excellence (ICE), which includes the UK's first 7T-MRI scanner in an acute clinical setting. The scanner allows scientists and clinicians to study the human body in greater resolution than ever before, hugely benefiting patients across the UK and beyond. It also houses the £3.4 million Molecular Pathology Node, the largest of its kind in the UK. The Node brings scientists, pathologists and clinicians together to develop and perform new tests that better diagnose patients and guide treatment in cancer and chronic diseases such as rheumatoid arthritis, and cardiovascular and metabolic diseases.

Source: University of Glasgow

As well as delivering economic benefits by supporting companies to develop and commercialise, encouraging business start-ups, and offering the NHS substantial savings by implementing Precision Medicine in the UK's largest hospital, CIZ will also deliver significant improvements in healthcare treatment and outcomes for patients.

Inclusive Innovation and Growth

Whilst these examples highlight the important role that the University plays in strengthening the innovation ecosystem within the Glasgow City Region, there is an increasing focus on the need to ensure that economic growth and innovation activity is inclusive, and its resultant benefits are felt by all citizens within the region. The innovation foundation, NESTA, defines inclusive innovation as that which prioritises considerations about "who benefits from…participates in…[and] decides on the priorities and manages the outcomes of innovation"[100].

The University's **campus development** is a key example of a significant financial investment in which inclusivity and community benefits are a central part of the strategy for delivery. The University and its Programme Delivery Partner for the campus development, Multiplex, formalised this commitment in the Social Value Strategy that underpinned the project to build the £90.6 million **James McCune Smith Learning Hub**, which opened in April 2021. This strategy contained specific targets on job creation, apprenticeships, graduate traineeships, qualifications, and supporting local small- and medium-sized businesses and social enterprises. Multiplex also worked collaboratively with partners to make these opportunities accessible to those farthest from the jobs market, and to break down some of the barriers typically faced by local SMEs and social enterprises in bidding for contracts on a project of this scale.

Inclusive innovation is also at the heart of the development of the **Glasgow Riverside Innovation District** (GRID), which is being led by the University of Glasgow in partnership with Scottish Enterprise and Glasgow City Council. GRID is part of the wider innovation ecosystem in the city, aiming to build on existing strengths in Precision Medicine, boost existing collaborations with industry, and encourage the formation of new partnerships in some of the most dynamic sectors of the economy. GRID is also founded on an inclusive innovation approach, whereby it seeks to work in partnership with local stakeholders and communities to shape the delivery of the innovation district and ensure that they benefit. An inclusive innovation approach also acknowledges that innovation has broader applicability beyond economic growth, and that it can play a critical role in addressing social issues, such as education, sustainability and health, as well as improving the everyday services people use, such as transport. With its breadth of research excellence, the University is well placed to help drive these non-economic innovations.

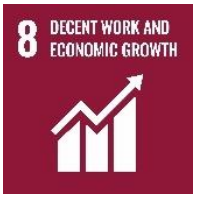
[100] NESTA (2018)

Glasgow Riverside Innovation District (GRID)

Encompassing both banks of the River Clyde, an area synonymous with the legacy of shipbuilding and Glaswegian leadership in industry, GRID offers the city the chance to reimagine its proud industrial heritage for the 21st century and to establish Glasgow's leadership in the hi-tech industries of the future.

Building on Existing Assets

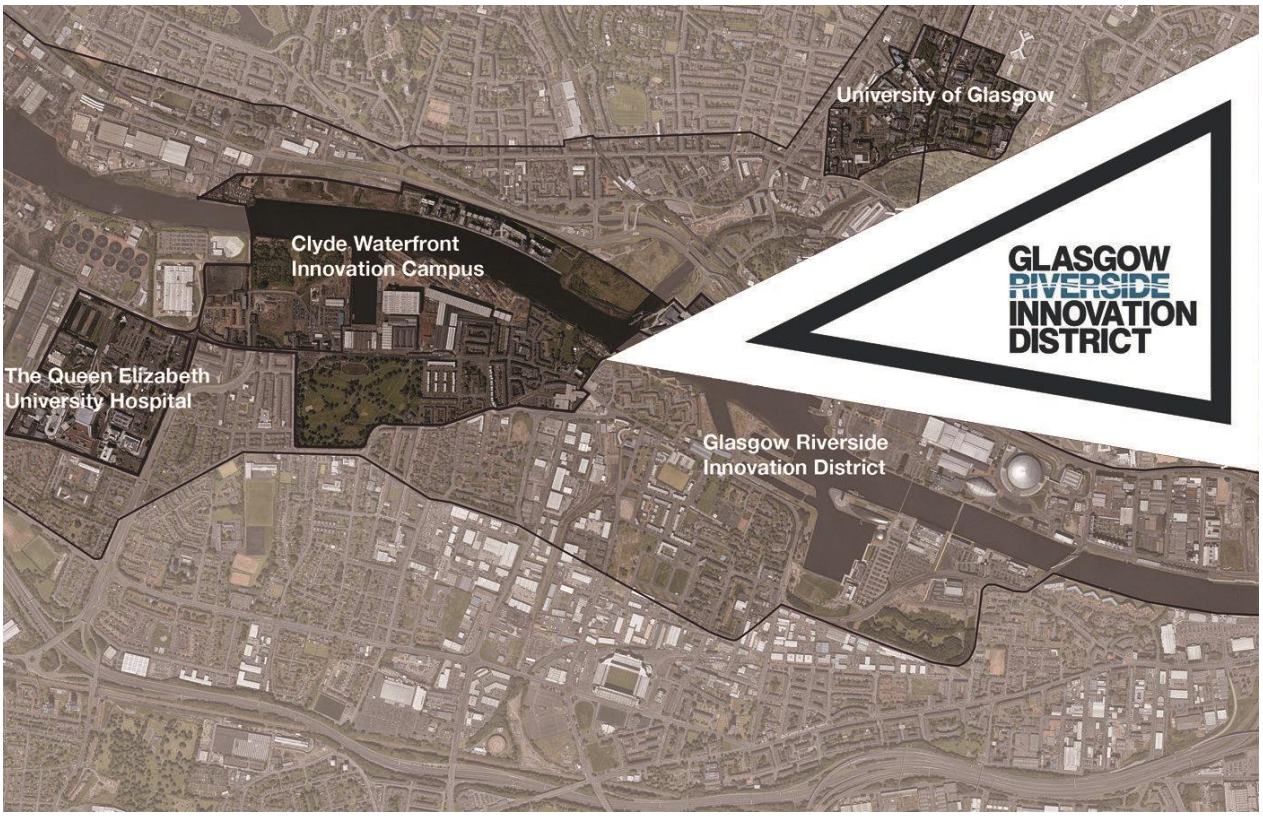
Alongside access to the outstanding academic expertise based around the University, GRID is home to the world-leading Clinical Innovation Zone based around the Queen Elizabeth University Hospital (QEUH), the largest hospital campus in Europe, the emerging cultural quarter based around the Kelvingrove Museum & Art Gallery, the world-leading Scottish Events Campus, as well as the vibrant media hub at Pacific Quay, which includes the headquarters of BBC Scotland.



By bringing together these diverse industries, skillsets and perspectives, GRID offers the chance to create a world-class innovation cluster which can see Glasgow retake its place at the forefront of international industry and innovation.

The Opportunities for the City

GRID will empower the University and its partners to nurture indigenous businesses within the city region and to attract dynamic and innovative companies to Glasgow, driving the west of Scotland to the next level in those industries where it has the genuine potential to lead the world.



Source: University of Glasgow

Outreach, Stakeholder and Community Engagement

GRID has at its heart the community of Govan. This is an area that has suffered large scale de-industrialisation but has mature and embedded community networks to realise its ambitions. The development of GRID and the new high-technology **Clyde Waterfront Innovation Campus** will be carried out working alongside these over-arching structures that will help the University navigate and forge meaningful relationships with the diverse range of community stakeholders present in the local area - the most relevant being Central Govan Action Plan - with others including the Govan Area Partnership and Govan Thriving Places.

A stakeholder and community engagement strategy is being developed to underpin and inform the five-year strategy being developed for GRID. The University will work with stakeholders across the community to agree a shared vision, identify and segment key stakeholders, agree methods of engagement, deliverables and outcomes, and a high-level engagement programme.

7.3 Tackling Inequality and Improving Social Mobility

Section 7.2 highlighted the importance of ensuring that economic growth and innovation are inclusive and that all citizens benefit from it. While the uneven distribution of the benefits of growth is an issue in and of itself, research by the OECD has found that widening inequalities, particularly educational inequalities, can act as a dampener on *overall* levels of economic growth.[101]

'**Addressing Inequalities**' is one of the University's Research Beacons, which are cross-disciplinary areas of research excellence that have attracted major financial and intellectual investment. As well as having a strong international reputation and reach, a great deal of the research within these areas is focused on the underlying issues that contribute to the inequalities that are evident within the Glasgow City Region. For example, one of the core strengths of the region is the high percentage of its residents with degree-level qualifications[102], to which the University contributes through the relatively high proportion of its graduates that are originally from and stay within the city post-graduation; however, the region also has a relatively high proportion of residents with *no* formally recognised qualifications.

Skills Accumulation and Education

The University has taken steps to address some of the educational inequalities through its policies and partnerships, particularly those focused on widening access to applicants from non-traditional backgrounds. As highlighted within the analysis of the impact of Teaching and Learning (see Section 3), the University runs several initiatives that work with more than 30,000 targeted pupils each year across secondary schools in the west of Scotland to address some of the challenges that students from disadvantaged communities have faced when making the transition from school to university. These programmes have had real success in improving access, as is evidenced by the fact that, in 2018, nearly 20% of Scottish entrants to the University's School of Medicine were from the most deprived areas of Scotland, a level that was seen as unprecedented among the UK's medical schools.

These efforts are being further strengthened by the **IntoUniversity** centre established in 2021 in Govan, which is the result of a collaboration between the University of Glasgow, the University of Edinburgh (where another centre is being set up in Craigmillar) and the education charity, IntoUniversity. The centres will work with schools, colleges and other agencies to provide additional education support to young people aged between the ages of 7 and 18, with the aim of improving educational outcomes and supporting their journey into employment and a positive destination.

The University is also expanding opportunities and promoting inclusion beyond its student population and school-leavers. In 2020, the University launched its first **microcredentials**, for which anyone can apply, with Scottish residents also being eligible to apply for full funding provided by the Scottish Funding Council. Each course, which lasts for 10 weeks, has been developed to equip participants with in-demand professional skills and insights, underpinned by the University's core strengths in research and teaching, and act as a springboard to new career opportunities and/or further study.

[101] Organisation for Economic Co-operation and Development (2014)
[102] Glasgow City Region (2021), page 6 (Skills)

Top of the Class – Helping Schools Reach their Potential

A strong link exists between a pupil's socioeconomic status and how well they do in school. Children living in deprived communities and lower-income households generally do significantly worse at all levels of the education system than those from more affluent areas. This is known as the attainment gap.

Researchers at the University of Glasgow **Robert Owen Centre for Education Change** developed the **Network for Social and Education Equity** (NSEE), an innovative model designed to help schools work together to make significant changes to support all children in Glasgow and its surrounding areas to reach their full potential.

Collaborating for Change

The Network facilitates school-to-school partnerships which are established and moderated to develop and embed evidence-based strategies. These strategies are designed to tackle education inequality and spark sustainable change. Teachers are encouraged to work with colleagues within their own school and with partner schools, to allow educators to share effective strategies with others.

Professor Chris Chapman, who leads the NSEE team, is also a member of the First Minister's International Council of Education Advisers and is Senior Academic Adviser to the Scottish Attainment Challenge. He is also President of the International Congress for School Effectiveness and Improvement. Professor Chapman explains: *"Improving outcomes isn't always the goal of collaboration, but rather about trying new approaches, testing existing theories about learning and sharing critical reflections in an open, safe space with peers."*

Source: University of Glasgow

Widening Impact

The NSEE model has been implemented in 32 schools and six local authorities. West Dunbartonshire fully adopted the principals of NSEE to improve student outcomes. The schools participating in the NSEE methods show increasing performance for primary 4 and primary 7 students, the two participating year groups.

Since 2016, achievement in numeracy has increased by 14% for P4 and 11% for P7, while achievement in writing has increased by 9% for P4 and 13% for P7, a clear improvement thanks to collaborative working.

The NSEE team also works in collaboration with the West Partnership Regional Improvement Collaborative (RIC), which is made up of eight local authorities that together are responsible for more than one third of Scotland's children. While the West Partnership's geographic spread includes some of the country's most affluent areas, it also spans some of the least affluent. This scale and scope puts it in a strong position to influence the national agenda regarding achieving excellence and equity for all learners.

Reacting to COVID

The COVID-19 pandemic has had a staggering impact on global education. The NSEE team continues to support local schools and inform and support educational leaders and policy makers to develop ongoing responses to the COVID19 crisis.

As Professor Chapman explains: *"NSEE is about using the existing knowledge, expertise and ideas that exist within schools and combining them with research evidence and collaborative action research to enhance learning and teaching and impact on student outcomes. Collaboration and networking are used to move the knowledge and practices across classrooms, schools and local authorities. Tackling educational inequity is the defining challenge of our time and the COVID-19 has bought it into even sharper focus."*.

Skills Transmission

Upskilling and lifelong learning have received increased attention since the onset of the COVID-19 pandemic, as the pace of technological change and innovation that it has accelerated is likely to create the need for repeated and rapid upskilling throughout many people's working lives in the future. It poses a further challenge by exacerbating the digital divide as services previously delivered face-to-face increasingly move online, which may itself reinforce existing social and economic inequalities. The issues around digital inclusion were recognised swiftly by a group of students within the **University's Adam Smith Business School**, who established the DigiGallus Connect project (see Section 3.7), which has initiated an intergenerational mentoring programme to increase digital accessibility and confidence amongst the over 50s population in Glasgow. The initiative aims to establish 100 mentee-mentor relationships with mentors supporting their member of the community in learning how to send emails, make online video calls, increase internet usage and ensure safe online browsing. The programme will also help support a key component of Glasgow City Council's strategy to improve digital inclusion and participation of older residents in their *Digital Glasgow Strategy*.

7.4 Contribution Towards Health Outcomes

Population Health and Wellbeing

As with educational outcomes, disparities in health outcomes between residents in the most and least deprived neighbourhoods in the Glasgow City Region is a long-standing issue that the city is trying to address. One of the University's key areas of research strength is clinical medicine, and the University has formed very strong links with NHS Greater Glasgow & Clyde to work together to try and improve population health and wellbeing in Glasgow. In 2018, the two organisations formalised this relationship through the establishment of the **Glasgow Health Sciences Partnership** (GHSP) to better integrate world-leading research, top quality education, and expertise in clinical practice between the University and NHS and to deliver better healthcare and health outcomes for Glasgow.

Another crucial collaboration that the University has entered into in recent years is that between its College of Social Sciences and the Glasgow Centre for Population Health (GCPH), with partners from both organisations co-located in the **Olympia Social Research Hub** in the East End of Glasgow, which itself is a partnership between the University, GCPH and Clyde Gateway. Through its research and wider engagement, the Hub aims to make a real, positive difference that benefits both the local community in the East End and the wider city region, as well as informing the policy debate in Scotland and beyond.

One of the main projects that has been established by the partnership is **Children's Neighbourhoods Scotland** (CNS). The initiative was developed in response to the fact that, despite record levels of investment, levels of child poverty remain stubbornly high, and children growing up in poverty continue to fall behind across a broad range of outcomes. CNS is a distinctive and innovative approach that brings together people, organisations and other resources in a local area so that they can work in concert to promote better lives for the children and young people living there. The first pilot site was officially launched in 2018 in the communities of Bridgeton and Dalmarknock in the East End of Glasgow, and the project has been subsequently supported by the Scottish Government's *Every Child, Every Chance: Tackling Child Poverty Delivery Plan (2018-2022)* to expand to a further five sites in a range of urban, town and rural settings.

GPs at the Deep End

The Deep End GP group is a network of GP surgeries in Scotland which cover the 100 most socio-economically deprived patient populations. The network enables front line GPs to share their experience of the challenges faced in supporting some of the most disadvantaged and marginalised people in society.

Scotland still has one of the lowest life expectancies in Western Europe, with stark inequalities in health between those living in the most deprived communities and those in the least deprived areas. Almost 80 per cent of the participating Deep End GP practices are in Glasgow.

The initiative has now spread internationally, as well as to other parts of the UK, with similar projects in Canberra, Ireland, Yorkshire, Greater Manchester, Plymouth, north east and north Cumbria, Nottinghamshire and north west London.

Supporting the Community

The Deep End GP steering group meets every six to eight weeks to discuss common issues and encourage sharing of learning within and between practices.

One of the most impactful developments arising from the network has been the introduction of the **Links Worker Programme**. Deep End GPs worked with the Alliance for Health and Social Care to develop a model to create better links between practices and local community organisations to support people with complex health and social care problems.

The programme also helps patients overcome issues such as lack of confidence and social isolation and helps to rebuild trust in services. Originally piloted in seven Deep End practices, the Links Worker Programme is now being rolled out across Scotland.

Source: University of Glasgow

Providing Seamless Care

Govan, in the south west of Glasgow, ranks in the top 5 per cent of Scotland's most deprived areas. The Deep End GPs network supported the creation of the Govan **Social and Health Integration Partnership**

(SHIP), which brought together teams, including GPs and social workers, to identify and support vulnerable patients with complex needs.

The SHIP approach helps people manage their own conditions and can prevent the need for emergency services or hospital admission through anticipatory care, early intervention and developing effective alternatives. For vulnerable children and families, the project has established a model for early intervention to address their needs.

Professional Development

It was recognised early on that the learning needs of Deep End GPs were not being met by the existing GP training programmes, or by professional development courses.

In response, researchers from the University's **Institute of Health & Wellbeing** have developed specific learning opportunities related to Deep End GPs. The Deep End GP Pioneer scheme, shortlisted as a finalist in the 2019 Herald Society Awards, has provided 12 early career GP fellowships, which have included protected time for service and professional development. A bespoke curriculum of learning related to developing the knowledge and skills for working in areas of concentrated deprivation has also been created

Impact of COVID-19

As well as working with partners to quickly establish the **Lighthouse Laboratory** testing facility at the onset of the COVID-19 pandemic, academic staff across the University have been at the heart of the research response in Scotland and the UK, working on a number of vital COVID-19-related research projects, including vaccines, testing, treatment, virus behaviour, health complications and the wider effect of the pandemic on society.

Central to this has been the **Centre for Virus Research** (CVR), which worked in partnership with the NHS Greater Glasgow & Clyde West of Scotland Specialist Virology Centre to rapidly sequence the virus from the first confirmed COVID-19 patient in Scotland in March 2020. In early 2021, it was announced that scientists from the CVR would join G2P-UK, a new national research project to study the effects of emerging SARS-CoV-2 mutations, and that the Centre would also lead the establishment of CRUSH, a COVID-19 drug screening and resistance hub in Scotland.

Academics at the University have also led and collaborated on research into the broader impacts of the pandemic, such as the link between socioeconomic deprivation and the severity of the virus in individuals; the impact of lockdown on education; and the effect of the pandemic on the population's mental health and wellbeing. Research led by Professor Rory O'Connor at the Institute of Health & Wellbeing has been particularly impactful, and has been widely picked up by national and international media. The study, which was produced with and funded by the Samaritans, the Scottish Association for Mental Health (SAMH), and the Mindstep Foundation, found that young people, women, individuals from more socially disadvantaged backgrounds, and those with pre-existing mental health problems reported the worst mental health outcomes in the initial phase of the national lockdown. As Professor O'Connor comments: *[T]he effects of COVID-19 on the population's mental health and wellbeing are likely to be profound and long-lasting… [I]nvestigating the trajectory of mental health and wellbeing is crucial to giving us a better understanding of the challenges people face during this difficult time. By having such analysis and information, we can formulate targeted mental health measures and interventions for those most in need as this pandemic continues, as well as being prepared for future."*

7.5 Supporting Sustainability

Glasgow is hosting the **UN Climate Change Conference** (COP26) in November 2021, presenting an opportunity for the city to show its leadership on environmental sustainability and commitment to tackling climate change. The focus on Glasgow also enables the University to demonstrate the commitment that it is making to addressing climate change through its operations, research, teaching and partnerships.

In 2020, the University published a new strategy document, *Glasgow Green: The University of Glasgow's Response to the Climate Emergency*, pledging to go 'further and faster' in its response with a raft of new commitments, including a target for net zero greenhouse gas emissions by 2030. This builds on leadership shown by the University in recent years: in 2016 it became the first UK university to declare that it would divest from fossil fuels within a decade; and in 2019 it became the first university in Scotland to declare a climate emergency.

In April 2020, the University also established the **Centre for Sustainable Solutions** (CfSS) to respond to the climate emergency. Among the core aims of CfSS are enabling individuals, communities and organisations to act towards a sustainable future through education, research and partnerships, and supporting interdisciplinary, cross-campus and cross-sectoral solutions to climate change. One key aspect of this is the bringing together of research and professional services communities within the University, so that plans and policies can be directly informed by high-quality research, and researchers can conversely access the University as a "living lab".

CfSS also offers support with developing new projects, partnerships and events, and creating teaching resources for students, staff and the wider community. One important recent development was a new evening course free to all students, 'Introduction to Climate Change and Sustainability', which was conceived and developed by students with the support of the Centre. CfSS also recently launched a microcredential course on the FutureLearn platform as part of the **Glasgow Upskilling Project**, open to all University staff and external learners. The aim of the course is to provide key resources to understand where a business or an individual can start with respect to assessing and improving their sustainable practices.

Partnering to Deliver Net Zero

The Centre for Sustainable Solutions (CfSS) is building collaborative relationships both within the University and between partners across the city and country to respond to the climate emergency and enhance the growing ambition for the University and its community to be part of the solution.

Green Recovery Dialogues

CfSS took part in a series of **Green Recovery Dialogues** in late 2020, which were organised jointly by CfSS, Glasgow City Council and Policy Scotland (also based at the University). The Dialogues were focused on ensuring that Glasgow's recovery from COVID-19 is sensitive to environmental and social concerns, and involved a full range of experts and senior leaders from academic, public, private and third sector organisations, ensuring that civic society was effectively represented. Participants included the Scottish Environmental Protection Agency, the Wheatley Group and Zero Waste Scotland.

A Leadership Round Table in February 2021, which included the Leader of Glasgow City Council and the Principal of the University, among other senior figures, considered ways to implement the Dialogues' recommended actions in the context of the new Glasgow City Council Climate Emergency Implementation Plan and the University's climate change strategy, *Glasgow Green*.

COP26 Universities Network

The Dialogues project is part of the University's preparation for COP26. Alongside this, CfSS and other researchers across the University are collaborating with more than 50 UK-based universities and research centres to ensure there is an ambitious, coherent and comprehensive academic contribution to the summit that helps deliver tangible outcomes.

Source: University of Glasgow

Sustainable Glasgow

The University of Glasgow, along with the University of Strathclyde and Glasgow Caledonian University, is a member of the **Sustainable Glasgow** partnership, which seeks to position Glasgow as a leading city in

the development of the green and wider circular economy. As part of this, Sustainable Glasgow aims to improve the city's built infrastructure, improve quality of life for its residents, enhance the city's natural environment, and build a green economy with just transition at its core.

The University is a signatory to the **Sustainable Glasgow Green Economy Hub Charter**, which represents a commitment by the city's leading businesses and employers to take action within their own organisations and sectors to contribute to a green recovery and radically reduce carbon emissions in the city as a whole, allowing it to realise its goal of achieving carbon neutrality by 2030.

Climate Ready Clyde

The University is also a member of **Climate Ready Clyde**, a cross-sector initiative that aims to understand and address the risks posed by climate change to the Glasgow City Region and to develop the *Glasgow City Region Climate Adaptation Strategy and Action Plan*, which was published in June 2021.

7.6 Cultural Impact

Cultural Assets and Attractions

The city of Glasgow and its surrounding area is a prime destination for visitors to Scotland, accounting for around 18% of the total domestic and overseas visitor trips to Scotland in 2018 and worth around £774 million to the regional economy in 2018[103].

The University, which was founded in 1451, is a hugely important part of the city's cultural and historical fabric, contributing to a sense of place among its residents and attracting visitors to its iconic Gilmorehill campus, its culturally significant museum and art gallery, and through its hosting of large conferences and public events. In 2018/19, the University hosted 75 conferences at its campus, which were attended by almost 8,000 delegates in total[104], along with more than 190,000 attendees at exhibitions housed at the University and around 15,000 at free public lectures[105].

The Hunterian, which comprises a museum and art gallery that are free to members of the public, houses one of the finest university collections in the world. The Hunterian Museum is Scotland's oldest public museum and has been recognised as a collection of national significance. Whilst this provides an important contribution to the city and nation's sense of history, its significance means that, as its Director Steph Sholten notes, *"It is deeply rooted in Scotland's complex history which has led to multiple inequalities and prejudices that persist today, perhaps most notably in relation to race... Museums play an important and highly symbolic role for people in the way the past and the present are explained and identities represented. The way we do this is not, cannot be, and has never been neutral."* As part of efforts to address this, The Hunterian appointed a Curator of Discomfort in 2020, who will lead the Museum Galleries Scotland funded Curating Discomfort project. This project will challenge the museum to find new, inclusive ways of interpreting collections that may be contested and are sensitive to different viewpoints.

This builds on the University's **Historical Slavery Initiative**, which commissioned historians within the University to research the University's financial gain from slavery-related wealth. The report on their findings was published in 2018, and the University committed itself to a significant programme of reparative justice, including a unique partnership with the University of West Indies. The University's leadership within the sector in confronting its legacy and initiating redressals was recognised by the judges of the 2020 Times Higher Education (THE) Awards, which awarded it University of the Year as a result of its programme of reparative justice.

Broadening Access

The University has also had a significant impact on the city's cultural vitality and accessibility through its role in the redevelopment of Kelvin Hall, another of the city's much-loved and iconic buildings. The University worked in partnership with Glasgow Life, the city's culture and sports charity, and the National Library of Scotland to transform the landmark building, which re-opened in 2016. Kelvin Hall is now a centre of excellence for research, teaching, public engagement, and health and wellbeing, housing one of Scotland's biggest health and fitness centres.

[103] Glasgow City Region (2021)
[104] University of Glasgow internal data. Note, this only captures conferences and large events that have been formally booked through the University's central team, and does not represent informal or locally held seminars or gatherings that would also have attracted delegates from outside Glasgow.
[105] Higher Education Statistics Agency (2020b)

Transforming Kelvin Hall

The development of Kelvin Hall was an extensive collaborative effort, utilising resources from across Glasgow and nationally to create an unparalleled, multi-use space: a combination of museum, gallery, tourist centre and learning space in one location. As the first shared space between a higher education, city and national institution, it is also a pioneering development.

Kelvin Hall is now one of the largest exhibition centres in the UK, attracting over 650,000 visitors annually prior to the pandemic, and has made Glasgow home to national institutions, making materials accessible outside Scotland's capital for the first time.

The Hunterian at Kelvin Hall

The Hunterian is one of the world's leading university museums. While the Hunterian's public galleries remain on the University of Glasgow campus, around 1.5 million items have been relocated to purpose-designed study and storage facilities at Kelvin Hall. By having a presence in Kelvin Hall, the Hunterian is more visible to the citizens of Glasgow and to visitors to the city, encouraging them to visit the museum and experience one of Scotland's greatest cultural assets.

At Kelvin Hall, the University has created **The Hunterian Collections Study Centre**, which offers a state-of-the-art environment for research, teaching and training. These unique facilities allow the University to build on its international reputation for collections and object-based learning, offering much greater access to the collections while forging new academic and educational practice. Over 10,000 students have benefited from the new facilities and the postgraduate programmes. Built on theory, practice and knowledge of the cultural sector, the new facilities provide an enriched student experience, and the development of Kelvin Hall has allowed the University to increase its postgraduate student intake and attract research funding.

Source: University of Glasgow

Creative and Cultural Economy

Co-location of University, civic and national cultural heritage partners at Kelvin Hall has forged new practices and opportunities for those in the arts and heritage sector. The University is now a central part of Glasgow's tourism strategy, providing a strategic focus for Mackintosh collections, which are one of the

City’s key cultural tourism draws. Mackintosh attractions generate around half a million visits to Glasgow every year. A unified city and Mackintosh collection in the Kelvin Hall, including The Mackintosh House, draws tourists from around the world to Glasgow.

Internationally, Kelvin Hall is gaining a reputation as an exciting research facility and has played a crucial role in developing international partnerships, including one with the Smithsonian - the world's largest museum, education, and research complex - with whom the University signed a Strategic Partnership agreement in June 2018.

Kelvin Hall also supports Glasgow’s creative industry, which is hugely important not only to the city's economy, but also its culture, and national and international profile. Plans have been recently announced to create a £11.9 million television and film studio within Kelvin Hall, which will attract big budget entertainment and drama productions. This new development will also develop Glasgow’s creative industries’ skills base and the studio space will create significant social and economic benefits for Scotland.

Cultural and Creative Industries

Creative industries are an important part of Scotland's economy, and have been highlighted in the Scottish Government's Economic Strategy as a sector in which Scotland has a distinct comparative advantage. **Cultural and Creative Economies** is another of the University's Research Beacons, having attracted significant investment and built a strong reputation, and will be one of the key themes in the new Advanced Research Centre that forms part of the University's extensive campus redevelopment. The Advanced Research Centre will also be located in close proximity to Kelvin Hall, facilitating greater collaboration between researchers, industry and the public.

One research project that has attracted significant funding and attention is focusing on the works of Robert Burns, Scotland's national poet, utilising hundreds of previously inaccessible manuscripts to revitalise and reconceptualise the public's view of Burns. The project has also reached out to the wider, worldwide Burnsian community, working with museums, cultural heritage institutions and Burns clubs through the Burns Scotland partnership. The continuing public interest in Burns is reflected in the fact that over 17,000 people signed up for an online course run by the Centre for Robert Burns Studies, based within the University's College of Arts. The College of Arts has also received funding from the Scottish Government for research into the impact of Burns on the Scottish economy. The research aims not only to assess how much the continuing fascination with Burns around the world is supporting Scottish jobs and businesses, but also the potential that exists for the Burns brand to support future regional growth.

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Annex 2 Technical Annex

A2.1 Impact of the University's teaching and learning activities

A2.1.1 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 A2.1.2) considered **five different higher education qualification groups** (i.e. five **'treatment' groups**): three at postgraduate level (higher degree (research), higher degree (taught) and 'other' postgraduate qualifications[106]) and two at undergraduate level (first degrees and 'other' undergraduate qualifications[107]).

Table 12 presents these 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 3.5.1, 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.

Table 12 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 6 vocational[1]
Higher degree (taught)	First degree	Level 6 vocational
Other postgraduate	First degree	Level 6 vocational
First degree	Scottish Highers[2]	Level 6 vocational
Other undergraduate	Scottish Highers	Level 6 vocational
Scottish Highers	Scottish National 5 Certificate grade A-C[3]	Level 6 vocational

Note: 1. Level 6 based on the Scottish Credit and Qualifications Framework. This is equivalent to Level 3 on the Regulated Qualifications Framework (for England/Northern Ireland) and the Credit and Qualifications Framework for Wales.
2. Equivalent to 2 or more GCE 'A' Levels.
3. Equivalent to 5 or more GCSEs at A*-C.
Source: London Economics

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

[106] This relates to Labour Force Survey variables a) HIQUAL11 and HIQUAL15 value labels 'Level 7 Diploma' and '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).
[107] 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.

counterfactual group consists of individuals holding Scottish Highers (or equivalent[108]) as their highest qualification. For the purposes of estimating the returns to all higher education qualifications, the highest level of professional or vocational qualification that an individual may be in possession of is Level 6 on the Scottish Credit and Qualifications Framework (equivalent to Level 3 on the Regulated Qualifications Framework (for England/Northern Ireland) and the Credit and Qualifications Framework for Wales), 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).

In addition to the analysis of higher education qualifications, we also included a separate specification comparing the earnings associated with Scottish Highers to possession of Scottish National 5 Certificates at grades A-C[109]. 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 2018-19 University of Glasgow cohort is **greater** than might be the case compared to those in possession of levels of prior attainment 'traditionally' associated with higher education entry[110]. 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 Glasgow was higher or lower than the 'traditional' counterfactual qualifications outlined in Table 12, 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 Glasgow**, we *deducted* the returns to undertaking an 'other undergraduate' qualification (relative to the possession of Scottish Highers) from the returns to undertaking a first degree (again relative to the possession of Scottish Highers). Similarly, to calculate the returns for a student **in possession of a Scottish National 5 Certificate grade A-C undertaking a first degree at the University of Glasgow**, we *added* the returns to achieving Scottish Highers (relative to the possession of a Scottish National 5 Certificate grade A-C) to the returns to undertaking a first degree (relative to the possession of Scottish Highers)[111].

A2.1.2 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 (LFS), we estimated a standard **Ordinary Least Squares** linear regression model, where the dependent 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

[108] E.g. 2 or more GCE 'A' Levels (in England, Wales, or Northern Ireland).
[109] Equivalent to 5 or more GCSEs at grades A*-C (in England, Wales, or Northern Ireland).
[110] For instance, there were 145 UK domiciled students in the 2018-19 cohort expected to complete 'other undergraduate' qualifications/modules and who had previously not attained any formal education qualification. In all of these instances, we assigned a prior attainment level of Scottish National 5 Certificate grade A-C to these students (i.e. we assume that, if they had not completed a qualification/module at the University of Glasgow, they would otherwise have achieved the same earnings and employment probabilities as individuals in possession of a Scottish National 5 Certificate grade A-C as their highest qualification).
[111] 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).

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:

$$ln\ (\omega_i) = \alpha + \beta X_i + \epsilon_i \qquad \text{for } i = 1 \text{ to n}^{112}$$

where ln(ω_i) represents the natural logarithm of hourly earnings, $\epsilon_i$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 and studying in Scotland.

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 2020**[113]. 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 estimated marginal wage returns to higher education qualifications are presented in Table 13. 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

[112] Where *i* is an individual LFS respondent.
[113] 2020 Q3 is the most recent quarter included in the LFS dataset.

qualification. To take an example, the analysis suggests that men aged between 31 and 35 in possession of a first degree achieve a **22.3%** hourly earnings premium compared to comparable men holding only Scottish Highers (or equivalent) as their highest level of attainment. The comparable estimate for women aged between 31 and 35 stands at **26.1%**.

Table 13 Marginal earnings returns to higher education qualifications (across 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										
Scottish Highers[1]	8.8%	4.9%	10.0%	18.4%	24.9%	17.9%	26.0%	17.0%	19.0%	11.6%
Other undergraduate[2]			-5.1%	-4.8%		7.8%	7.6%	7.8%	11.4%	8.9%
First degree[2]		10.1%	15.8%	22.3%	20.7%	26.7%	17.8%	24.6%	23.5%	26.2%
Other postgraduate[3]		9.7%	12.4%	9.2%	4.9%	5.4%				
Higher degree (taught)[3]		10.3%	11.5%	7.9%	10.1%	12.5%	12.4%	13.4%	12.3%	13.4%
Higher degree (research)[3]			18.3%	19.0%	20.4%	19.7%	25.1%	27.0%	27.4%	47.4%
Women										
Scottish Highers[1]	8.5%	5.5%	10.0%	12.3%	17.9%	19.2%	14.0%	14.9%	13.3%	10.3%
Other undergraduate[2]				3.0%	7.6%	10.3%	12.5%	17.6%	17.5%	20.7%
First degree[2]		10.2%	17.4%	26.1%	33.4%	30.9%	31.9%	33.4%	27.6%	25.9%
Other postgraduate[3]		8.4%	8.7%	12.1%	9.4%	9.1%	11.2%	14.3%	11.1%	14.3%
Higher degree (taught)[3]		7.8%	6.3%	9.6%	12.5%	17.4%	22.1%	15.3%	27.8%	20.8%
Higher degree (research)[3]		16.9%	20.0%	21.4%	31.1%	28.1%	38.4%	40.2%	34.0%	39.5%

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 Scottish Highers (or equivalent) compared to Scottish National 5 Certificates grade A-C (or equivalent).

[2] Returns to first degrees and 'other' undergraduate qualifications are estimated relative to individuals holding Scottish Highers (or equivalent) as their highest qualification.

[3] Returns to higher degree (taught), higher degree (research), and 'other' postgraduate qualifications are estimated relative to first degrees.

Source: London Economics' analysis of pooled Quarterly Labour Force Survey data for 2004Q2-2020Q3

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*[114]. Combining these subject-level returns with the number of students in the 2018-19 University of Glasgow cohort 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 Glasgow's student cohort**.

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 for more than 1 hour in the reference week (using the standard International

[114] The HESA Joint Academic Coding System (JACS) was used to classify subject areas. The following subject groups were distinguished: (1) Medicine & dentistry, (2) Subjects allied to medicine, (3) Biological sciences, (4) Veterinary science, (5) Agriculture & related subjects, (6) Physical sciences, (7) Mathematical sciences, (8) Computer science, (9) Engineering & technology, (A) Architecture, building & planning, (B) Social studies, (C) Law, (D) Business & administrative studies, (E) Mass communications & documentation, (F) Languages, (G) Historical & philosophical studies, (H) Creative arts & design, (I) Education, and (J) Combined.

Labour Organisation definition) or not in employment (being either unemployed or economically inactive)). The specification of the probit model was as follows:

$$Probit(EMPNOT_i) = \alpha + \gamma Z_i + \epsilon_i \qquad \text{for } i = 1 \text{ to n}^{115}$$

The dependent variable adopted represents the binary variable $EMPNOT_i$, which is coded 1 if the individual is in employment and 0 otherwise[116]. 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 2018-19 cohort of UK domiciled students attending the University of Glasgow. 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 Glasgow's specific subject mix)) are presented in Table 14. 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 **2.5 percentage points** more likely to be in employment than a man of similar age holding only Scottish Highers (or equivalent) as his highest level of education. The corresponding estimate for women stands at **4.4 percentage points**.

[115] Where *i* is an individual LFS respondent.
[116] The probit function reflects the cumulative distribution function of the standard normal distribution.

Table 14 Marginal employment returns to higher education qualifications (across 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										
Scottish Highers[1]	-2.1		2.9	1.4	1.9	1.4	1.6			
Other undergraduate[2]		-2.9	-2.9		-1.9					
First degree[2]			1.4	2.5	2.0	1.9	1.6	3.9	2.2	
Other postgraduate[3]		5.5		1.8		1.7	1.7	2.5		-5.0
Higher degree (taught)[3]			-1.0						2.4	3.2
Higher degree (research)[3]						1.9		3.8	7.4	9.7
Women										
Scottish Highers[1]		3.8	3.2	2.1		1.9	3.2	3.6		
Other undergraduate[2]			-3.4							
First degree[2]		2.5	3.8	4.4	6.4	4.7	4.3	2.9	2.9	
Other postgraduate[3]		4.6	1.3	3.2	2.3	5.5	5.1	3.9		
Higher degree (taught)[3]			-1.8			3.6	2.6	2.9	5.5	
Higher degree (research)[3]			-3.2	3.6		5.7	6.7	5.4	11.0	16.7

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 Scottish Highers (or equivalent) compared to Scottish National 5 Certificates grade A-C (or equivalent).

[2] Returns to first degrees and 'other' undergraduate qualifications are estimated relative to individuals holding Scottish Highers (or equivalent) as their highest qualification.

[3] Returns to higher degree (taught), higher degree (research), and 'other' postgraduate qualifications are estimated relative to first degrees.

Source: London Economics' analysis of pooled Quarterly Labour Force Survey data for 2004Q2-2020Q3

A2.1.3 '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 22 or 23). 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 2018-19 cohort completing first degrees with the University of Glasgow on a part-time basis is **34**, compared to **19** 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 15 presents the assumed average age at enrolment, study duration, and age at completion for students in the 2018-19 University of Glasgow cohort[117].

[117] The assumed average age at enrolment is based on the number of UK domiciled students in the cohort assumed to *complete* a given qualification at the University of Glasgow (adjusted for the fact 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

Table 15 Average age at enrolment, study duration, and age at completion for students in the 2018-19 University of Glasgow 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	44	1	45
First degree	19	4	23	34	3	37
Other postgraduate	27	1	28	35	2	37
Higher degree (taught)	25	1	26	32	2	34
Higher degree (research)	27	3	30	39	4	43

Note: All values have been rounded to the nearest integer.

Source: London Economics' analysis based on HESA data and other data provided by the University of Glasgow

Given these characteristics, we adjust the methodology when estimating the returns to part-time (and later full-time) education attainment at the University, using 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[118]. 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 16 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 Glasgow in the 2018-19 cohort. To take an example, we have assumed that a student undertaking a first 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 first degree student, we assume that because of the late attainment (at age 37 (on average)), these students recoup only **65%** of the corresponding full-time earnings and employment premiums from that age (of attainment).

more information)). In particular, the age at enrolment per qualification (based on the HESA data provided by the University of Glasgow) is calculated as the weighted average age at enrolment across students in the 2018-19 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 (by qualification level and mode) is based on separate information on the expected study duration of students in the 2018-19 cohort provided by the University of Glasgow. Note that the lower duration for part-time first degree students (3 years) than for full-time first degree students (4 years) is driven by a difference in the underlying composition of students in the cohort by programme (where most part-time students were undertaking pre-registration ordinary (non-honours) first degrees (with a 3 year duration), while most FT students were enrolled in first degrees with honours (with a 4 year duration)).

[118] E.g. Callender et al. (2011) suggest that the evidence points to decreasing employment returns with age at qualification, as 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 16 Assumed age decay adjustment factors for students in the 2018-19 University of Glasgow 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 Glasgow:

Full-time students Part-time students

Source: London Economics' analysis based on HESA data and other data provided by the University of Glasgow

Note that the application of the 'age-decay' function implies that, for *all* qualification levels at the University, 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[119].

A2.1.4 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 A2.1.2) 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. Scottish Highers or a first degree).
2. We inflated these baseline or counterfactual earnings using the above-described marginal earnings premiums and employment premiums (see Annex A2.1.2), adjusted to reflect late attainment (as outlined in Annex A2.1.3), 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)[120]).
4. Based on the earnings profiles generated by qualification holders, and income tax and National Insurance rates and allowances for the relevant academic year[121], we computed the future stream of net earnings (i.e. post-tax)[122]. Using similar assumptions, we further calculated the stream of (employment-adjusted) foregone earnings (based

[119] 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.

[120] 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).

[121] i.e. 2018-19. 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%**.
The analysis makes use of relevant tax rates and thresholds applicable to individuals living in England, Wales, and Northern Ireland. This approach was taken for simplicity given that there is no information available on where the University's graduates live at each point throughout their working lives. However, note that there are only relatively marginal differences between the rates and thresholds for these Home Nations as compared to the Scottish tax system. In addition, approximately 48% of the University of Glasgow live outside of Scotland (as of May 2021; see Figure 16 in Section 3.4). As a result, it is expected that the application of Scotland-specific income tax rates and thresholds would only have a limited effect on the estimated impact of the University's teaching and learning activities on students and the Exchequer (and the *total* impact would be unaffected, as income taxes constitute a transfer between graduates and the public purse).

[122] 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).

on earnings in the relevant counterfactual group[123]) during the period of study, again net of tax, for full-time students only.

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, 2018)), 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 qualification at 'other postgraduate level' at the University of Glasgow 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 Scotland.

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 17.

A2.1.5 Net graduate premium and net public benefit

Table 18 and Table 19 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 Glasgow (respectively), based on the 2018-19 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[124].

[123] The foregone earnings calculations are based on the baseline or counterfactual earnings associated with Scottish Highers or first degrees. As outlined in Annex A2.1.1, some students in the 2018-19 University of Glasgow 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 Scottish Highers as the highest qualification (adjusted for the age at enrolment and completion associated with the relevant qualification obtained). In addition, the estimated foregone earnings for students previously in possession of postgraduate qualifications are based on the level of earnings associated with first degrees.

[124] 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 A2.1.2).

Table 17 Gross graduate premiums and Exchequer benefits per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, and prior attainment

Level of study	Previous qualification and gender					
	Scottish National 5 Certificate		Scottish Highers		Other undergraduate	
	Men	Women	Men	Women	Men	Women
Gross graduate premiums						
Full-time students						
Other undergraduate			-£8,000	-£7,000	-£8,000	-£7,000
First degree			£90,000	£71,000	£115,000	£70,000
Other postgraduate			£168,000	£162,000		
Higher degree (taught)			£180,000	£176,000		
Higher degree (research)			£232,000	£198,000		
Part-time students						
Other undergraduate	£29,000	£17,000	£2,000	£7,000	£0	£0
First degree			£83,000	£65,000	£84,000	£57,000
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Gross Exchequer benefits						
Full-time students						
Other undergraduate			-£1,000	-£1,000	-£1,000	-£1,000
First degree			£116,000	£82,000	£136,000	£82,000
Other postgraduate			£176,000	£141,000		
Higher degree (taught)			£186,000	£152,000		
Higher degree (research)			£272,000	£183,000		
Part-time students						
Other undergraduate	£24,000	£13,000	£2,000	£5,000	£0	£0
First degree			£80,000	£53,000	£81,000	£47,000
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 17 Cont. Gross graduate premiums and Exchequer benefits per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, and prior attainment

Level of study	Previous qualification and gender							
	First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women
Gross graduate premiums								
Full-time students								
Other undergraduate	-£12,000	-£8,000						
First degree	-£41,000	-£36,000				-£36,000		
Other postgraduate	£34,000	£52,000		-£19,000	-£22,000	-£19,000		-£19,000
Higher degree (taught)	£40,000	£62,000			-£20,000			
Higher degree (res.)	£107,000	£87,000						-£57,000
Part-time students								
Other undergraduate	£0	£0	£0	£0	£0	£0		£0
First degree	£0	£0				£0		
Other postgraduate	£26,000	£44,000			£0			
Higher degree (taught)	£47,000	£67,000						
Higher degree (res.)	£88,000	£74,000						
Gross Exchequer benefits								
Full-time students								
Other undergraduate	-£3,000	-£1,000						
First degree	-£9,000	-£6,000				-£6,000		
Other postgraduate	£49,000	£50,000		-£9,000	-£12,000	-£9,000		-£9,000
Higher degree (taught)	£53,000	£58,000			-£10,000			
Higher degree (res.)	£153,000	£92,000						-£28,000
Part-time students								
Other undergraduate	£0	£0	£0	£0	£0	£0		£0
First degree	£0	£0				£0		
Other postgraduate	£30,000	£36,000			£0			
Higher degree (taught)	£52,000	£56,000						
Higher degree (res.)	£94,000	£60,000						

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 18 Net graduate premiums per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender					
	Scottish National 5 Certificate		Scottish Highers		Other undergraduate	
	Men	Women	Men	Women	Men	Women
Students from England						
Full-time students						
Other undergraduate			-£10,000	-£9,000		
First degree			£89,000	£70,000	£114,000	£69,000
Other postgraduate				£156,000		
Higher degree (taught)						
Higher degree (research)			£223,000	£188,000		
Part-time students						
Other undergraduate		£19,000				
First degree						
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Students from Wales						
Full-time students						
Other undergraduate			-£7,000	-£7,000		
First degree			£99,000	£80,000		
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Part-time students						
Other undergraduate						
First degree						
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 18 Cont. Net graduate premiums per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender							
	First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women
Students from England								
Full-time students								
Other undergraduate	-£14,000	-£10,000						
First degree	-£42,000	-£37,000						
Other postgraduate	£28,000	£46,000			-£28,000	-£25,000		
Higher degree (taught)	£32,000	£54,000						
Higher degree (res.)	£97,000	£78,000						
Part-time students								
Other undergraduate	£1,000	£1,000				£1,000		
First degree								
Other postgraduate	£22,000	£40,000						
Higher degree (taught)	£41,000	£60,000						
Higher degree (res.)	£81,000	£67,000						
Students from Wales								
Full-time students								
Other undergraduate								
First degree								
Other postgraduate								
Higher degree (taught)	£33,000	£55,000						
Higher degree (res.)	£97,000	£78,000						
Part-time students								
Other undergraduate		£2,000						
First degree								
Other postgraduate	£22,000	£40,000						
Higher degree (taught)	£42,000	£62,000						
Higher degree (res.)								

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 18 Cont. Net graduate premiums per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender					
	Scottish National 5 Certificate		Scottish Highers		Other undergraduate	
	Men	Women	Men	Women	Men	Women
Students from Scotland						
Full-time students						
Other undergraduate			-£5,000	-£4,000	-£5,000	-£4,000
First degree			£100,000	£81,000	£125,000	£80,000
Other postgraduate			£165,000	£159,000		
Higher degree (taught)			£176,000	£171,000		
Higher degree (research)			£223,000	£188,000		
Part-time students						
Other undergraduate	£29,000	£17,000	£2,000	£7,000	£0	£0
First degree			£81,000	£64,000	£83,000	£56,000
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Students from Northern Ireland						
Full-time students						
Other undergraduate			-£12,000	-£11,000		
First degree			£81,000	£62,000		
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Part-time students						
Other undergraduate						
First degree						
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 18 Cont. Net graduate premiums per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender							
	First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women
Students from Scotland								
Full-time students								
Other undergraduate	-£9,000	-£5,000						
First degree	-£31,000	-£26,000				-£26,000		
Other postgraduate	£31,000	£49,000		-£22,000	-£25,000	-£22,000		-£22,000
Higher degree (taught)	£35,000	£57,000			-£24,000			
Higher degree (res.)	£97,000	£78,000						-£67,000
Part-time students								
Other undergraduate	£0	£0	£0	£0	£0	£0		£0
First degree	-£1,000	-£1,000				-£1,000		
Other postgraduate	£24,000	£41,000			-£2,000			
Higher degree (taught)	£42,000	£62,000						
Higher degree (res.)	£80,000	£66,000						
Students from Northern Ireland								
Full-time students								
Other undergraduate								
First degree	-£50,000							
Other postgraduate	£28,000	£46,000						
Higher degree (taught)	£32,000	£54,000						
Higher degree (res.)	£95,000	£75,000						
Part-time students								
Other undergraduate	£0	£0						
First degree								
Other postgraduate	£22,000	£40,000						
Higher degree (taught)	£41,000	£60,000						
Higher degree (res.)								

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 19 Net Exchequer benefits per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender					
	Scottish National 5 Certificate		Scottish Highers		Other undergraduate	
	Men	Women	Men	Women	Men	Women
Students from England						
Full-time students						
Other undergraduate			-£12,000	-£12,000		
First degree			£76,000	£43,000	£97,000	£42,000
Other postgraduate				£137,000		
Higher degree (taught)						
Higher degree (research)			£270,000	£181,000		
Part-time students						
Other undergraduate		£10,000				
First degree						
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Students from Wales						
Full-time students						
Other undergraduate			-£15,000	-£15,000		
First degree			£66,000	£33,000		
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Part-time students						
Other undergraduate						
First degree						
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 19 Cont. Net Exchequer benefits per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender							
	First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women
Students from England								
Full-time students								
Other undergraduate	-£14,000	-£12,000						
First degree	-£49,000	-£46,000						
Other postgraduate	£45,000	£46,000			-£16,000	-£13,000		
Higher degree (taught)	£49,000	£54,000						
Higher degree (res.)	£151,000	£90,000						
Part-time students								
Other undergraduate	-£4,000	-£4,000				-£4,000		
First degree								
Other postgraduate	£28,000	£34,000						
Higher degree (taught)	£50,000	£54,000						
Higher degree (res.)	£91,000	£58,000						
Students from Wales								
Full-time students								
Other undergraduate								
First degree								
Other postgraduate								
Higher degree (taught)	£47,000	£52,000						
Higher degree (res.)	£151,000	£90,000						
Part-time students								
Other undergraduate		-£4,000						
First degree								
Other postgraduate	£28,000	£34,000						
Higher degree (taught)	£48,000	£52,000						
Higher degree (res.)								

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 19 Cont. Net Exchequer benefits per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender					
	Scottish National 5 Certificate		Scottish Highers		Other undergraduate	
	Men	Women	Men	Women	Men	Women
Students from Scotland						
Full-time students						
Other undergraduate			-£9,000	-£9,000	-£9,000	-£9,000
First degree			£84,000	£50,000	£104,000	£50,000
Other postgraduate			£172,000	£137,000		
Higher degree (taught)			£179,000	£145,000		
Higher degree (research)			£272,000	£183,000		
Part-time students						
Other undergraduate	£23,000	£12,000	£1,000	£4,000	-£1,000	-£1,000
First degree			£75,000	£48,000	£76,000	£41,000
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Students from Northern Ireland						
Full-time students						
Other undergraduate			-£10,000	-£10,000		
First degree			£84,000	£51,000		
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						
Part-time students						
Other undergraduate						
First degree						
Other postgraduate						
Higher degree (taught)						
Higher degree (research)						

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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 19 Cont. Net Exchequer benefits per student associated with HE qualification attainment at the University of Glasgow, by study mode, level, gender, prior attainment, and domicile

Level of study	Previous qualification and gender							
	First degree		Other postgraduate		Higher degree (taught)		Higher degree (research)	
	Men	Women	Men	Women	Men	Women	Men	Women
Students from Scotland								
Full-time students								
Other undergraduate	-£12,000	-£10,000						
First degree	-£41,000	-£38,000				-£38,000		
Other postgraduate	£45,000	£46,000		-£13,000	-£16,000	-£13,000		-£13,000
Higher degree (taught)	£46,000	£51,000			-£17,000			
Higher degree (res.)	£153,000	£92,000						-£28,000
Part-time students								
Other undergraduate	-£1,000	-£1,000	-£1,000	-£1,000	-£1,000	-£1,000		-£1,000
First degree	-£5,000	-£5,000				-£5,000		
Other postgraduate	£28,000	£34,000			-£2,000			
Higher degree (taught)	£49,000	£52,000						
Higher degree (res.)	£94,000	£60,000						
Students from Northern Ireland								
Full-time students								
Other undergraduate								
First degree	-£41,000							
Other postgraduate	£45,000	£46,000						
Higher degree (taught)	£49,000	£54,000						
Higher degree (res.)	£153,000	£92,000						
Part-time students								
Other undergraduate	-£2,000	-£2,000						
First degree								
Other postgraduate	£28,000	£34,000						
Higher degree (taught)	£50,000	£54,000						
Higher degree (res.)								

Note: All values are rounded to the nearest £1,000. Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (with the given characteristics). Grey shading indicates instances where the level of study at the University of Glasgow 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***

A2.2 Impact of educational exports

A2.2.1 Industry breakdown

Table 20 provides an overview of the high-level industry classifications used throughout the multi-regional Input-Output analysis (described in greater detail in Section 4).

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)***

A2.2.2 Additional information on the 2018-19 cohort of international students studying at the University of Glasgow

Table 21 presents a detailed breakdown of the 2018-19 non-UK domiciled University of Glasgow cohort, by domicile, level, and mode of study.

Table 21 Non-UK domiciled students in the 2018-19 cohort of University of Glasgow 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	20	**20**
First degree	400	605	**1,005**
Other postgraduate	25	25	**50**
Higher degree (taught)	520	3,590	**4,110**
Higher degree (research)	100	300	**400**
Total	**1,045**	**4,540**	**5,585**
Part-time			
Other undergraduate	120	105	**225**
First degree	0	0	**0**
Other postgraduate	5	5	**10**
Higher degree (taught)	30	5	**35**
Higher degree (research)	10	5	**15**
Total	**165**	**120**	**285**
Total			
Other undergraduate	120	125	**245**
First degree	400	605	**1,005**
Other postgraduate	30	30	**60**
Higher degree (taught)	550	3,595	**4,145**
Higher degree (research)	110	305	**415**
Total	**1,210**	**4,660**	**5,870**

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, Diplomas of Higher Education, other undergraduate-level diplomas and certificates, and undergraduate-level credits. 'Other postgraduate learning' includes Postgraduate Certificates or Professional Graduate Diplomas in Education, Postgraduate 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 the University of Glasgow's HESA data***

A2.2.3 Net tuition fee income per international student

Table 22 presents estimates of the net tuition fee income per international student in the 2018-19 University of Glasgow cohort (over the entire study duration), by domicile, level of study, and mode of study.

Table 22 Net tuition fee income per international student in the 2018-19 cohort of University of Glasgow 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	-£4,000	-£1,000	£19,000	£3,000
First degree	-£14,000		£78,000	
Other postgraduate	-£1,000	£1,000	£12,000	£9,000
Higher degree (taught)	£2,000	£2,000	£19,000	£17,000
Higher degree (research)	£7,000	£7,000	£34,000	£32,000

Note: Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (of the given characteristics). All estimates are presented in 2018-19, discounted to reflect net present values, and rounded to the nearest £1,000.

Source: London Economics' analysis

A2.2.4 Assumed average stay durations among international students

As outlined in Section4.3.2, to estimate the non-tuition fee income associated with non-UK students in the 2018-19 University of Glasgow 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 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[125]. 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 23.

Table 23 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)

[125] 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 2019-20 and 2020-21 academic years to account for the increased likelihood of students returning to their home countries during the Covid-19 pandemic (see Section 4.3.1).

A2.2.5 Non-fee income per international student

Table 24 presents estimates of the non-tuition fee income per international student in the 2018-19 University of Glasgow cohort (over the entire study duration), by domicile, level of study, and mode of study.

Table 24 Non-fee income per international student in the 2018-19 cohort of University of Glasgow 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	£11,000	£14,000	£12,000	£15,000
First degree	£41,000		£44,000	
Other postgraduate	£15,000	£37,000	£15,000	£37,000
Higher degree (taught)	£15,000	£37,000	£15,000	£37,000
Higher degree (research)	£40,000	£72,000	£40,000	£72,000

Note: Gaps may arise where there are no students in the 2018-19 University of Glasgow cohort expected to complete the given qualification (of the given characteristics). All estimates are presented in 2018-19, discounted to reflect net present values, and rounded to the nearest £1,000.

Source: London Economics' analysis

Annex 3 Total impact by region and sector (where available)

In addition to the total impact on the UK economy as a whole (presented in Section 6), 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), including:

- The impact of the University's **educational exports** (**£631 million**, see Section 4); and
- The impact associated with the **operating and capital expenditure of the University** (**£1,202 million**, see Section 5).

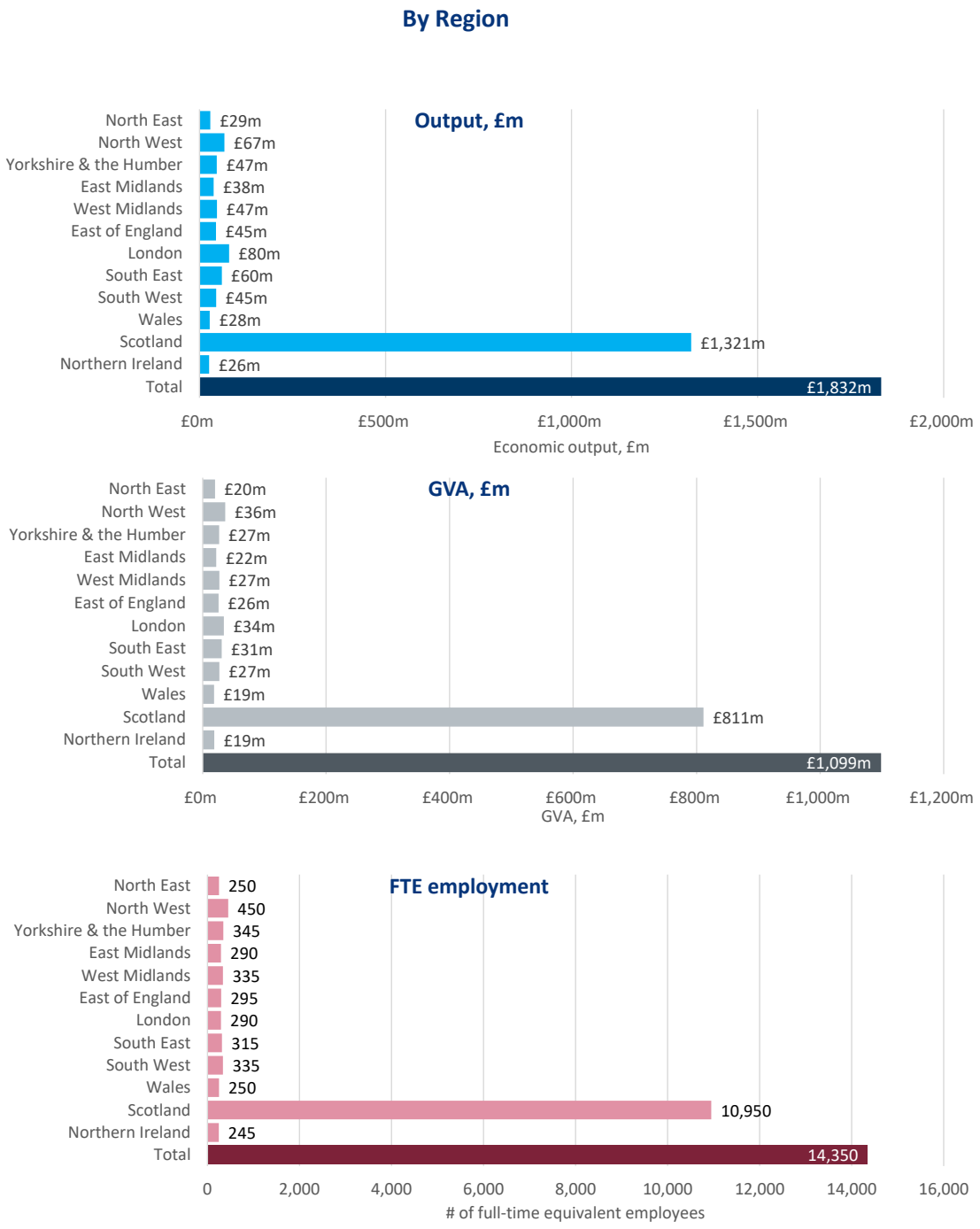
Hence, approximately **£1,832 million** (**42%**) of the University of Glasgow's total impact of **£4,399 million** can be disaggregated in this way[126] (see Figure 32).

In terms of the breakdown by region, the analysis indicates that of this total of **£1,832 million**, **£1,321 million** (**72%**) was generated in **Scotland**, with **£511 million** (**28%**) occurring in **other regions** across the UK.

In terms of sector, the University's activities resulted in particularly large impacts within the **government, health, and education sector** (**£717 million**, **39%**), the **distribution, transport, hotel, and restaurant sector (£272 million**, **15%**), the **production sector** (**£256 million**, **14%**), and the **real estate sector** (**£198 million**, **11%**).

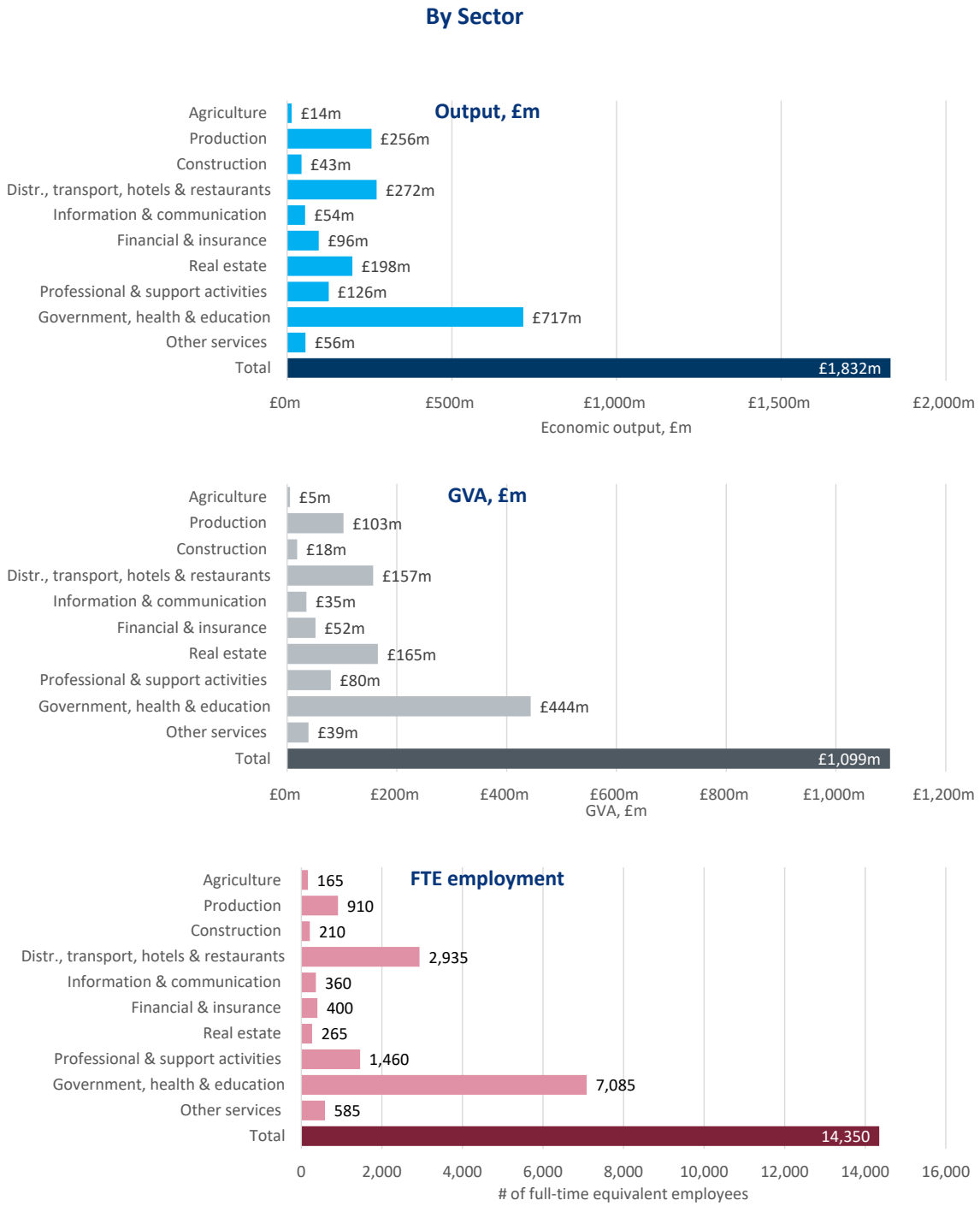
[126] The remaining **£2,567 million** of impact includes the impact of the University's **research activities** (**£1,833 million**, where a breakdown by region or sector is not available as it was not possible to assign the geographic location or sectors of businesses benefiting from productivity spillovers generated by the University's research); and the impact of **teaching and learning activities** (**£734 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 32 Total economic impact of the University of Glasgow's activities in 2018-19, by region and sector (where possible)



Note: Monetary estimates are presented in 2018-19 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***

Figure 32 Cont. Total economic impact of the University of Glasgow's activities in 2018-19, by region and sector (where possible)



Note: Monetary estimates are presented in 2018-19 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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