The economic impact of Scotland's university research activity

A Report for Universities Scotland

December 2022

About London Economics

London Economics is one of Europe's leading specialist economics and policy consultancies and has its head office in London.

We advise clients in both the public and private sectors on economic and financial analysis, policy development and evaluation, business strategy, and regulatory and competition policy. Our consultants are highly-qualified economists with experience in applying a wide variety of analytical techniques to assist our work, including cost-benefit analysis, multi-criteria analysis, policy simulation, scenario building, statistical analysis and mathematical modelling. We are also experienced in using a wide range of data collection techniques including literature reviews, survey questionnaires, interviews and focus groups.

Head Office: Somerset House, New Wing, Strand, London, WC2R 1LA, United Kingdom.

w: londoneconomics.co.uk e: info@londoneconomics.co.uk : @LondonEconomics
t: +44 (0)20 3701 7700 f: +44 (0)20 3701 7701

Key points of contact

Dr Gavan Conlon, Partner, gconlon@londecon.co.uk, +44 (0)20 3701 7703
Ms Joscelyn Miller, Senior Economic Consultant, jmiller@londecon.co.uk, +44(0)20 3701 7711
Mr Rhys Williams, Senior Economic Consultant, rwilliams@londecon.co.uk

Table of Contents

Page

1 Introduction and methodological approach

London Economics were commissioned to assess the **economic and social impact of research activities delivered by Scottish higher education institutions on the United Kingdom economy**, focusing on the 2019-20 academic year.[1,2]

1.1 Calculation of the research impact

In undertaking the estimation of the economic impact associated with the research activity delivered by Scottish higher education institutions, we estimate both the **direct effects** of this research (which is essentially captured by the research income accrued by Scottish universities, net of any public funding), as well as the **productivity spillover** effects from universities' research activities to the rest of the UK economy.

Direct impacts

To estimate the **direct impact** generated by universities' research activities, we used information on the total research-related income accrued in the 2019-20 academic year (which was the most recent data available at the time the analysis was undertaken), 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 universities by the Scottish Funding Council (SFC)[3].

To arrive at the **net direct impact** on the UK economy, we deducted the costs to the public purse of funding universities' research activities in 2019-20 from the above total research income[4]. These public costs include the funding provided by the UK Research Councils, recurrent research grants provided by the Scottish Funding Council and other research income from UK central government bodies, Local Authorities, and health and hospital authorities.

[1] Note that our analysis **excludes** the impact of **teaching and learning** activity associated with the 2019-20 cohort of UK domiciled students studying at Scottish HEIs, the impact of **educational exports** generated by the international students in the 2019-20 cohort, as well as the **direct, indirect and induced effect associated with universities' operational and capital expenditure**. If these three additional impacts were included within our analysis, clearly the total economic impact would be greater. Given the characteristics of the Scottish universities under consideration, it is difficult to estimate the size of these additional elements of economic impact. In our analysis of the economic contribution of Russell Group universities (see footnote 2), the impact of research accounted for 40% of the total economic contribution, while teaching and learning, exports and universities' expenditure contributed the remaining 60%. Given the fact that, on average, Scottish universities are marginally less research intensive than the Russell Group institutions, the contribution of teaching and learning, educational exports and universities' expenditure are likely to make up a greater contribution. Unfortunately, the extent to which is unknown without carrying out more detailed and thorough analyses for each institution.

[2] London Economics (2017). 'The economic impact of Russell Group universities.' https://londoneconomics.co.uk/wp-content/uploads/2017/11/LE-Economic-impact-of-Russell-Group-universities-19-10-2017-FINAL.pdf

[3] This includes funding from the Scottish Funding Council through its main quality research grant, research postgraduate grant, and knowledge transfer grant.

[4] Note that we are unable to estimate the economic impact of the research activity undertaken by The Open University in Scotland since there is no research income "booked" in Scotland (but rather, any research income is booked at The Open University's main operational address in the UK (in England)).

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[5]. 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)[6] investigates evidence of **spillovers from publicly funded Research & Development activities**. The authors analyse productivity spillovers to the private sector from public spending on R&D by the UK Research Councils and public spending on civil and defence-related R&D[7, 8], 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[9]. Their findings imply that, while there is no spillover effect associated with publicly funded civil and defence R&D, the marginal spillover effect of public spending on research through the Research Councils stands at **12.7 (i.e. every £1 spent on research through the Research Councils results in an additional annual output of £12.70 within the UK private sector)**.

Another study by Haskel et al. (2014) provides additional insight into the size of potential productivity spillovers from university research. Rather than estimating effects on the UK economy as a whole, the authors analyse the size of spillover effects from public research across different UK industries[10]. 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)[11], interacted with measures of industry research activity, and total

[5] 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.

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

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

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

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

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

[11] A key difference to the multiplier for Research Council spending provided by Haskel and Wallis (2010) lies in the distinction between *performed* and *funded* research, as outlined by Haskel et al. (2014). In particular, whereas Haskel and Wallis (2010) estimated the impact of research *funding* by the Research Councils on private sector productivity, Haskel et al. (2014) instead focus on the *performance* of R&D. Hence, they use measures of the research undertaken by the Research Councils and the government, rather than the research funding which they provide for external research, (e.g. by higher education institutions). The distinction is less relevant in the higher education sector. To measure the research performed in higher education, the authors use Higher Education Funding Council funding where research is both funded by and performed in higher education.

factor productivity within the different market sectors[12]. 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 Scottish universities' research activities, we apply productivity spillover multipliers from the existing literature to the different types of research-related income received by universities in 2019-20. Specifically, we assign the multiplier of **12.7** to the research funding that universities received from **UK Research Councils and UK charities**[13] in 2019-20, and the multiplier of **0.2** to **all other research funding** received by universities in that academic year.

To estimate the **total economic impact** associated with Scottish universities' research activities in 2019-20, we take the **sum of the direct economic impact** and the **estimated productivity spillovers** associated with this research. We can thus infer a weighted average spillover multiplier associated with Scottish universities' research activities – i.e. for **every £1 million invested in the University's research activities what is the additional annual economic output generated across the UK economy**.

How do these estimates compare to the wider literature?

Whilst these research spillovers are quantitatively large; they are in line with related findings from the (relatively limited) economic literature. A report for the (former) Department for Business, Innovation and Skills (2014a) replicates the Haskel and Wallis (2010) approach, using a different (publicly-available) dataset and a slightly different methodology to explore variation in types of research council R&D investments in terms of their impact on private sector productivity. Despite the difference in data and approach, they find qualitatively similar findings: research council R&D investments yield large returns through their impact on private sector productivity.[14] The comparable research multiplier is estimated at 10.71. Moreover, the report finds much higher returns, depending on the precise approach and sample used. Additionally, research from Australia finds a similar research spillover to Haskel and Wallis (2010), albeit with a slightly lower research multiplier of 9.76, which may be expected given the different country studied (Elnasri and Fox, 2017)[15].

There is more limited research associated with general R&D multipliers (for other research income) although a report published for the Department for Business, Innovation and Skills, looking into the international benchmarking of the UK science and innovation system, notes a rate of return in the range of 20 to 50% (Department for Business, Innovation and Skills, 2014b).[16]

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

[12] 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.

[13] Where the vast majority of funding provided by UK charities relates to projects commissioned through an open competitive process.

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

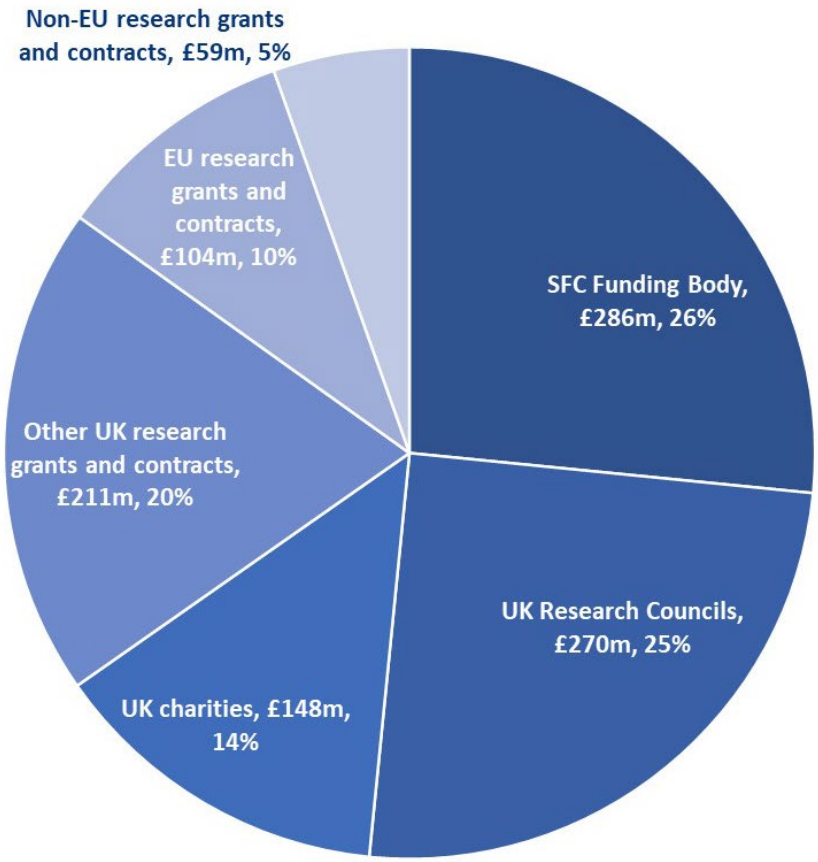
[15] See London Economics (2018), *The economic impact of the Group of Eight in Australia* (Section 2.2.1). The authors find an elasticity of 0.175, which converted to a research spillover, equals 9.76.

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

2 Findings

The total research-related income accrued by 19 Scottish universities in the 2019-20 academic year stood at **£1.077 billion** (see Figure 1). Approximately **27%** of this income was received through recurrent research grant funding provided by the Scottish Funding Council (**£286 million**). This research funding provided by the Scottish Funding Council funding is a vital element of the 'dual support system'. It therefore has a significant role in providing support to maintain the research infrastructure across the sector and enabling leverage of other resources. In particular, through highly competitive tendering, Scottish higher education institutions generated an additional **£791 million** in research income in 2019-20 (equating to approximately **73%** of all research funding received). This research income, generated through success on the basis of quality within competitive tendering processes, is accrued from the UK Research Councils (**£270 million, 25%**) and UK charities (**£148 million, 14%**), alongside approximately **£211 million** (**20%**) in other UK research grant and contract income[17]. In addition, Scottish universities also generated substantial amounts of research income from both EU (**£104 million, 10%**) and non-EU sources (**£59 million, 5%**).

Figure 1 Research related income accrued by Scottish HEIs in 2019-20



Note that this information relates to all Scottish higher education institutions except The Open University in Scotland as any research income received by that institution is booked to The Open University's main headquarters in Milton Keynes in England.

Source: London Economics' analysis of HESA data

[17] This includes £157 million of research income from UK central government bodies, Local Authorities, and health and hospital authorities. As discussed in further detail below, to arrive at the net direct impact of the University's research activities, this funding is deducted from the University's total research income, as it represents a cost to the public purse.

2.1 Net direct impact of research activity

To arrive at the net direct impact of Scottish universities' research activities on the UK economy, we deducted the **costs to the public purse** of funding the universities' research activities from the above total research income in 2019-20. These public costs include the funding provided by the UK Research Councils (**£270 million**), recurrent research grants provided by the Scottish Funding Council (**£286 million**), and other research income from devolved governments, UK central government bodies, Local Authorities, and health and hospital authorities (**£157 million**). Deducting these total public purse costs (**£713 million**) from the above total research-related income (**£1.077 billion**), we thus estimated that the **net direct impact** associated with the research activity delivered by Scottish higher education institutions in the 2019-20 academic year stood at **£364 million**.

Whilst the funds referred to above are all public funds, as noted earlier, the 'dual support system' is such that the SFC recurrent funds enable the leverage of the other public funds. Therefore, whilst for the purposes of the calculation of net direct impact, such public funds are excluded, it is important to note that this leverage of public funds through competitive processes has a significant subsequent economic impact.

2.2 Productivity Spillovers

In order to estimate the productivity spillovers associated with the universities' research activities, we apply these productivity spillover multipliers from the existing literature to the different types of research-related income received by Scottish universities in 2019-20 (again see Figure 1). Specifically, assigning the multiplier of **12.7** to the research funding that Scottish universities received from **UK Research Councils and UK charities**[18] in 2019-20 (amounting to **£417 million**), and assigning the multiplier of **0.2** to **all other research funding** received by Scottish universities in that academic year (amounting to **£660 million**)[19], we estimate that the research conducted by Scottish universities in 2019-20 resulted in **total market sector productivity spillovers of £5,429 million**.

In other words, compared to total research income, we infer a weighted average spillover multiplier associated with Scottish universities' research activities of approximately **5.4** – i.e. **every £1 invested in Scottish universities' research activities generates additional annual economic output of £5.40 across the UK economy**.

This captures the impact of the research undertaken by Scottish universities in 2019-20 within that same academic year (but excludes any additional (and likely substantial) impacts in subsequent years).[20]

[18] Where the vast majority of funding provided by UK charities relates to projects commissioned through an open competitive process.
[19] 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.
[20] Note, however, that following Haskel and Wallis (2010) we take a flow approach rather than a stock measure, which implicitly assumes a 0% depreciation rate.

2.3 Aggregate impact of Scottish universities' research

The estimated impact of Scottish universities' research activities in 2019-20 stood at £5.794 billion.

Combining the direct economic impact of Scottish universities research (**£364 million**) with the estimated productivity spillovers associated with this research (**£5,429 million**), we estimate that the total economic impact associated with Scottish universities' research activities in 2019-20 stood at approximately **£5,794 million**.

Comparing the **£713 million** of publicly funded research income received by Scottish universities in 2019-20 to the **£5,794 million** impact from research activities, this suggests that **for each £1 million of publicly funded research income, Scottish universities' research activities generated an estimated total of £8.1 million in economic impact across the UK.**

2.4 Concluding remarks

Scottish universities are **incredibly successful** and have a huge impact of the UK economy, much of which takes place in Scotland. The success of Scottish universities is demonstrated by the fact they accrue approximately **73%** (**£791 million**) of their research income from open competitive research tendering processes, whilst only relying on the Scottish Funding Council for **27%** (**£286 million**) of research income to support the nation's core research environment and infrastructure.

However, the success of Scottish universities is being hampered by the lack of Scottish Funding Council funding. In particular, the ability of Scottish universities to leverage in additional competitively tendered research funding is declining: in 2013-14, Scottish universities accrued approximately **15.4%** of all UK Research Council funding (which is well above what might be expected given the size of the sector or the population of Scotland), whereas this had declined to just **12.9%** in 2019-20. Essentially, without increasing the support for the core research infrastructure in Scottish universities, the Scottish Funding Council may be hindering the ability of universities to accrue additional external research funding, with detrimental impacts on the Scottish and UK economies.

Index of Tables, Figures and Boxes

References

Department for Business, Innovation and Skills (2014a). 'Rates of Return to Investment in Science and Innovation'.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/333006/bis-14-990-rates-of-return-to-investment-in-science-and-innovation-revised-final-report.pdf

Department for Business, Innovation and Skills (2014b). 'Insights from International Benchmarking of the UK Science and Innovation System'.
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/277090/bis-14-544-insights-from-international-benchmarking-of-the-UK-science-and-innovation-system-bis-analysis-paper-03.pdf

Elnasri, A., & Fox, K. (2017). 'The Contribution of Research and Innovation to Productivity'.
https://link.springer.com/article/10.1007/s11123-017-0503-9

Haskel, J., Hughes, A., and Bascavusoglu-Moreau, E. (2014). 'The economic significance of the UK science base: a report for the Campaign for Science and Engineering'.
http://sciencecampaign.org.uk/UKScienceBase.pdf

Haskel, J., & Wallis, G. (2010). 'Public support for innovation, intangible investment and productivity growth in the UK market sector'.
http://ftp.iza.org/dp4772.pdf

Imperial College London (2010). 'University research contributes £45 billion a year to the UK economy, according to new impact study'.
http://www3.imperial.ac.uk/newsandeventspggrp/imperialcollege/newssummary/news_16-3-2010-13-6-57

London Economics (2017). 'The economic impact of Russell Group universities.'
https://londoneconomics.co.uk/wp-content/uploads/2017/11/LE-Economic-impact-of-Russell-Group-universities-19-10-2017-FINAL.pdf

London Economics (2018), 'The economic impact of the Group of Eight in Australia'
https://londoneconomics.co.uk/wp-content/uploads/2018/08/Go8_London-Economics-Report.pdf

Salter, A., & Martin, B. (2001). 'The Economic Benefits of Publicly Funded Basic Research: A Critical Review'.
https://doi.org/10.1016/S0048-7333(00)00091-3

LE London Economics

Somerset House, New Wing, Strand
London, WC2R 1LA, United Kingdom
info@londoneconomics.co.uk
londoneconomics.co.uk
: @LE_Education @LondonEconomics
+44 (0)20 3701 7700