RE-P-2021-03

November 2021

An Update on IP-Related and Commercialisation Activities in England in 2019/20.

Report detailing IP-related and commercialisation activities submitted as part of the HE-BCI survey, focussing on those conducted in England in 2019/20.

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HE-BCI Survey 2019/20

To	Heads of Research England-funded higher education providers
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Introduction

1. The Higher Education Business and Community Interaction (HE-BCI) survey is an essential source of information on university knowledge exchange (KE) in the UK. 'Business' in this context may refer to private, public, and third-sector partners of all sizes[1]. 'Community' in this context means society as a whole outside higher education providers (HEPs), including all social, community and cultural organisations, individuals, and the public, both nationally and internationally.

2. The survey records information on a wide range of interactions with external partners and the wider world, such as collaborative and contract research, consultancy, continuing professional development, regeneration and development programmes, the exploitation of intellectual property and other activities with a direct social benefit, such as hosting events in museums and giving public lectures.

3. The data is collected by the Higher Education Statistics Agency (HESA). All publicly funded HEPs in the UK are required to submit data to the HE-BCI survey. HEPs who do not receive public funding may also submit data to HE-BCI but they have been excluded from the data presented in this report[2]. HEPs provided data for activity occurring during the academic year 2019/20.

4. Furthermore, in this report comments on a further subset of the total providers that completed the HE-BCI survey in 2019/20, in order to maintain comparability with the data collected in previous years and analyse year-on-year trends. Therefore, many new HEPs added to the Office for Students (OfS) register are not included, however as these providers conduct relatively little commercialisation activity conclusions drawn in this report remain broadly representative of the sector.

5. The HE-BCI survey collects income to HEPs, which is considered a sound proxy for the impact of their KE activities[3]. The main indicators for which income to HEPs reflects the market value of these resources in the economy and society are collaborative research, contract research, consultancy, equipment and facilities, continuing professional development, regeneration, and Intellectual Property (IP) income. In addition, external investment into spin-outs can also be deemed a reasonable proxy for impact[4].

[1] The 'third sector' refers to voluntary and community groups, social enterprises, charities, co-operatives and mutuals.
[2] Data from the University of Buckingham is excluded from this report as it is not a publicly funded HEP.
[3] See 'Allocating HEIF: The suitability of knowledge exchange income as a proxy for outcome performance'.
[4] See 'Assessing the Gross Additional Impacts of the Higher Education Education Innovation Fund (HEIF)'

6. This report provides an update on similar analysis published in the 2020 report[5] by Research England commenting on the 2018/19 HE-BCI data release.

7. This report covers the academic year August 2019 to July 2020 and includes the initial period from March 2020 of national restrictions due to the Covid-19 pandemic.

8. Therefore, all findings and trends should be considered in light of possible effects that the Covid-19 pandemic and related disruptions may have had on the HE sector, and the varying impact on different sectors and disciplines[6]. However, it is likely that the full effect of these disruptions will not have been felt during the 2019/20 reporting period and a proportion of activities included would have been instigated prior to the Covid-19 pandemic and therefore still resulted in measurable activity and income. It will be important to continue to monitor the ongoing effects of the Covid-19 pandemic and the related disruption in future reporting periods.

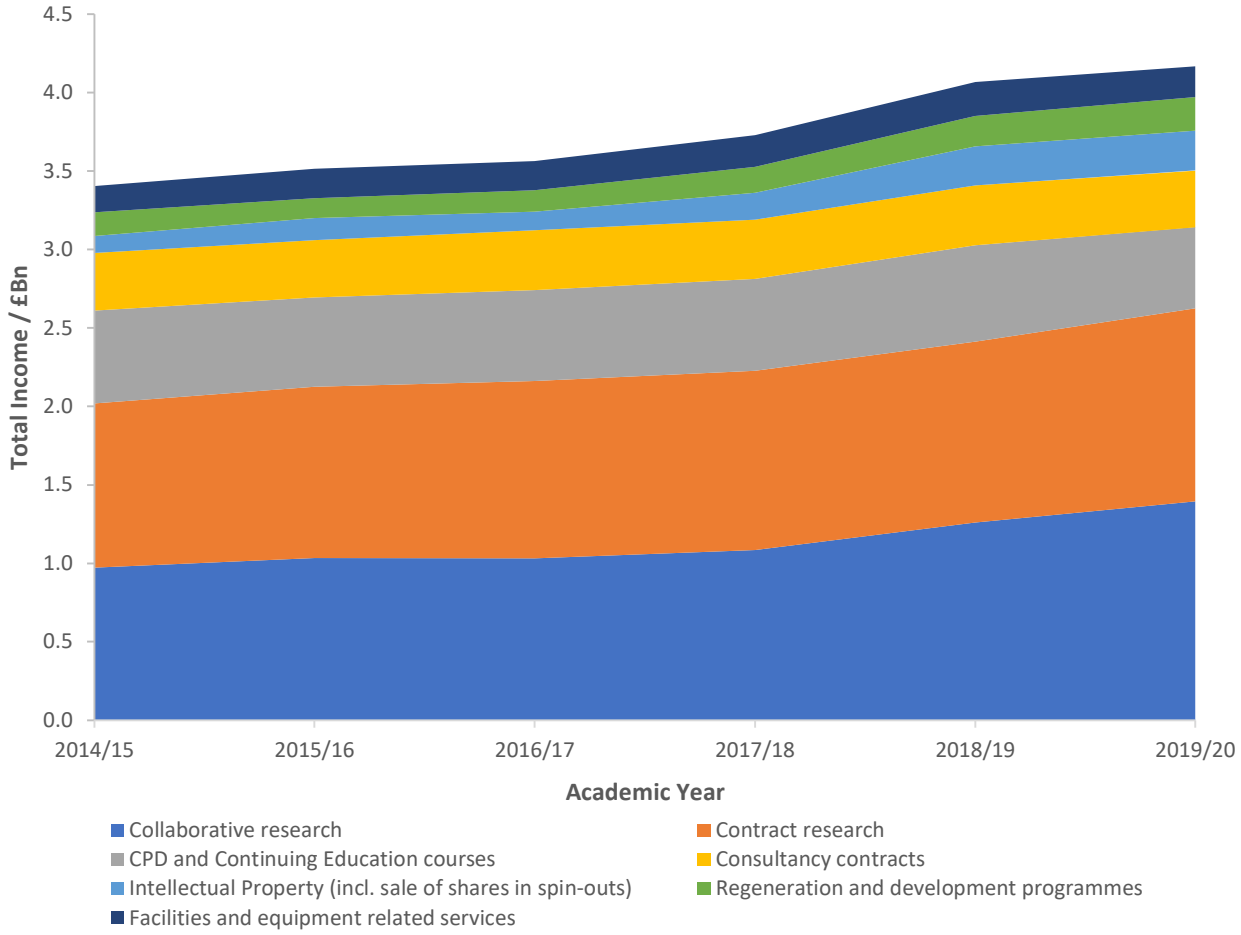
The UK's KE Landscape

9. The following section of the report outlines the overall sources of KE income in the UK and England in 2019/20 as collected in the HE-BCI survey and are illustrated in Figure 1 below. In 2019/20 the total income to UK HEPs increased by £152m (3.1%) compared to that of 2018/19 and although this is a slower rate of increase compared to that of recent years, 7.6% and 6.9% in 2018/19 and 2017/18 respectively, this is encouraging in light of possible effects of the Covid-19 pandemic.

10. Significant increases continued to be observed in income from collaborative research, contract research, intellectual property, and regeneration and development programmes. However notable decreases in income were reported for CPD and CE courses, consultancy contracts, and facilities and equipment related services, decreases of 16%, 5.5%, and 9.7% respectively. Declines in these income sources are potentially not unexpected due to the immediate effects of Covid-19 related disruptions and the fiscal limitations on businesses to engage with the HE sector.

[5] See RE-01102021-IPRelatedCommerialisationActivitiesUpdate-2018-2019.pdf (ukri.org)
[6] See 'Innovating During a Crisis: The Effects of the Covid-19 Pandemic on How Universities Contribute to Innovation (2021)'

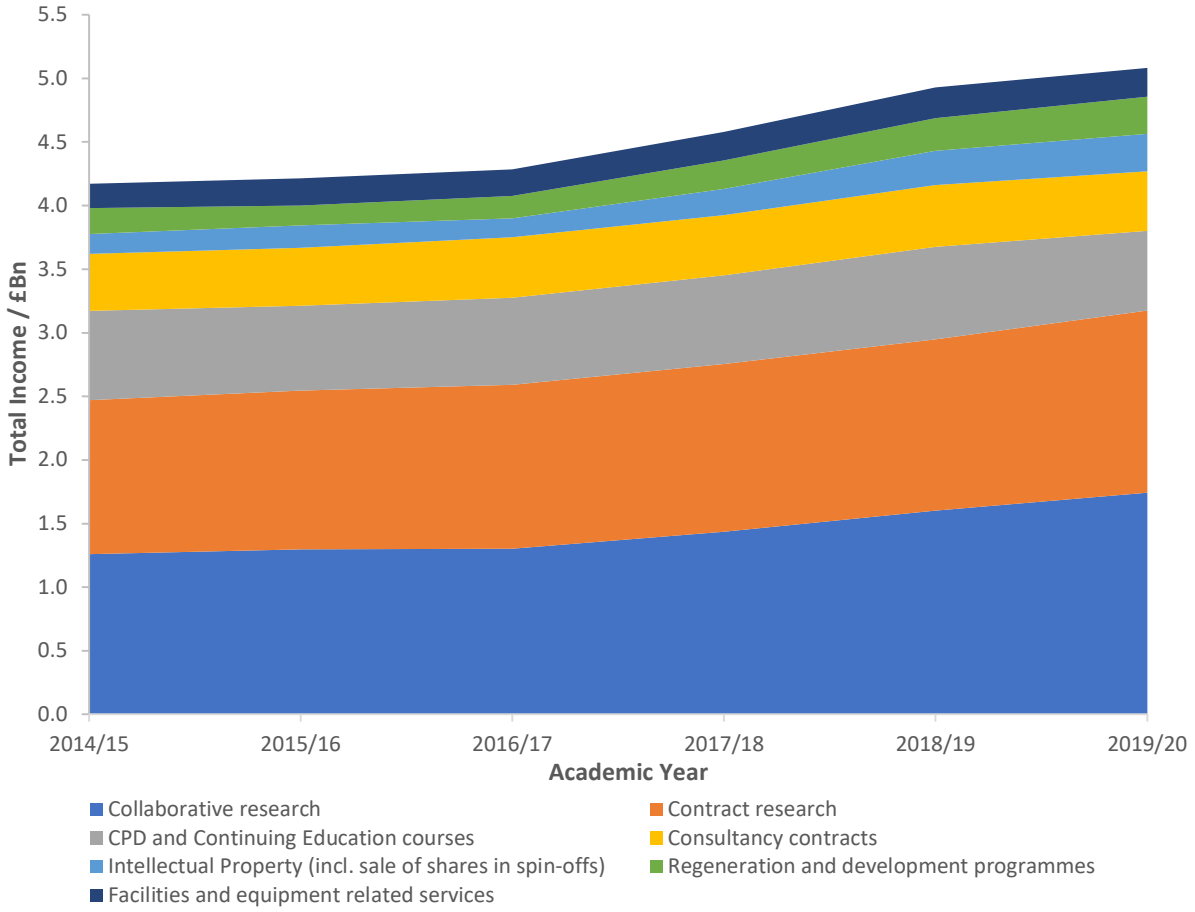
Figure 1: Total income for each category across all UK providers stacked for each academic year from 2014/15 to 2019/20.



For the remaining sections of this report all data is based on English providers only unless otherwise stated.

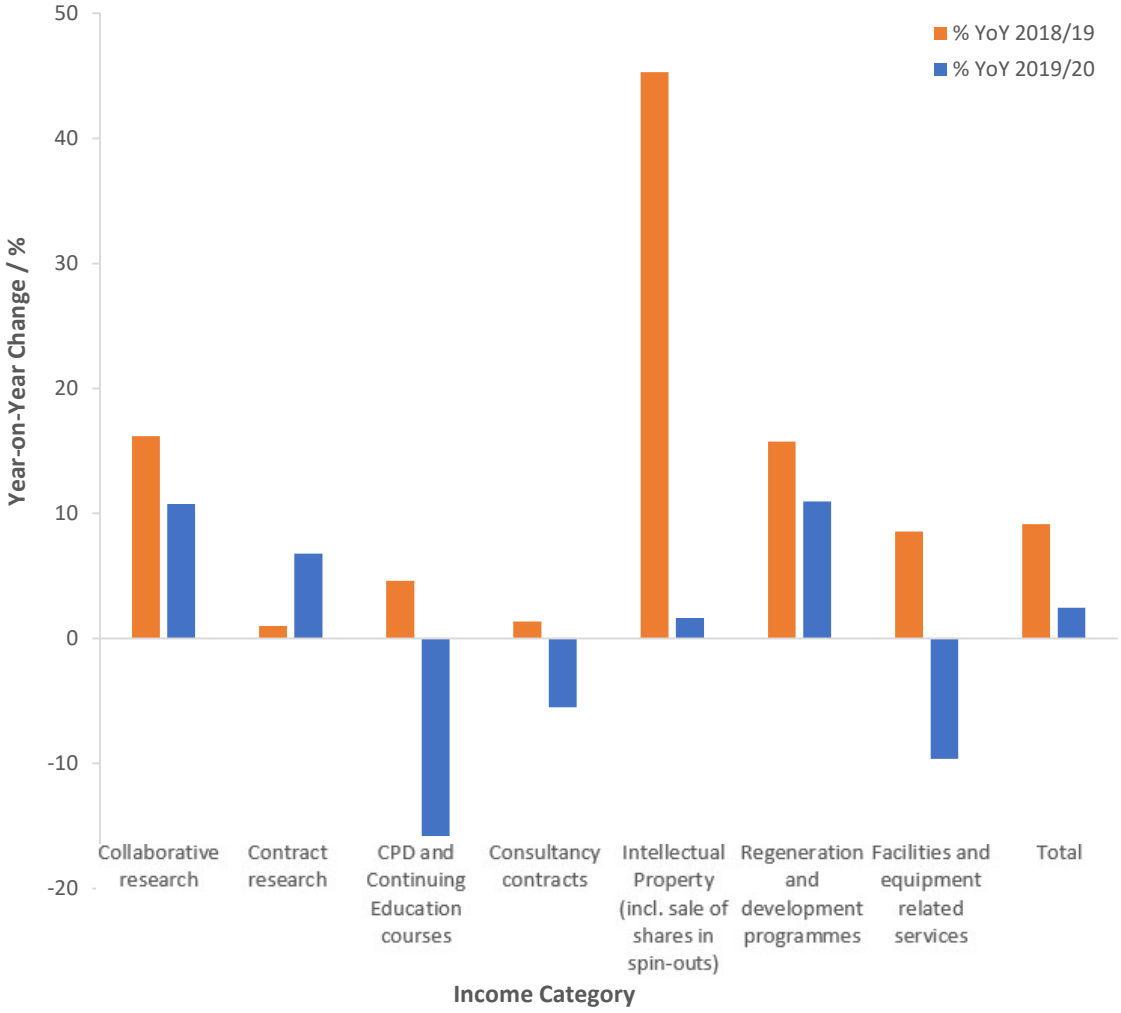
11. Generally, changes in total income for English providers in 2019/20 mirrored that across the whole of the UK. Figure 2 below demonstrates that despite a decrease in some categories, an overall increase of £99m (2.5%) was observed in 2019/20 in the income to English providers compared to that in 2018/19. Increases in income were observed in all categories in England except for CPD and CE courses, consultancy contracts, and facilities equipment related services, as shown in Figure 3.

Figure 2: Total income for each category across all English HEPs stacked for each academic year from 2014/15 to 2019/20.



12. Although income to English providers from IP was still significant in 2019/20 at £255m, the growth rate of 1.6% compared to 45% in 2018/19 was notably lower. This is primarily due to a decrease in the sale of shares in spin-outs, however the number of spin-outs remained strong across the sector in England and significant growth in external investment continued (discussed in greater detail later in this report). Also of note is the significant growth of 6.8% in income from contract research compared to that of approximately 1.0% in the previous two reporting periods. This is predominantly due to a large increase of 13% in income from contracts with non-commercial organisations, in contrast with a 7.8% decrease in that with SMEs. In part this could be attributed to a decrease in business activity due to the Covid-19 pandemic contrasting with greater capability of the non-commercial sector to continue activity.

Figure 3: Year-on-year percentage change in income for each category in 2018/19 and 2019/20.



Intellectual Property Income, Patents and Spin-Outs

13. One area of knowledge exchange receiving considerable interest is commercialisation and the exploitation of research for the benefit of society and the economy. Therefore, the remainder of this report focusses on this area of current policy interest, examining income from intellectual property, patents, and spin-outs.

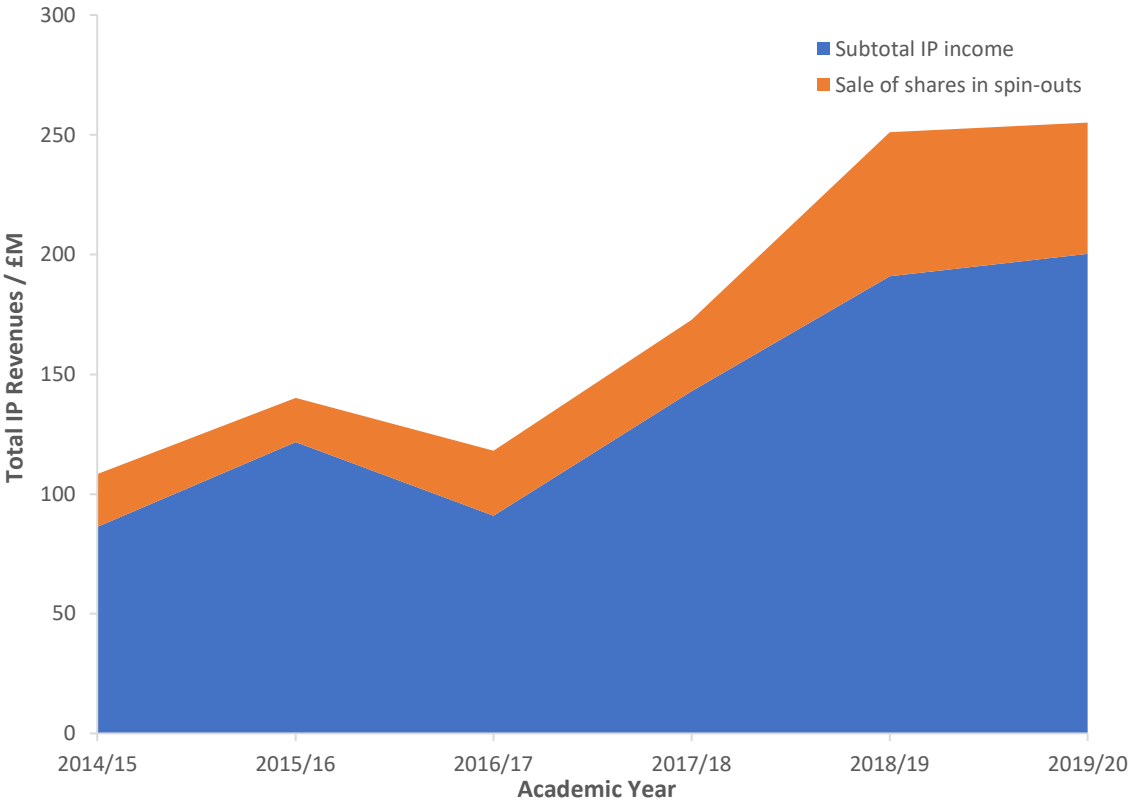
IP income

14. The HE-BCI survey collects data on the total IP income received by providers which can be divided into income due to sales of shares in spin-outs and the subtotal IP income. In

addition, the subtotal income can be further categorised by the source of income (software licences, non-software licences, and other IP) and the type of organisation.

15. Total IP revenues continued to increase in 2019/20, although at a notably slower rate than in 2018/19, and with a greater proportion being in subtotal IP income relative to 2018/19. This is due to a continued increase in subtotal income source of 5.0% and a decrease in the sale of shares in spin-outs of 9.0%. The decrease in sale of spin-out shares follows a period of continued growth since 2015/16 as illustrated by Figure 4 below. However, sales of shares are highly variable in nature and the 2019/20 sector decrease can be attributed primarily to significant decreases in sales by the Universities of Cambridge and Oxford. The overall sales of shares in 2019/20 remained greater than reporting periods prior to 2018/19, in part due to significant in increases in sales by Imperial College, University of Surrey, and University College London, of 1,100%, 4,800%, and 103% respectively compared to 2018/19.

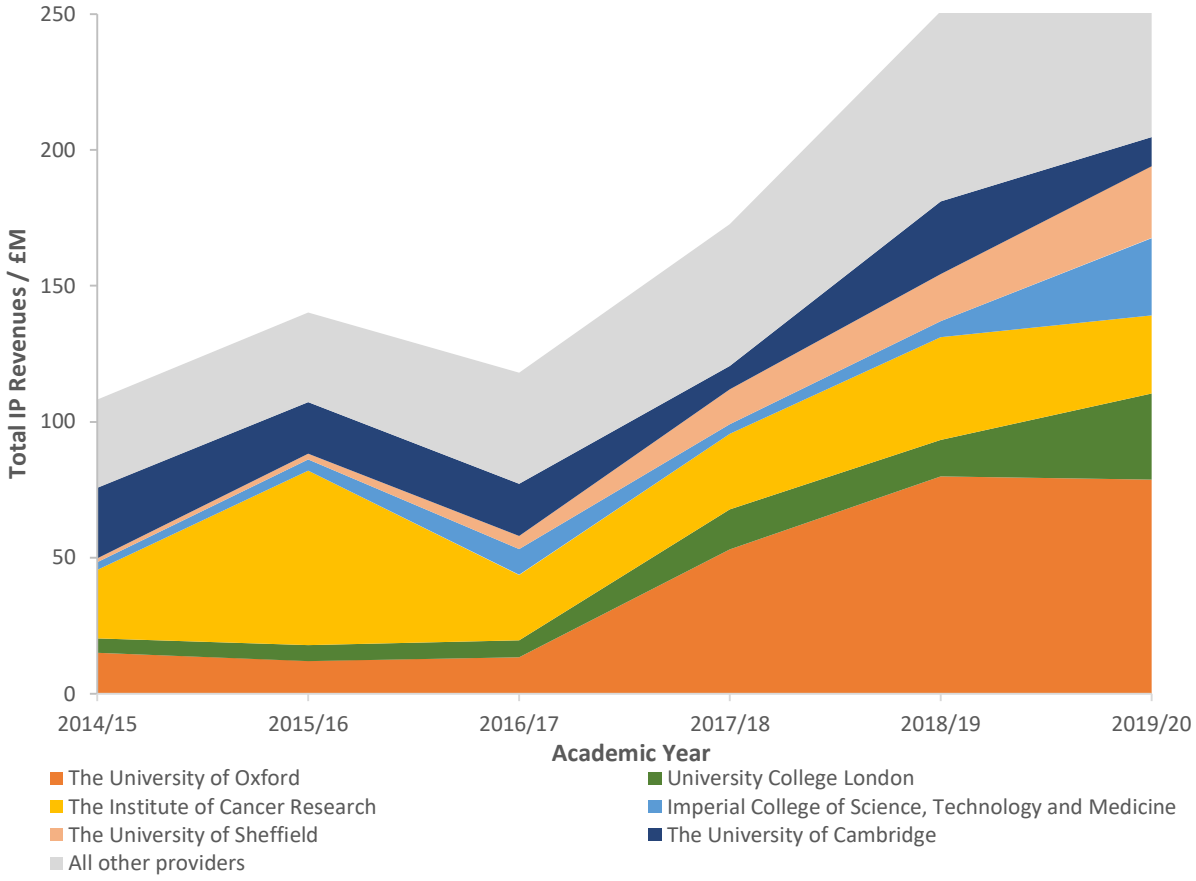
Figure 4: Combined total of the sale of shares in spin-out and the subtotal IP income for each academic year from 2014/15 to 2019/20.



16. It is important to note that trends observed in the total IP revenues are highly dependent on changes in a small number of providers. As illustrated by Figure 5, in 2019/20 IP income from just six providers represented 80% of the total income figure.

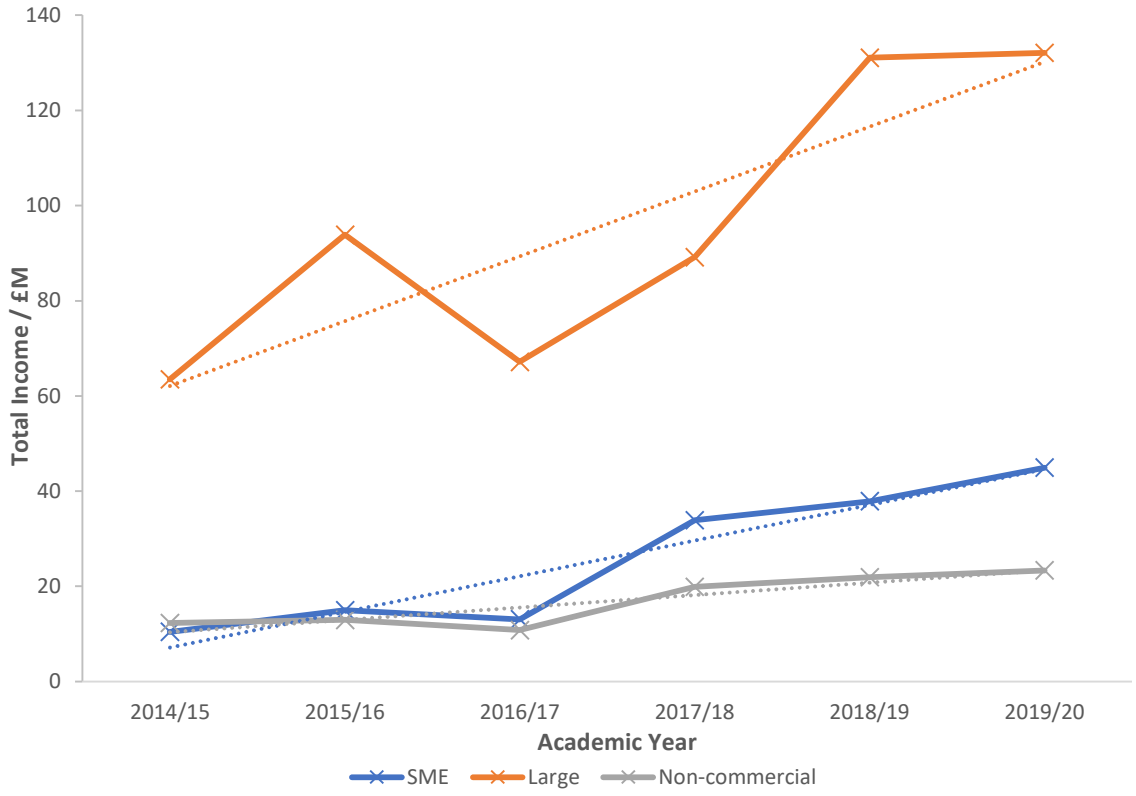
17. It is also important to emphasise that Figure 5 includes the sale of shares, which are naturally highly variable, and also that the six providers highlighted are those specifically with the greatest IP income in 2019/20 so this analysis should be considered as a snapshot rather than indicative of a long-term trend.

Figure 5: Total IP income (including sale of shares in spin-outs) across English HEPs for each academic year from 2014/15 to 2019/20, highlighting the proportion contributed by the six providers the greatest total IP incomes in 2019/20.



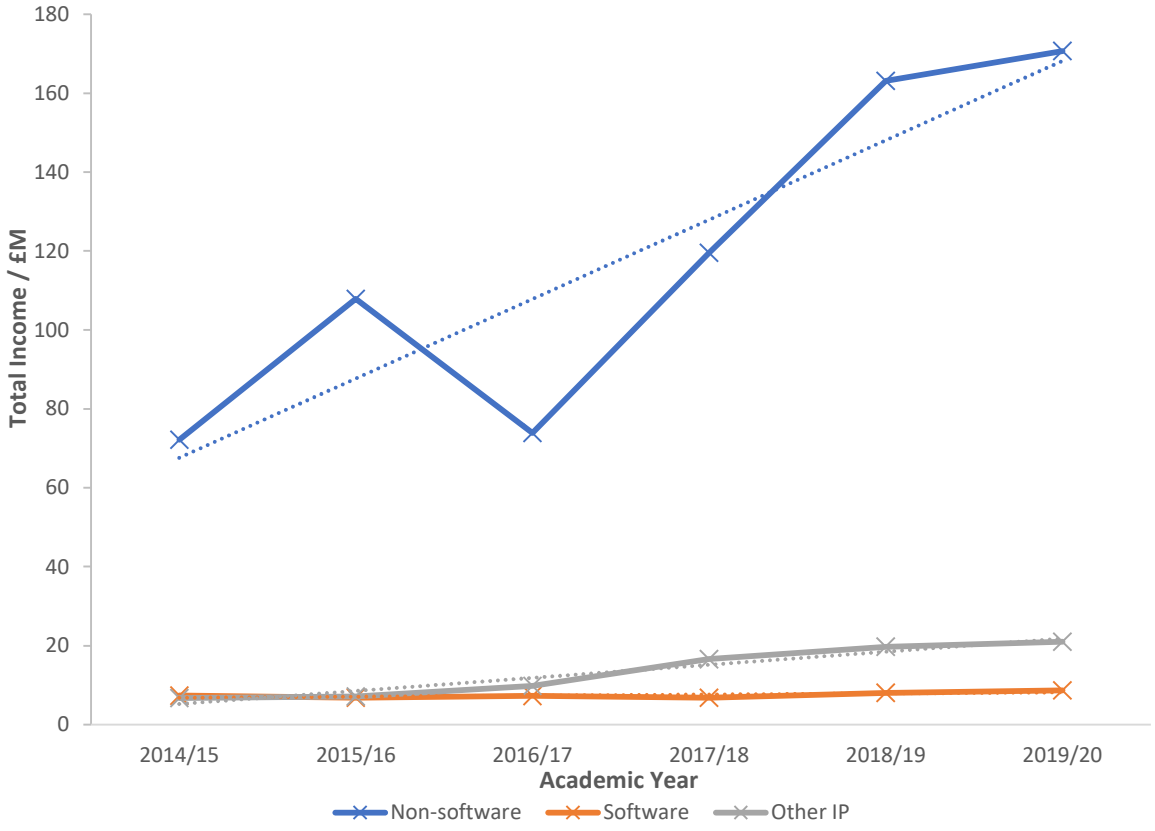
18. Totalled across all sources of IP income, increases have been seen for all types of organisation (large businesses, SMEs and non-commercial) in 2019/20 as demonstrated in Figure 6. Specifically, the rate of increase in income from large businesses slowed in 2019/20 to 0.79%, contrasting to a rate of 47% in 2018/19. In addition, the income from SMEs continued to increase which is of note considering small businesses would have been expected to be affected most by the Covid-19 pandemic. This continued increase could potentially be attributed to activities that were established prior to the pandemic and therefore income was still received during the reporting period. It is likely that full effects of the pandemic will not be observed until future reporting periods.

Figure 6: Total IP income for different organisation types for each academic year from 2014/15 to 2019/20.



19. The income across all organisation types for each source of income was totalled and is displayed in Figure 7. The relative distribution of income between different sources remained similar to that in 2018/19, with non-software licencing remaining the predominant source of income with 85% of the total and software and other IP income contributing 4.3% and 11% respectively. The rates of growth slowed in 2019/20 in all income sources, of note is the decrease in growth rate of non-software income from 36% to 4.6%. It is not unexpected that the trends in non-software licencing income and that from large businesses mirrors the overall trends in subtotal IP income as income from non-software licences with large businesses contributed 59% of the total income in 2019/20.

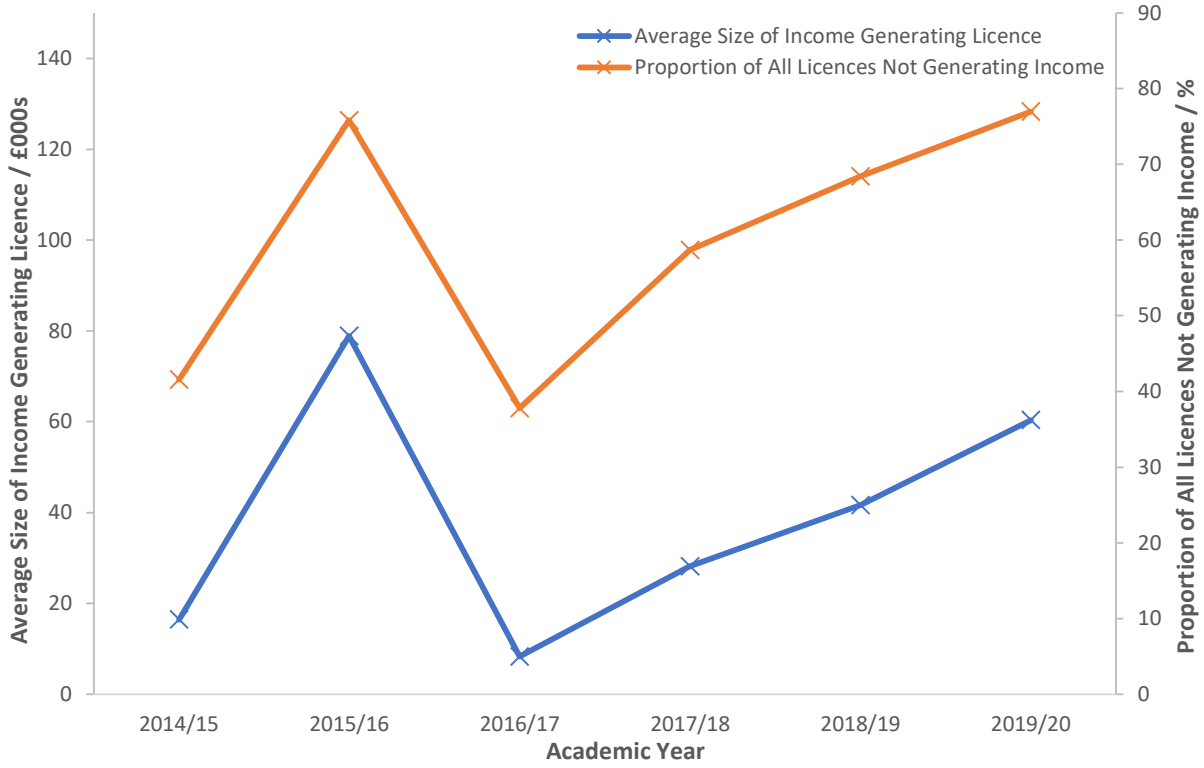
Figure 7: Total IP income across all organisation types for different sources of income for each academic year from 2014/15 to 2019/20.



20. However, despite this slow in growth in income from non-software licences, the overall continued increase since 2016/17 is significant as this source drives the overall trends in IP income. This increase in non-software income can be attributed to an increase in value of licensing deals rather than the total number of licenses that generated income, which in fact has continued to decrease from 8921 in 2016/17 to 2827 in 2019/20. Of the licenses that generated income, the average size of non-software licensing deals increased from £8,280 in 2016/17 to £60,400 in 2019/20, as illustrated in Figure 8. Also of note is the continued

increase in the proportion of all non-software licences that do not generate income from 38% in 2016/17 to 77% in 2019/20, perhaps reflecting a shift to more open models of innovation, or recognition of the need to the balance income generation with impact generation. For instance, the rise in use of the so-called NERF (non-exclusive royalty-free) licences in response to the Covid-19 pandemic could be an example of such a shift[7], and be one contributing factor to the decrease in reported licences generating income.

Figure 8: Average size of income generating non-software licences and the proportion of all non-software licences not generating income for each academic year from 2014/15 to 2019/20.



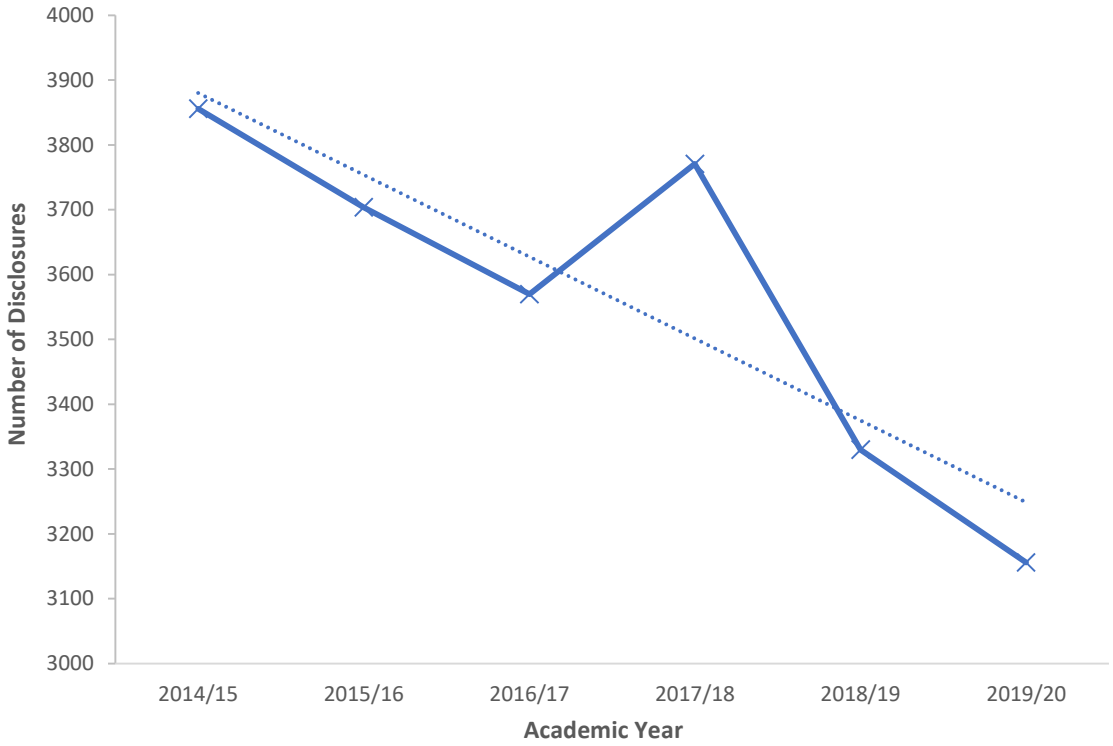
Disclosures and patents

21. HE-BCI records a range of data relating to IP, including numbers of disclosures, patents filed, patents granted, cumulative patent portfolio (and patents filed by an external party), but caution should be taken when discussing trends in disclosures as there may not be a consistent definition between providers as to what qualifies as a disclosure.

[7] See, for example, https://innovation.ox.ac.uk/technologies-available/technology-licensing/expedited-access-covid-19-related-ip/

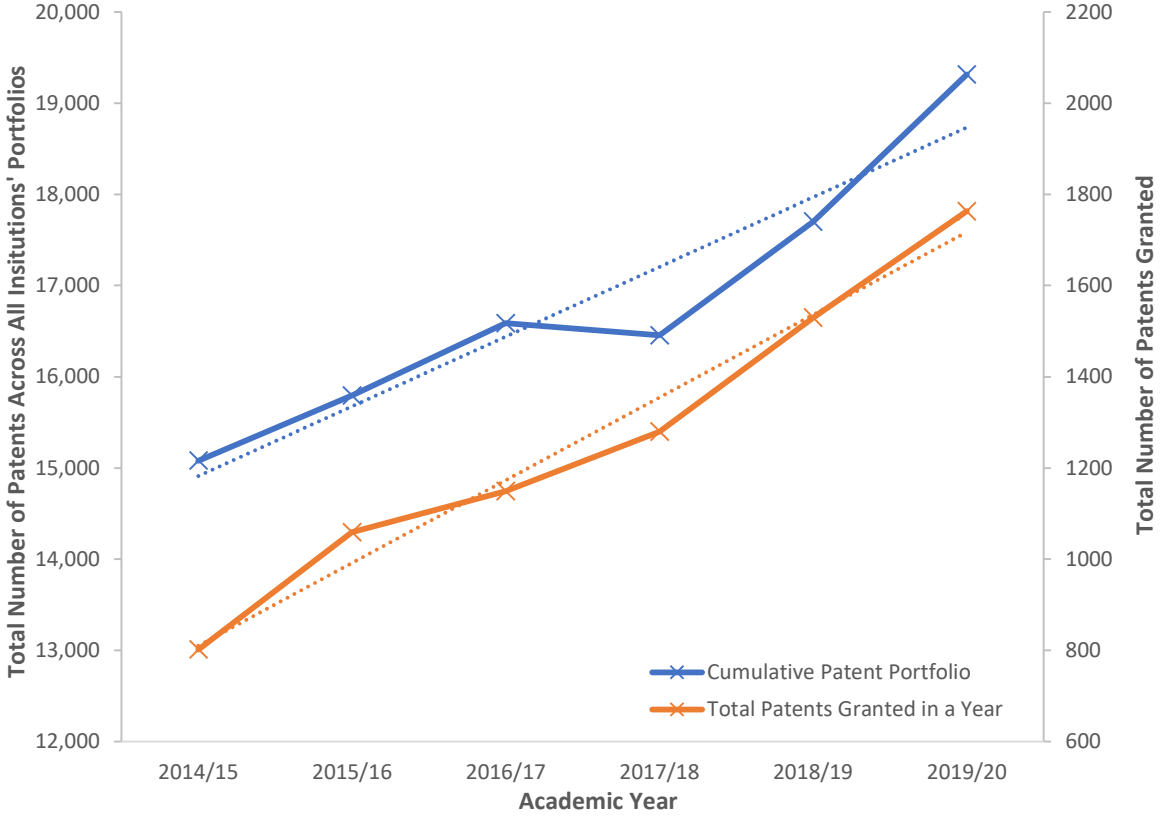
22. In 2019/20 the number of disclosures continued to decrease and at a rate of 5.2% which is more similar to that observed prior to the increase seen in 2017/18, as displayed in Figure 9. When considered alongside the continued increase in patenting activity (discussed below), this decrease may be a result of greater selectivity around the definition of a disclosure rather than a decrease in discoveries or patentable ideas from providers.

Figure 9: Total number of disclosures for each academic year from 2014/15 to 2019/20.



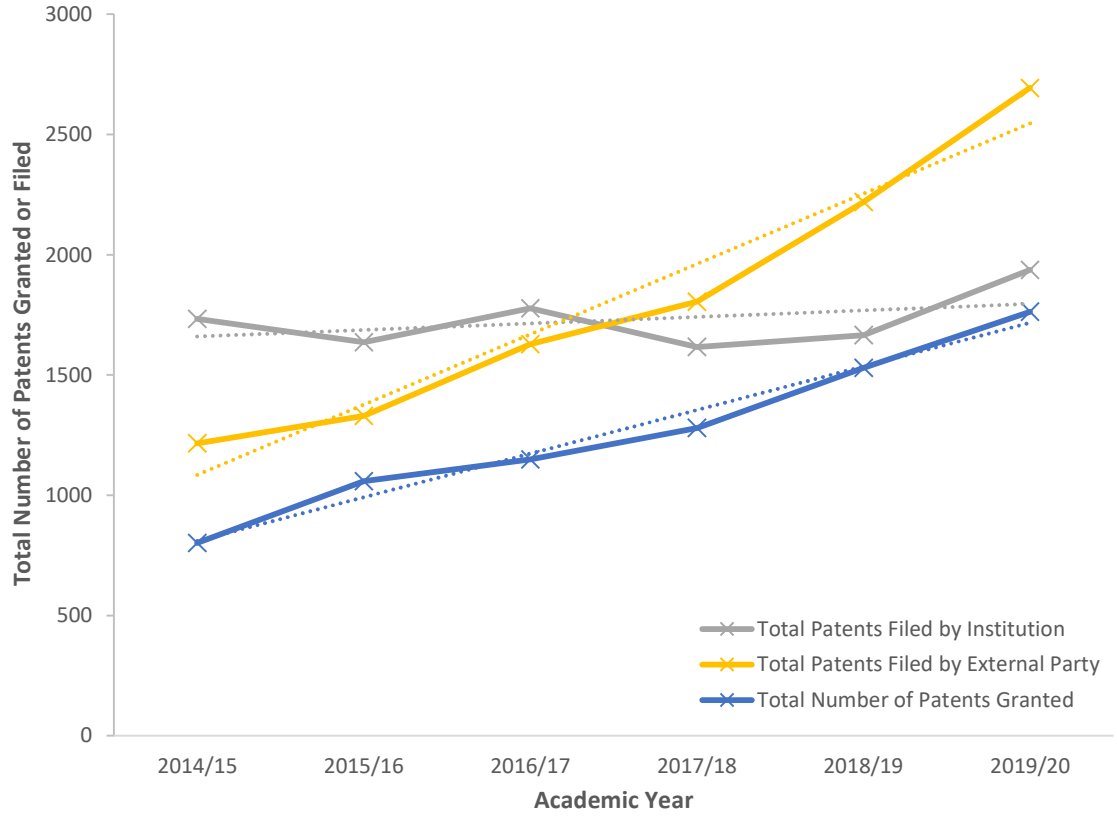
23. Patenting trends continued to strengthen in 2019/20, as depicted in Figure 10, with the total number granted across the sector increasing by 15%. In addition, the total cumulative patent portfolio increased by 9.1%, the largest year-on-year increase observed in the last five reporting periods.

Figure 10:Total number of patents granted and the cumulative patent portfolio across all providers for each academic year from 2014/15 to 2019/20.



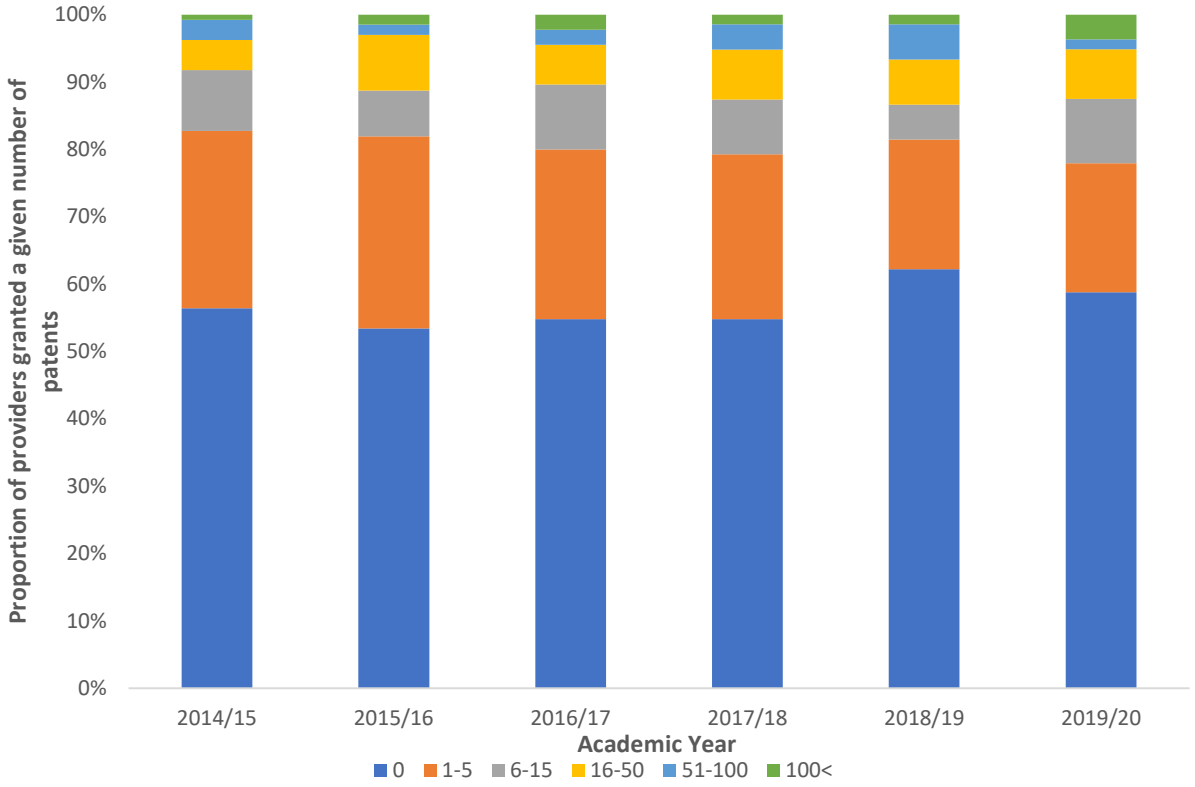
24. Consideration of the identity of the party filing the patents is also of interest and is illustrated in Figure 11. The number of patents filed by external parties naming the HEP as an inventor continued to increase in 2019/20 with a growth of 21% compared to 2018/19. Despite an increase in the number of patents filed by providers in 2019/20, the broader trend across all reporting periods examined suggests this figure remains relatively consistent. Both observations continue to suggest the way in which providers are managing their patent portfolios may be shifting. However, the 16% increase in the number of patents filed by providers is not insignificant and should be revisited in future reporting periods.

Figure 11: Total number of patents granted, and total patents filed by providers and by external parties for each academic year from 2014/15 to 2019/20.



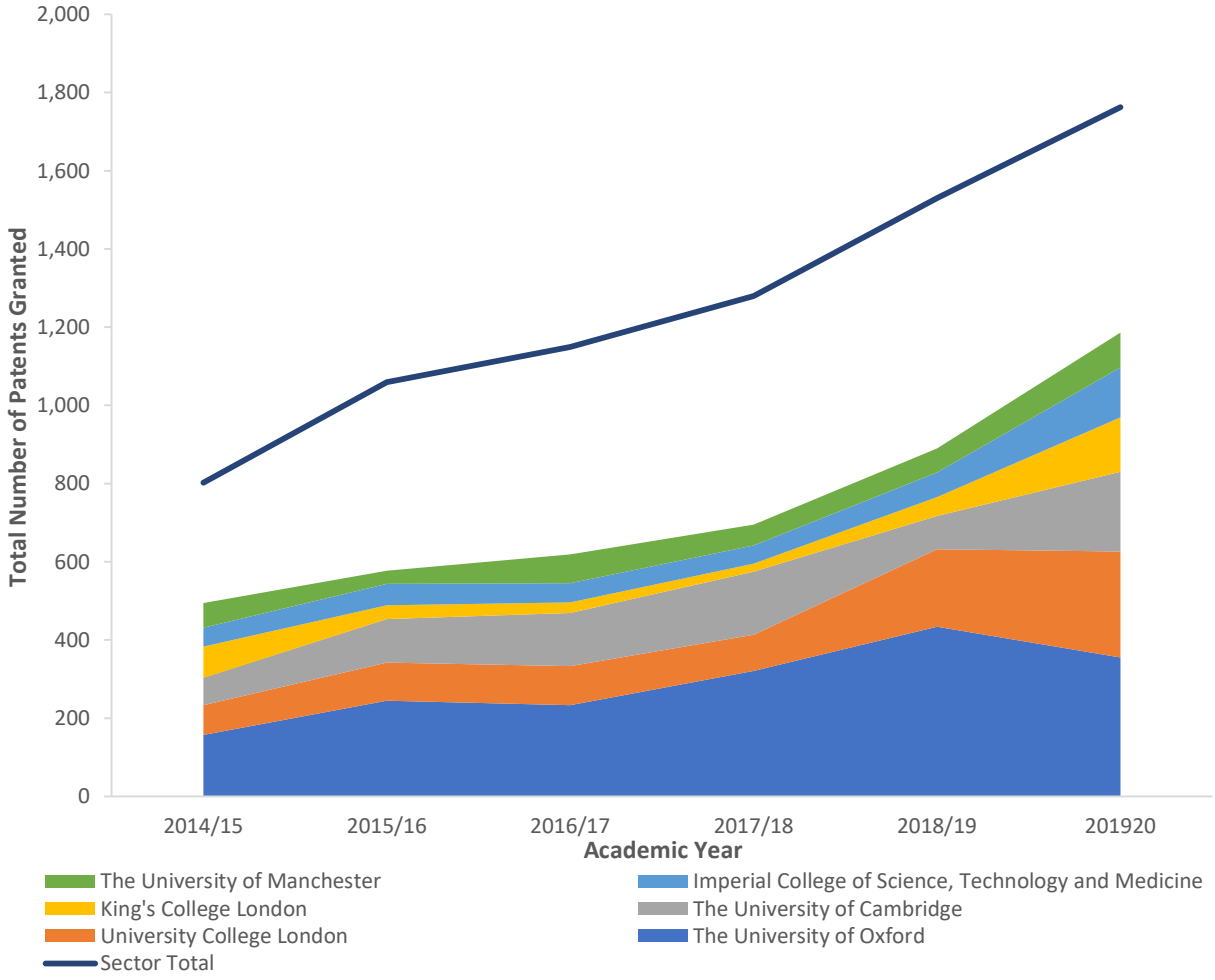
25. The proportion of providers which had a given number of patents granted in an academic year was also calculated and is shown in Figure 12. In 2019/20 the most significant changes compared to 2018/19 were that the proportion of providers with zero patents granted decreased slightly from 62% to 59% and the proportion of providers that had 6-15 patents granted increased from 5% to 10%. This has potential significance when compared to the considerable increase in the proportion granted zero patents in 2018/19, and may suggest that in 2019/20 the breadth of providers having patents granted did not continue to decrease. Given that there have been no significant changes across the sector and its profile is relatively stable besides a gradual increase in research income, it is not unexpected that the sector's patenting profile has also been stable in the short to medium term.

Figure 12: Proportion of the total number of providers that has a given number of patents granted each academic year from 2014/15 to 2019/20.



26. However, of note is that the six providers granted the greatest number of patents in 2019/20 (Universities of Oxford, Cambridge, and Manchester, King's College, University College London, and Imperial College) almost all saw considerable increases in 2019/10 as displayed in Figure 13. In 2019/20 this sample of providers held 67% of the sector total granted patents compared with 58% in 2018/19. Although patenting behaviours are very dependent on individual provider strategies, this increased concentration is of note when considering the sector as a whole.

Figure 13: Total number of patents granted across the whole sector, and for individual providers, for each academic year from 2014/15 to 2019/20.



27. It is important to be mindful when discussing patent data that, in some cases, trends may be reflective of a provider's strategic approach to IP, rather than being indicative of not producing potentially patentable IP.

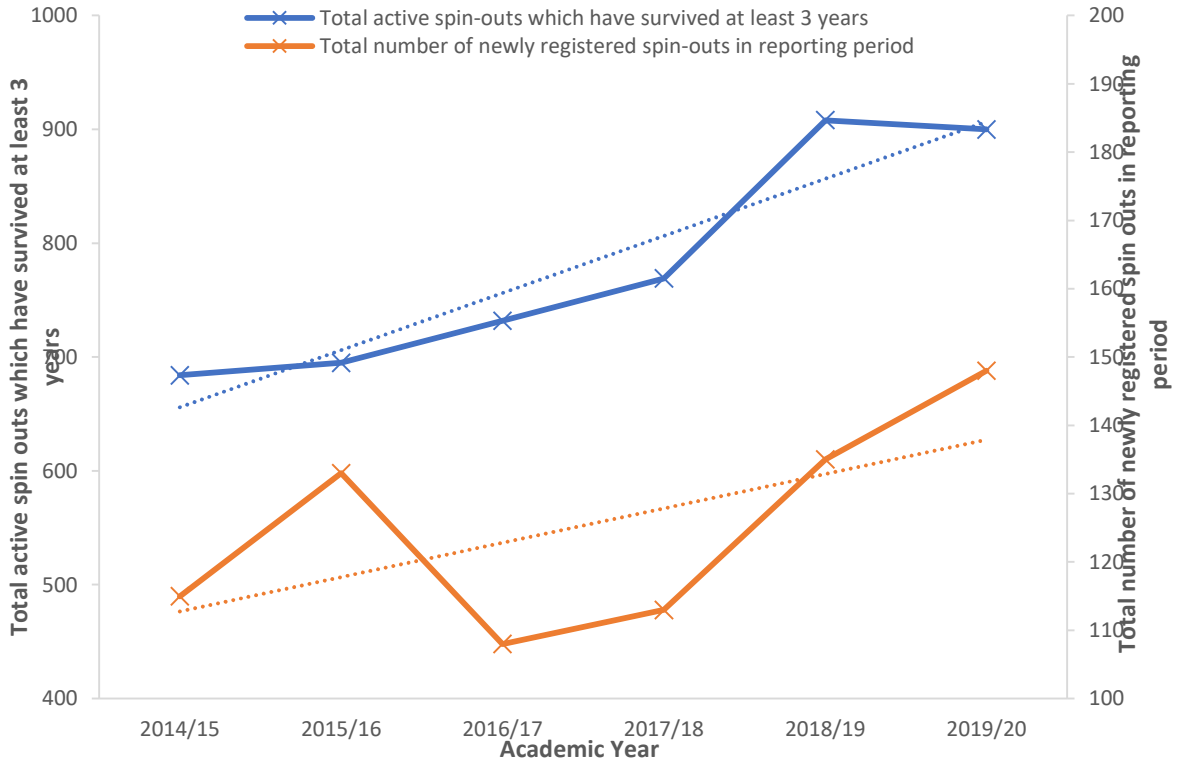
Spin-out company formation

28. For the purpose of this report, a spin-out is defined as a company which exploits intellectual property arising from a university.

29. Overall spin-outs continued to perform well in 2019/20. Figure 14 demonstrates the continued increase in the total number of newly registered spin-outs and the strong positive overall trend in active spin-outs to have survived at least three years. The small decrease in 2019/20 (8 spin-outs, 1%) in active spin-outs to have survived 3 years and slow in rate of

increase in newly registered spin-outs should be considered in the context of the significant increase in activity in 2018/19.

Figure 14: Total number of active spin-outs to have survived at least three years and the total number of newly registered spin-outs in the reporting periods for English HEPs, each academic year from 2014/15 to 2019/20.

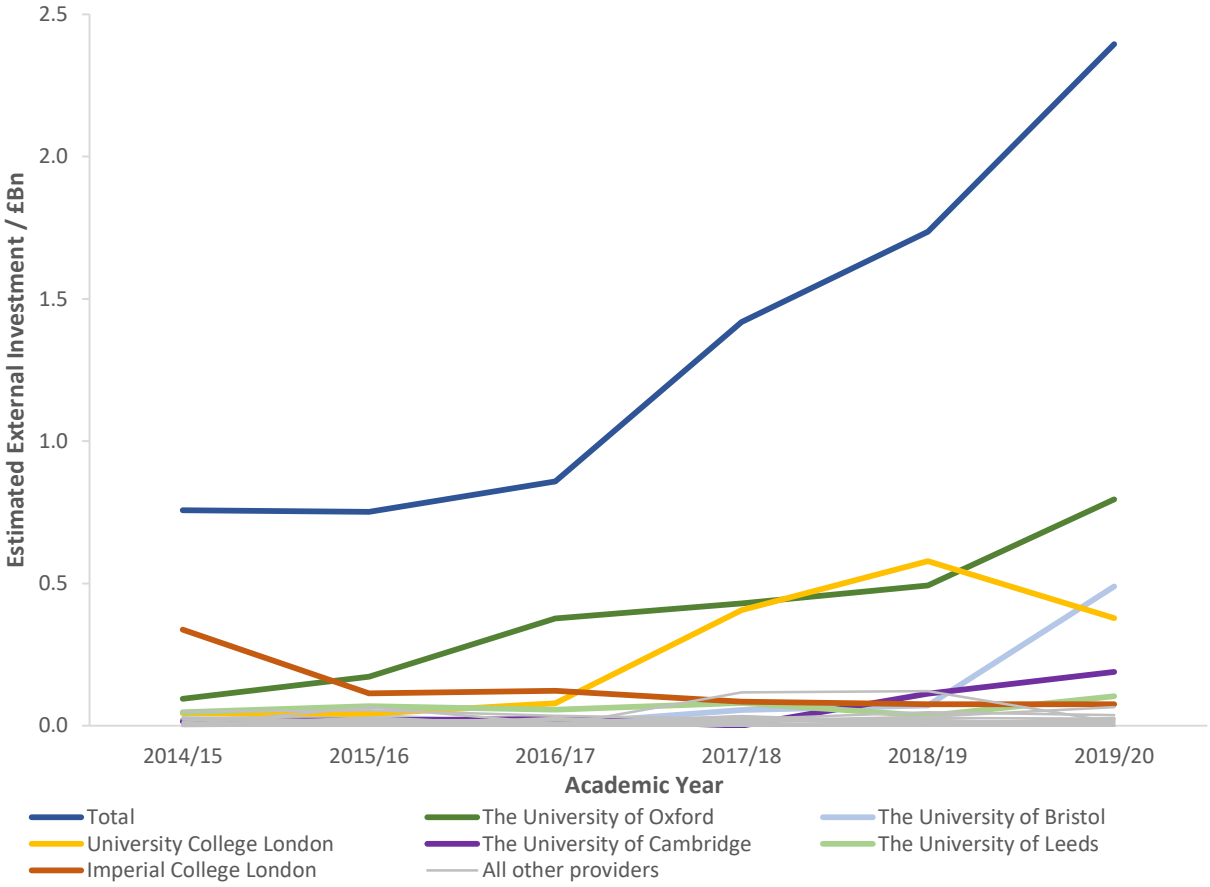


30. Although the above observations can provide indications of performance trends at an institutional level, these should be treated with caution as there is significant variance year-to-year in spin-out data. When analysing numerical spin-out data, the number that have survived at least three years can provide a better insight into performance, and the overall increase indicates an increase in quality of spin-outs.

31. The estimated external investment from all sources received by all spin-outs totalled across the sector continued to increase in 2019/20, and at an increased growth rate of 38% compared with 23% in 2018/19. The ability to attract equity investment may also be interpreted as indicative of the quality of spin-outs continuing to increase. However, it is important to note that a relatively small number of providers contribute to these figures and therefore broader trends are heavily influenced by changes at an individual provider level, as demonstrated in Figure 15. There was also an increase in 2019/20 in the proportion of total estimated external investment due to the highest five providers (see Figure 15) with

82% in 2019/20 compared to 70% 2018/19. However, it appeared that the concentration within the highest contributing five providers decreased with three contributing over 10% of the total in 2019/20 compared with two in 2018/19.

Figure 15: Estimated external investment received by all spin-outs totalled for all providers, and for individual providers, for each academic year from 2014/15 to 2019/20.



32. The total estimated current employment of all active firms may also be used as indicator of the success of the spin-outs across the sector (although it must be noted that it is a poorer proxy for performance due the differing staffing requirements of different types of businesses). The year-on-year change in this metric is depicted in Figure 16 below, alongside that for the total estimated external investment and total number of currently active spin-outs that have survived at least three years. While Table 1 displays the absolute values for these three indicators for the last three reporting periods.

Figure 16: Year-on-year % change in the three spin-out metrics from 2015/16 to 2019/20.

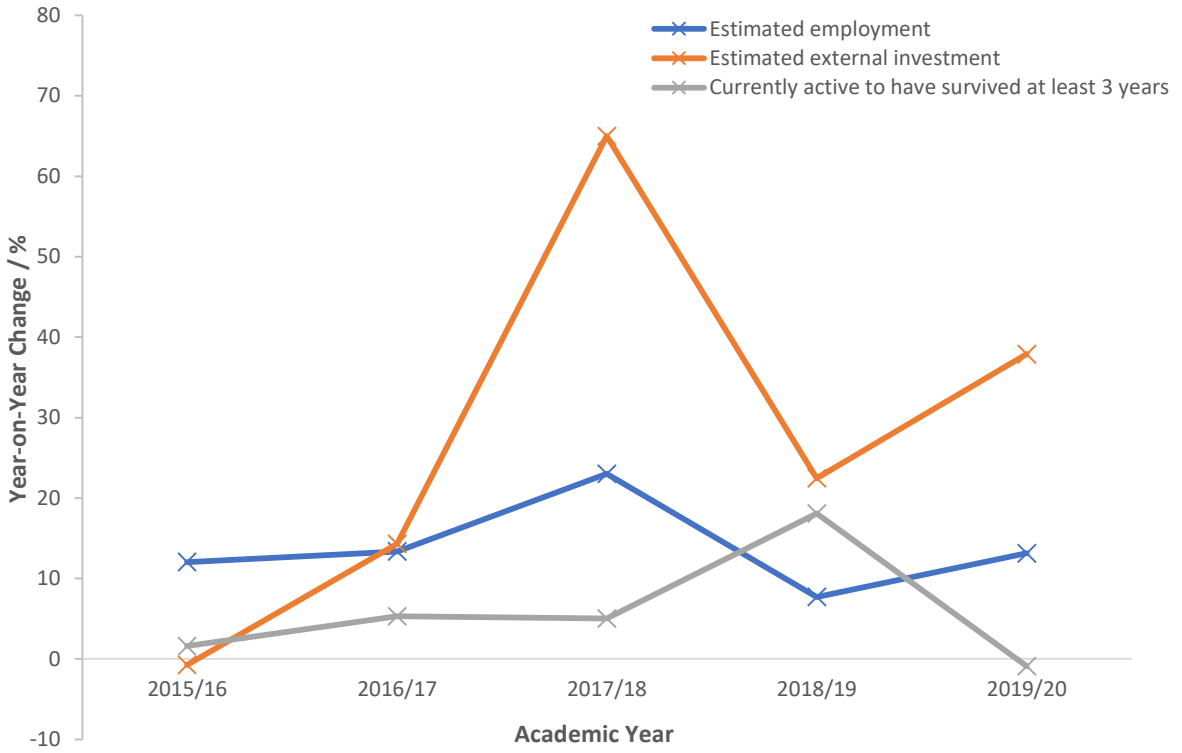


Table 1: Estimated employment, estimated external investment, and number of currently active spin-outs to have survived at least three years, for the most recent three reporting periods.

Spin-Out Metric	2017/18	2018/19	2019/20
Estimated Employment	16,595	17,872	20,221
Estimated External Investment / £Bn	1.42	1.74	2.39
Currently Active Spin-Outs to have Survived at Least 3 Years	769	908	900

33. Estimated employment and estimated external investment exhibited a significant increase in growth in 2019/20 which is of note following the slow in growth in 2018/19 in these measures. As discussed previously, the number of active spin-outs to have survived at least three years decreased in 2019/20 but by a very small absolute number and so this does not present a significant concern. It should be noted that all three of these indicators are highly influenced by institutional changes as only a few providers account for the bulk of these trends. However, these observations are indicative of continued increase in overall spin-out quality as they are attracting more business investment suggesting more confidence from business, employing more people, and creating more jobs.

Comparison of England with the UK

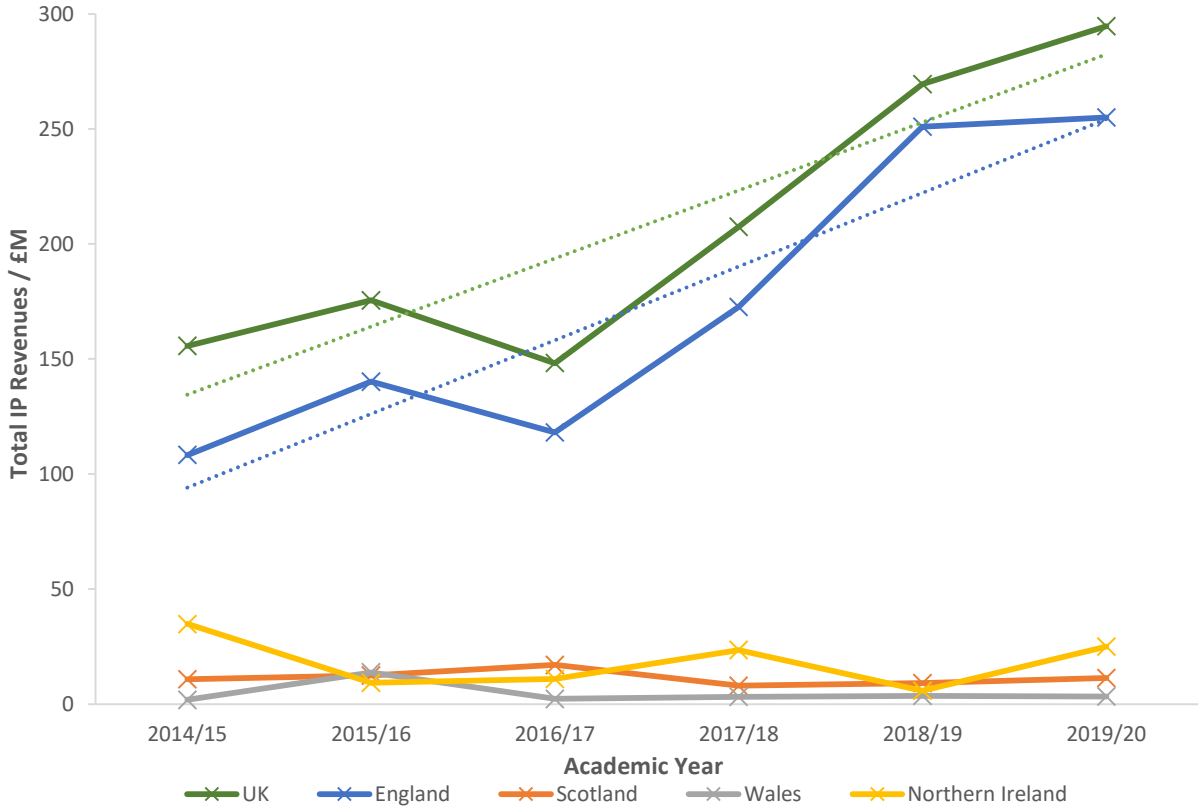
34. The total income received by English HEPs continued to increase in 2019/20 though to a slightly lesser extent to that of the UK overall with a growth of 2.5% compared to 3.1% for the UK.

35. For both the UK and England the year-on-year changes in the total income are predominantly driven by income from collaborative and contract research. In 2018/19 income from these two sources comprised 62% and 63% of the total income overall for the UK and England respectively.

36. The most significant difference between the year-on-year trends for England and that of the UK were the changes in IP income, as displayed in Figure 17. Although decreases in growth rates were observed for both England and the UK in 2019/20 compared to 2018/19, this decrease was more significant in England from 45% to 1.6%. This compares to a decrease from 30% to 9.4% in the UK which indicates there was still considerable growth in IP income. This is most likely due to a significant increase in IP income of £19m (332%) in Northern Ireland in 2019/20 compared to 2018/19. Similar to observations of significant variation in the IP income of Northern Ireland in previous years, this can be attributed to a large increase in sale of shares in spin-outs for Queen's University Belfast of 2,000%. This should be treated with caution as changes in the sale of shares in spin-outs can be unpredictable and does not necessarily reflect the broader shifts in overall IP income. However, trends in IP income in England are not dictated to such an extent by the sale of spin-out shares (discussed in more detail below), and the slow in growth of subtotal IP income to 5.0% compared with 34% in 2018/19 also contributed to the overall decline in total IP income.

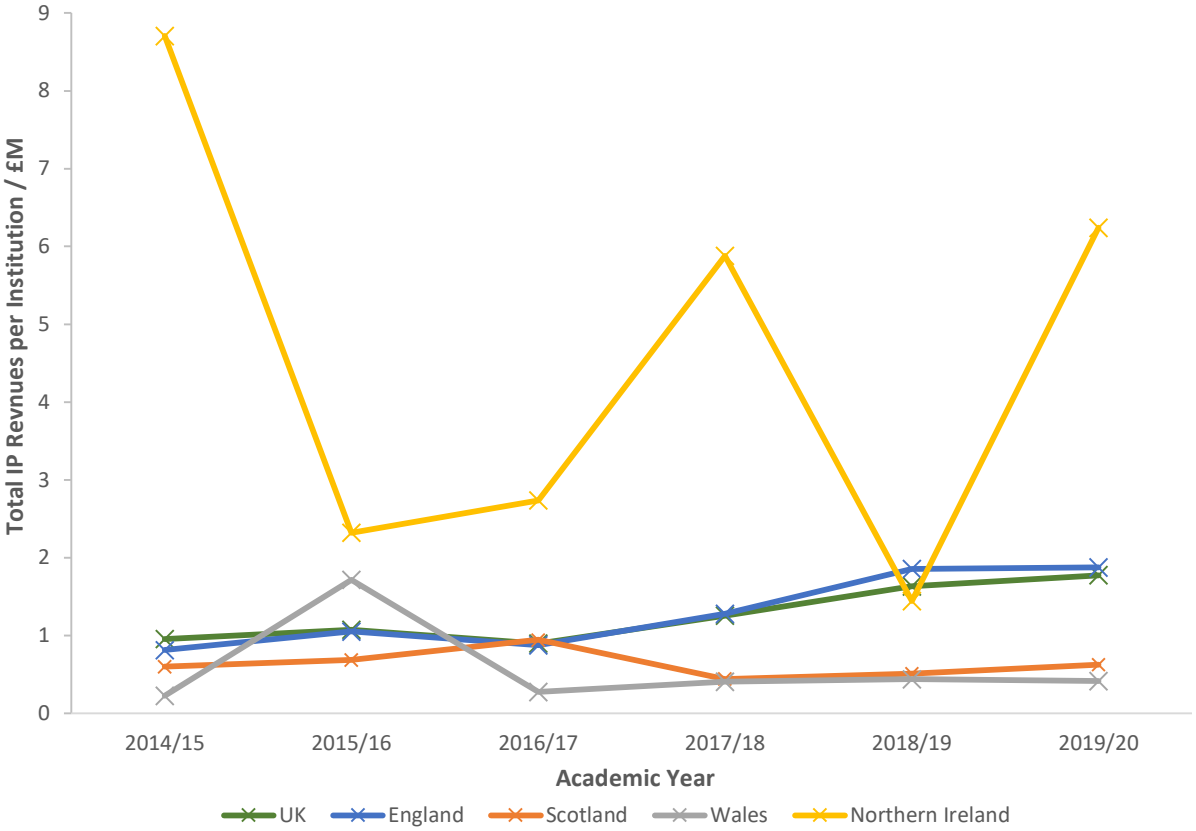
37. Conversely, the overall trend in IP income for England and the UK since 2014/15 is broadly very similar as depicted by the trendlines in Figure 17. This could be argued to be the more representative measure of IP income due to the large fluctuations that can occur at an institutional level year-on-year as a result of the sale of shares in spin-outs.

Figure 17: Total IP revenue for the UK and the devolved nations for each academic year from 2014/15 to 2019/20.



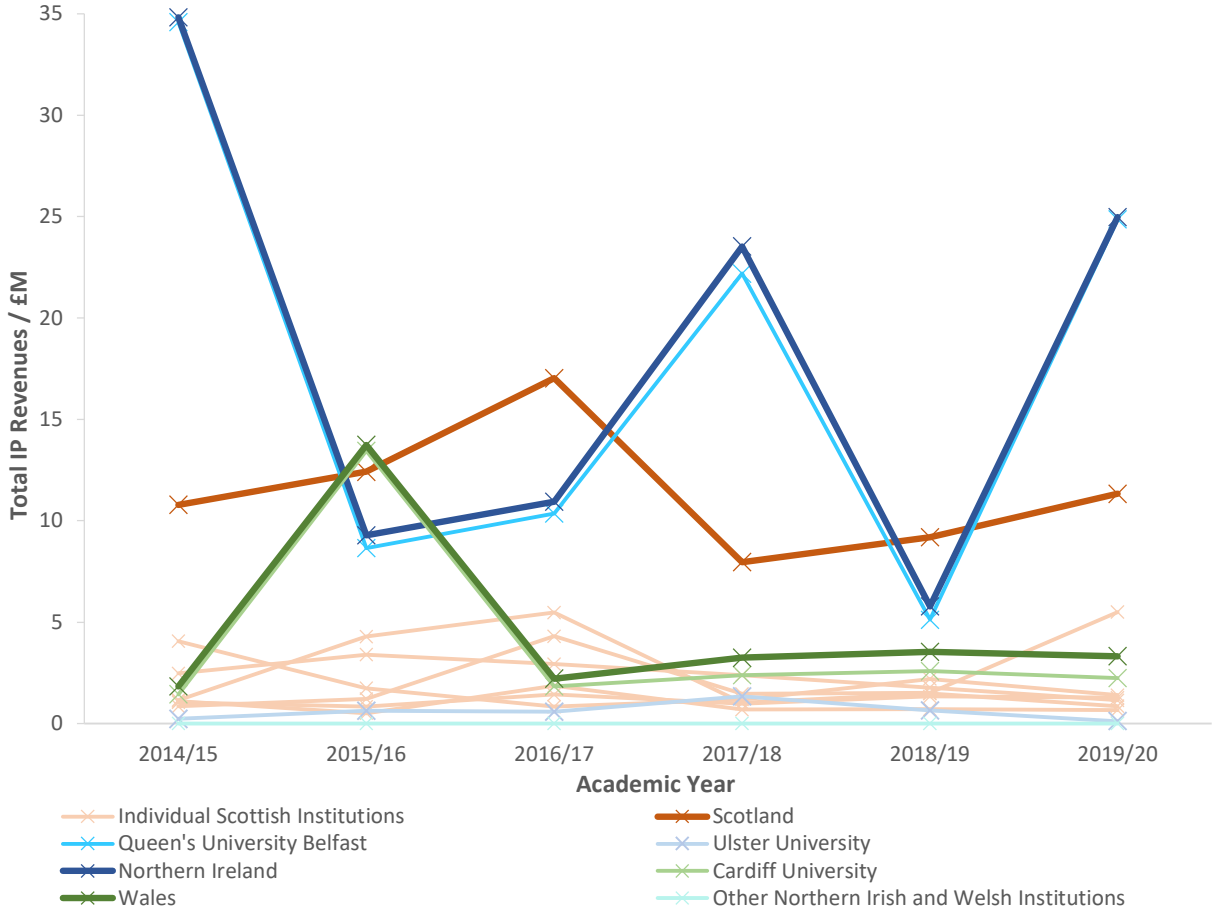
38. While this figure does show differences between the nations of the UK, it is important to be mindful of the relatively small number of providers outside of England. When the total IP income for each nation is normalised by their respective total number of providers, similar trends are observed, but performance in Scotland and Wales is more akin to that of the UK (and therefore England) as illustrated in Figure 18. However, the total IP income per provider in Northern Ireland was significantly greater than that of any other nation and the UK across most reporting periods, and this level of activity is usually dictated by changes in the income of Queen's University Belfast (see below).

Figure 18: Total IP revenue per provider for the UK and the devolved nations for each academic year from 2014/15 to 2019/20.



39. The relatively small number of providers outside of England also means that institutional changes have a greater effect on the broader trends in the devolved nations. This is demonstrated in Figure 19 where the total IP income for Queen's University Belfast is almost equal that of the Northern Irish total, and similarly the total IP income for Wales is predominantly that of Cardiff University. Changes in total IP income are often highly variable in nature due to the effect of year-to-year sales of shares, however individual providers have less of an individual impact in England due to the greater total number that generate revenue through IP.

Figure 19: Total IP revenue for Scotland, Wales, Northern Ireland, and the relevant providers for each devolved nation for each academic year from 2014/15 to 2019/20.



IP-Related International Comparisons

40. Commercialisation activities in the UK can be compared with that in the US by comparing HE-BCI data and elements of the HESA finance return, with the US AUTM Licensing Survey. Reasonable caution should be taken when comparing this data, because the US AUTM, UK HESA finance return and HE-BCI surveys are not identical, where different definitions and accounting periods are used.

41. UK data are collected by an official body, HESA. These data undergo a more comprehensive validation than data collected from the USA, which are submitted to sector-representative bodies.

42. As the number and size of higher education institutions (HEIs) varies between nations, some indicators are normalised using a measure of ‘total research resource’ (income from all sources to undertake research in the UK, or expenditure on research in the US). For example, the total research resource available is divided by the number of patents granted to give an indication of the research resource required per patent granted.

43. Comparisons of the UK and US data should be treated with caution. HESA data represents the entire UK sector whereas the AUTM data used consists of a self-selected group (in 2019/20, 146 of the approximate 1,400 that comprise the whole sector). Consequently, the identity of the institutions contributing data varies each year, including institutions with high volumes of activity and can make not insignificant contributions to the data. Thus, comparisons year-on-year should be treated as approximations.

44. With these caveats in mind, Table 2 below demonstrates that the UK is broadly comparable with the USA when research resource is taken into account. Although the total research resource for the UK decreased in 2019/20 compared to a continued increase for that of US, the commercialisation activities for the UK have continued to increase. These changes in research resource should be considered when analysing the research resource required for spin-out and patent activity.

45. Specifically, there continues to be significant growth in the number of spin-outs of 7.4% for the UK compared in contrast with a 5.3% decline in the US in 2019/20. Following the growth also observed in 2018/19 in the UK, this continues to perhaps indicate the time lag between research and commercialisation activity after a reduction in spin-out activity in previous years. The research resource per spin-out in the UK has also continued to decrease in 2019/20 in line with this growth.

46. In addition, the UK’s patenting activity continued to perform well against the US in 2019/20 with an 8.6% growth compared with 1.5% decline in the US. The research resource per patent of £4.2M remains lower than the £6.8M for the US – although changes from 2018/19 should be considered in light of the changes in research resource in both sectors. The UK also continues to compare well with the US on industry collaboration and also broadly on IP income, with continued growth in 2019/20 compared to a continued decrease in that of the US. The comparison of IP income is discussed in more detail below.

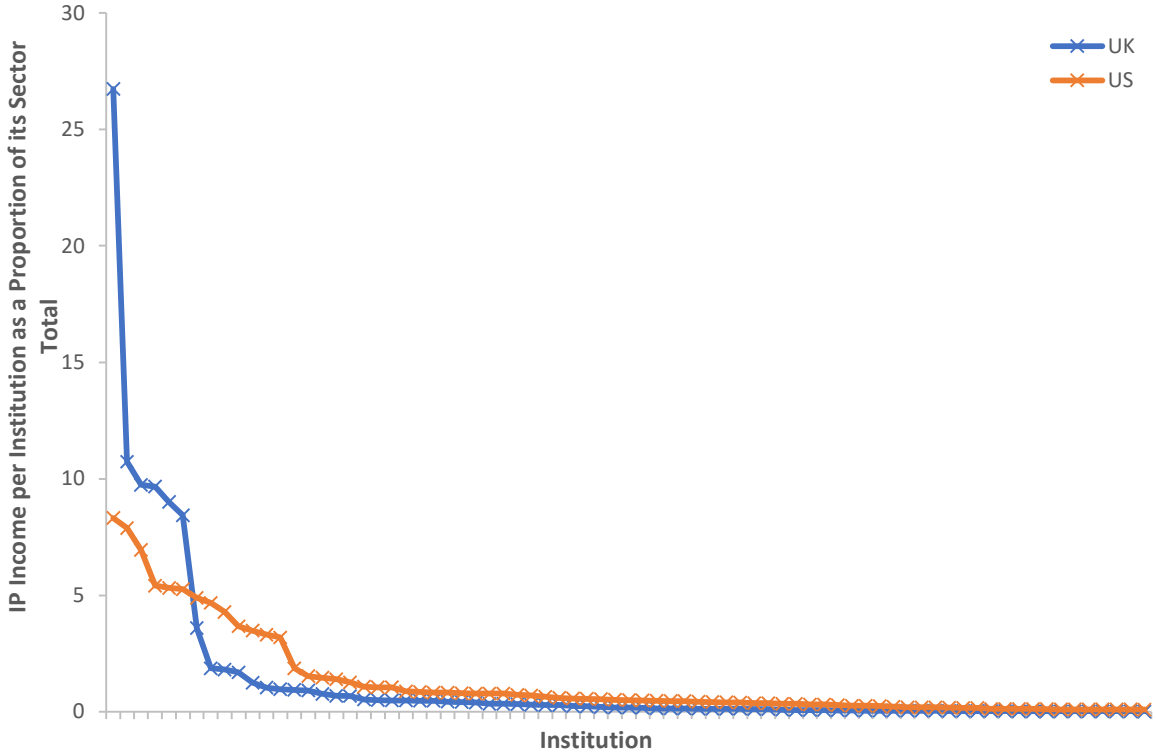
47. However, it will be important to monitor the continued relative performances of the two nations due to the lag between research and commercialisation activities that can often occur, and so it is unlikely that the effect of the decreased research resource in the UK will yet have been felt.

48. Whilst comparisons of the concentration of IP income in the US and UK are not straightforward, below is our attempt at analysing the two datasets. There are a number of caveats to this analysis which are discussed in more detail. There may be also be further alternative ways of doing this not discussed here, such as comparing groups of universities with similar characteristics.

49. One consideration is again the self-selection of institutions that report to AUTM, as this sample potentially represents more providers that conduct a larger amount of IP-related activity and therefore are more likely to opt to submit data. However, it is a reasonable assumption that most institutions in the US sector with significant IP incomes will have opted to report to the AUTM licensing survey, and therefore comparing an absolute number of institutions in the UK and the US serves as a reasonable approximation. In addition, the differing size and nature of research funding in the UK and US should be considered.

50. The distribution of IP income in both countries is generally concentrated in large, research-intensive institutions but Figure 20 below demonstrates that this is more apparent in the UK. In 2019/20, 74% of the UK's IP income was to 6 institutions whereas the 6 largest institutions in the US contributing 39% of the sector's total IP income.

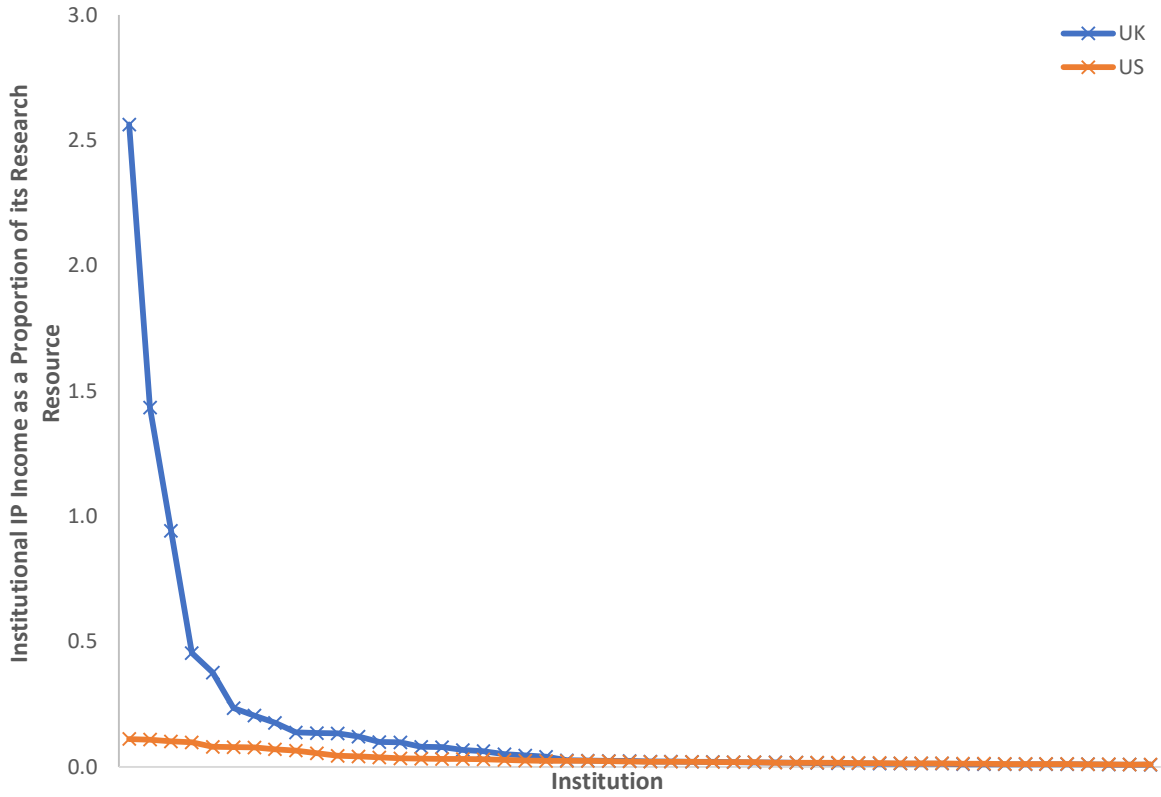
Figure 20: IP income per institution, for the 75 institutions with the greatest IP incomes, as a percentage of its sector total for the UK and the US in 2019/20.



51. The IP income for each institution can be normalised by its research resource in order to provide a more balanced comparison of the concentration of IP income in the US and UK sectors[8]. Figure 21 suggests that when the structural differences of institutions are taken into account, IP income in 2019/20 was more concentrated in the UK than the US based on the institutions submitting data.

52. When comparing this analysis to that in our previous publication, it is important to emphasise that the identity of the institutions submitting to AUTM varies year-on-year and therefore can contribute to any changes in trends. Although there are a few outlying institutions in the UK sector, more UK institutions achieve a greater return in IP income for the available research resource compared to the US.

Figure 21: IP income per institution normalised by its individual research resource in 2019/20, for the 50 institutions with the greatest normalised IP incomes, in the UK and the US.



53. Additional and more detailed information, for example, on US-UK comparisons on investment income raised by spin-outs is in the data report to the Mike Rees review.

[8] Only Institutions who returned both research resource and IP income data to AUTM were included in this analysis.

Table 2: Commercialisation activity for the US and UK 2015/16-2019/20.

	US (AUTM)					UK (HE-BCI and HESA finance record)				
	FY 2019	FY 2018	FY 2017	FY 2016	FY 2015	AY 2019/20	AY 2018/19	AY 2017/18	AY 2016/17	AY 2015/16
Total research resource (£M)	45,033	43,252	42,188	41,768	40,132	8,495	8,624	8,203	7,894	7,845
IP income including sales of shares in spin-outs (£M)	919	995*	1,345	1,248	1,240	295	269	207	148	176
IP income as percentage of total research resource	2.0%	2.3%	3.2%	3.0%	3.1%	3.5%	3.1%	2.5%	1.9%	2.2%
Spin-out companies formed	954	1,007	991	950	946	174	162	142	143	171
Research resource per spin-out (£M)	47.2	43.0	42.0	43.3	42.4	48.8	53.2	57.8	55.2	45.9
Patents granted	6,659	6,761	6,751	6,385	6,124	2,027	1,867	1,770	1,386	1,219
Research resource per patent (£M)	6.8	6.4	6.2	6.4	6.6	4.2	4.6	4.6	5.7	6.4
Industrial contribution (£M)	2,931	2,904	2,868	2,909	3,000	685	699	651	635	604
% industrial research	6.5%	6.7%	6.8%	7.0%	7.5%	8.1%	8.1%	7.9%	8.0%	7.7%
US cashed-in equity/UK Sale of spin-out shares (£M)	82.3	51.1	45.9	158.7**	45.9	83.5	61.4	44.6	36.4	35.8

*'FY' = 'Financial year'; 'AY' = 'Academic year'; 'IP' = 'intellectual property'. *Please note this figure differs to that published in the previous update report due to an error. **This figure is due to a single institution reporting a significantly increased equity for this year only.*

Further notes on Table 2 data

54. The exchange rate used is the Purchasing Power Parity (PPP) adjusted exchange rate published by the OECD (see https://www.oecd.org/sdd/prices-ppp/ for more information). The US dollar ($) to GB Pound (£) conversions for 2015 - 2019 are summarised below:

    - 2015: $1.444 to £1
    - 2016: $1.452 to £1
    - 2017: $1.465 to £1
    - 2018: $1.455 to £1
    - 2019: $1.462 to £1.

55. Note that previous international comparisons published by HEFCE in 2017 used a different methodology and as such, the published numbers for AY15-16 will differ slightly from those presented here.

56. We use data from the AUTM Statistics Access for Technology Transfer database, for US universities only, AUTM category 5U excluding hospitals and institutes that appeared in this category for 2019 only in order to maintain reasonable consistency with previous years.

57. AUTM allows for confidential returns, which have been excluded from the figures presented here. Their exclusion does not have a significant effect on the key indicators.

58. The start-up companies defined in the AUTM survey are those dependent on institutions' technology for initiation and so are equivalent to the spin-out companies recorded in the HE-BCI survey. Research expenditure is taken over the fiscal years and is taken as being the available resource for US universities.

59. Income from cashed-in equity is recorded in the AUTM survey and is assumed to be broadly equivalent to the income from the sale of shares in spin-out companies collected in the UK HE-BCI survey. For further information about the AUTM survey see https://autm.net/surveys-and-tools/databases/statt

60. The total number of UK HEI spin-out companies in Table 2 is derived from the HE-BCI survey, including those companies with some HEI ownership and those that use HEI-generated IP (formal spin-outs).

61. UK HEIs are free to use their total (research and teaching) block grant funds from funding councils for either research or teaching as they feel appropriate. Since full expenditure details for the block grant are not collected, it is assumed in this calculation that all of the research block grant funds and other research income are spent on research.

62. For the UK, HESA data on research income from industry, commerce and public corporations from UK and overseas sources is used to give the industrial contribution. For US universities, expenditure from industry is used.