Office for National Statistics

Article

Comparison of ONS business enterprise research and development statistics with HMRC research and development tax credit statistics

Guidance to help users interpret two data sources of expenditure on research and development and understand the differences between them. Outlines the impact of interim methodological improvements to how the ONS BERD statistics are compiled.

Contact:
Daniel Robinson
randd@ons.gov.uk
+44 1633 455718

Release date:
29 September 2022

Next release:
To be announced

Notice

7 October 2022

An extra sentence added to Section 5, third paragraph, for clarification on the use of HMRC data in this article.

Table of contents

1 . Main points

- The Office for National Statistics' (ONS') Business Enterprise Research and Development (BERD) statistics and HM Revenue and Customs (HMRC) research and development (R&D) statistics have different coverage and use different methods; these estimates of R&D would not be expected to fully align, however research suggests they should be closer than currently published.

- Analysis of ONS' BERD statistics shows that they could be changed to better represent smaller UK businesses, which have accounted for a growing amount of R&D activity in the HMRC statistics over recent years.

- Following interim methodological improvements to better represent small businesses, the value of expenditure on R&D performed by UK businesses according to ONS' BERD survey were £15.0 billion, £15.6 billion, and £16.1 billion higher in 2018, 2019 and 2020 respectively than previously estimated; this brings the ONS estimates closer to HMRC statistics.

- We will use these interim improvements in the next annual BERD publication released in November 2022, which will include new data for 2021.

- This work is part of a wider redevelopment of all ONS' R&D statistics due to conclude in 2024, although we expect the interim methodological improvement to be the most substantial change to the levels of business R&D.

2 . Overview

The Office for National Statistics (ONS) and HM Revenue and Customs (HMRC) have worked to understand differences between the two estimates of expenditure on research and development (R&D). These data sources are the ONS' Business Enterprise Research and Development (BERD) statistics, and HMRC's R&D Tax Credit statistics. The two datasets are compiled from different sources, for different purposes, but capture data in line with internationally recognised guidelines outlined in the Frascati Manual.

This article provides information to help users interpret both sources and understand the differences. It also outlines interim methodological improvements to how the ONS BERD statistics are compiled and the impact this will have.

Data in this article that relate to R&D tax credits are consistent with estimates published by HMRC on Thursday 29 September 2022 in their annual Research and Development tax credits publication.

3 . Comparison between sources

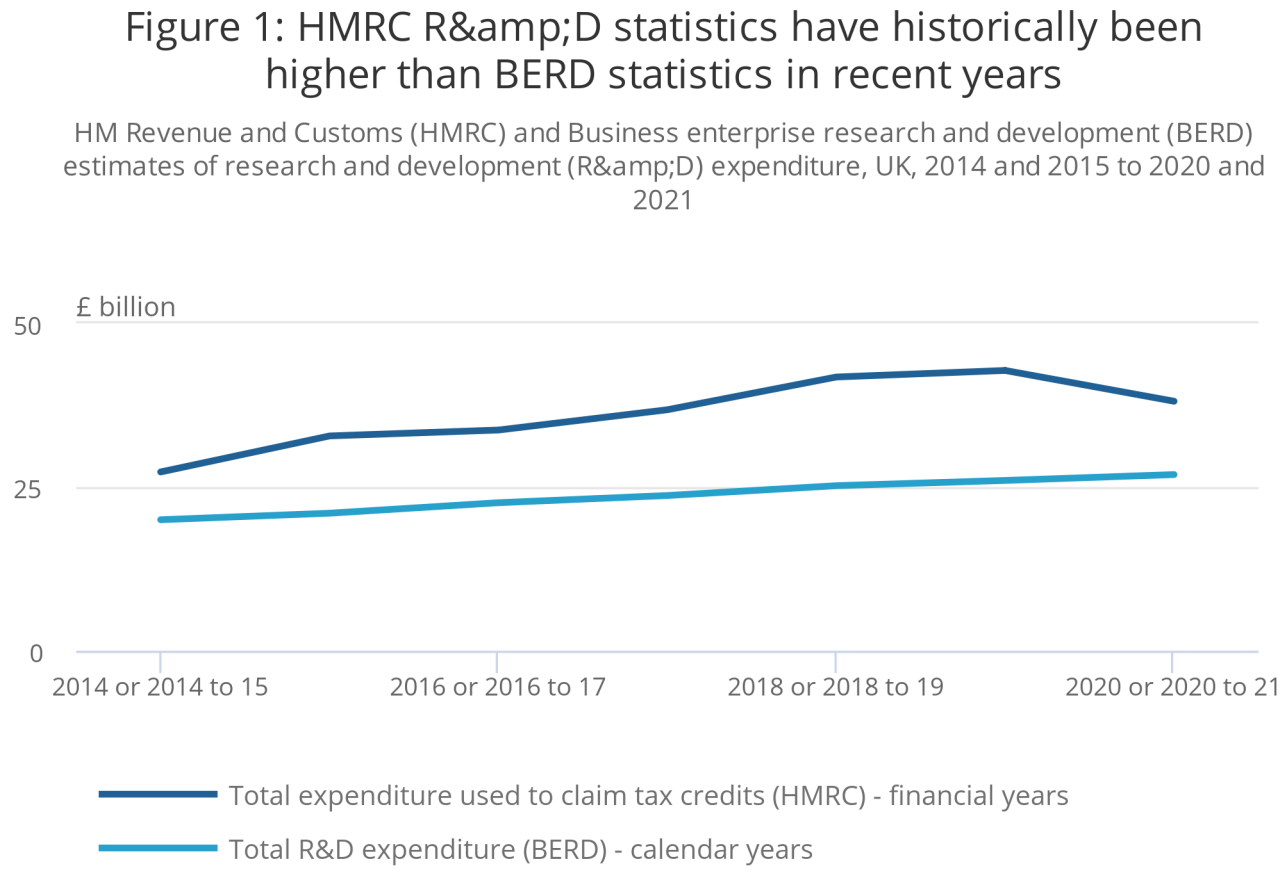
The Office for National Statistics' (ONS') Business Enterprise Research and Development (BERD) statistics are produced from an annual sample survey of 4,000 businesses in Great Britain (GB), with an additional 1,400 surveyed in Northern Ireland. A separate research and development (R&D) survey of businesses in Northern Ireland is conducted by the Northern Ireland Statistics and Research Agency (NISRA). The results are shared with ONS and aggregated with the GB BERD results to provide UK totals. The results produce estimates for the population of businesses that undertake R&D in the UK.

HM Revenue and Customs (HMRC) R&D statistics are based on administrative data where businesses have applied for and received R&D tax credits.

Figure 1 shows that the HMRC R&D statistics have historically been higher than BERD statistics and have seen a larger rate of growth in recent years. This has resulted in the HMRC R&D statistics for the financial year 2020 to 2021 being £11.2 billion (42%) higher than the BERD estimate of £26.9 billion for the calendar year 2020.

Figure 1: HMRC R&D statistics have historically been higher than BERD statistics in recent years

HM Revenue and Customs (HMRC) and Business enterprise research and development (BERD) estimates of research and development (R&D) expenditure, UK, 2014 and 2015 to 2020 and 2021



Source: Office for National Statistics - Business enterprise research and development, HM Revenue and Customs - research and development tax credit statistics

Notes:

1. Two time-period options are presented on the x axis as BERD statistics collect data on a calendar year basis, while HMRC R&D statistics collect data on a financial year basis.

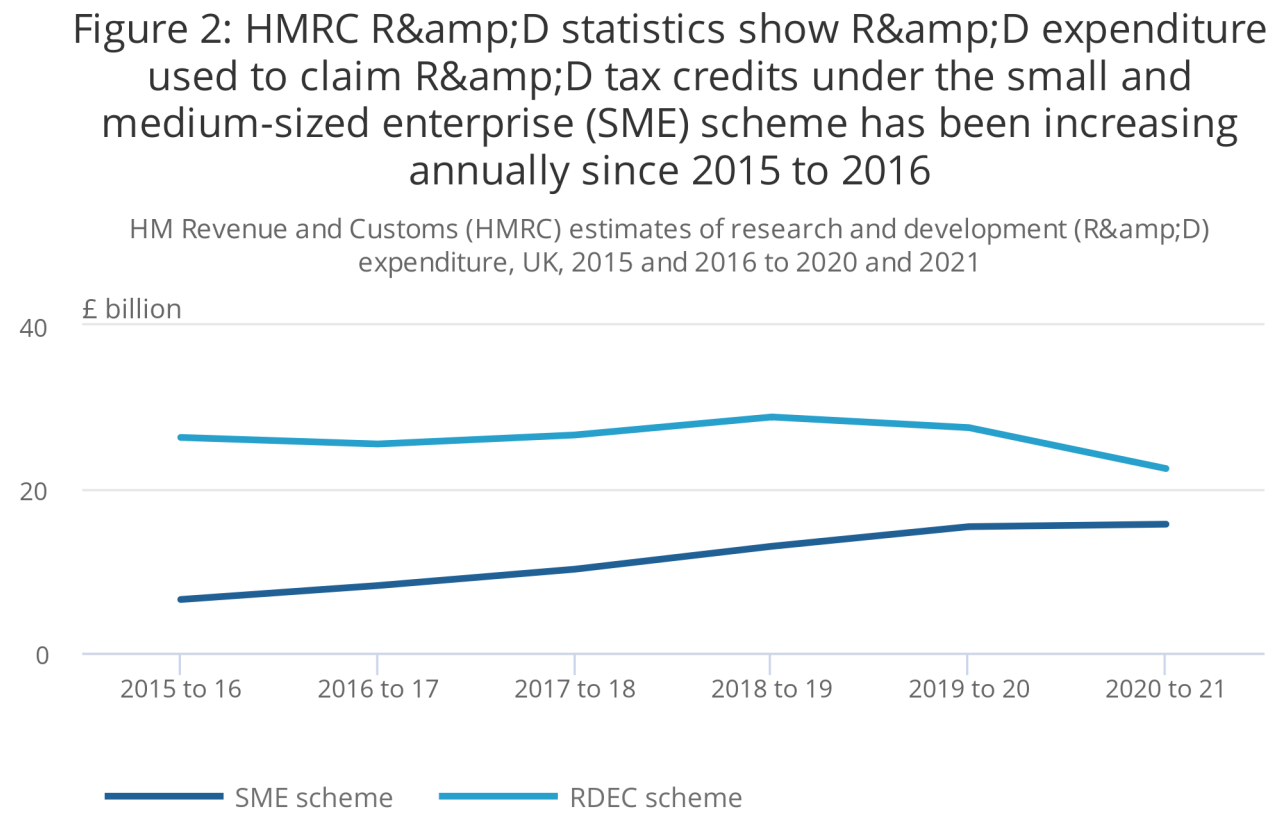
Growth in HMRC R&D statistics

A significant reason for the growth of estimated expenditure used to claim R&D tax credits has been the increase in the number and value of claims made under HMRC's small and medium-sized enterprise (SME) scheme. Under this scheme, companies can qualify for tax relief if they have less than 500 staff and either a turnover of under €100 million or a balance sheet total under €86 million. The estimated expenditure used to claim R&D tax credits under the SME scheme increased from £6.5 billion in the financial year 2015 to 2016 to £15.7 billion (140%) in the financial year 2020 to 2021.

Comparatively, there was a 5% increase in claims from the Large Company (LC) and Research and Development Expenditure Credit (RDEC) schemes from £26.3 billion in the financial year 2015 to 2016 and increasing to £27.5 billion in the financial year 2019 to 2020. However, in the financial year 2020 to 2021 expenditure estimates from RDEC claims dropped to £22.5 billion, an 18% decline compared with the previous year. This could be because of the impact of the coronavirus (COVID-19) pandemic, which may have prevented some companies from carrying out their usual levels of R&D activity. The pandemic may have also changed other business behaviour which could impact claims.

Figure 2: HMRC R&D statistics show R&D expenditure used to claim R&D tax credits under the small and medium-sized enterprise (SME) scheme has been increasing annually since 2015 to 2016

HM Revenue and Customs (HMRC) estimates of research and development (R&D) expenditure, UK, 2015 and 2016 to 2020 and 2021



Source: HM Revenue and Customs - research and development tax credit statistics

As a result of the strong growth in claims under the SME scheme, expenditure for companies claiming under the SME scheme now accounts for a larger proportion of the total R&D expenditure in 2020 to 2021 compared with 2015 to 2016. For the financial year 2020 to 2021, R&D expenditure used to claim tax credits under the SME scheme accounted for 41% of total estimated expenditure, compared with 20% for the financial year 2015 to 2016. This shows the importance of the contribution to R&D expenditure levels from both SMEs and large businesses.

International comparisons

Many countries have administrative data on R&D tax credits as well as R&D data from a survey source. It is difficult to make international comparisons because of differences in tax systems and survey methods. However, The Organisation for Economic Co-operation and Development (OECD) analysis indicates that while all countries see differences in levels and movements of the survey and administrative data sources, the majority see the survey estimate for R&D being above the administrative data source. See OECD Figure 16. Qualifying R&D compared to BERD, 2019 or latest. This suggests the current UK situation of HMRC R&D statistics reporting R&D above that of the BERD survey is unusual.

4 . Understanding the differences between both sources

The Office for National Statistics (ONS) and HM Revenue and Customs (HMRC) have worked to understand why the two sources produce different results. Our analysis has identified the main areas that explain why the outputs diverge, although not all can be quantified.

Coverage of surveys

Population of interest

HMRC research and development (R&D) statistics measure the amount of R&D expenditure used to claim tax credits, while ONS' Business Enterprise Research and Development (BERD) statistics aim to cover the total amount of R&D performed in the UK. These quantities are not the same, and the business population being covered is also different.

Movements in ONS BERD estimates should indicate changes in total R&D activity.

Movements in HMRC estimates of R&D expenditure used to claim tax credits could indicate a change in R&D activity in the economy and/or simply a change in claims for pre-existing R&D activity. For example, with new schemes and incentives or increased business awareness of the schemes.

Recent statistics from the ONS Business Insights and Conditions Survey show that not all businesses that undertake R&D plan to claim tax credits. This could be because they are not eligible, are unaware of the scheme, do not know how to claim, do not want to claim, or are receiving other support or funding.

Small businesses

The HMRC R&D statistics are based on administrative data derived from information provided by companies on the Company Tax return (CT600), with modifications made in subsequent amended returns and assessments. The CT return collects information on the enhanced level of R&D expenditure and the amount of any R&D payable tax credit.

The ONS BERD survey population is made up of businesses that have been identified to ONS via feeder questions on other business surveys such as the ONS' Annual Business Survey (ABS) as known R&D performers. A sample of businesses are contacted to collect information on R&D activity and then the results from these businesses are weighted back to the BERD survey population.

The feeder surveys used by the ONS to create the BERD population, for example the ABS, carry out a census of all large businesses (having a registered employment total of 250 employees or over) on the Inter-Departmental Business Register (IDBR). Smaller businesses are randomly sampled. This means that there will be many small businesses that have never been sampled by surveys such as the ABS. These could potentially conduct R&D but have not had the chance to be added to the BERD survey population, and therefore are not accounted for in the published BERD estimates. Essentially the BERD survey population has under coverage for small businesses. This indicates that improvements can be made so the BERD survey population is more representative of the population of small businesses undertaking R&D.

The current BERD sampling methodology has remained broadly unchanged from when the survey was first developed in the 1980s. This may have been suitable when R&D was highly correlated to business size and therefore more typically carried out by large businesses. However, the BERD and HMRC R&D statistics both show an important and growing share of R&D is conducted by small and medium-sized enterprises (SMEs). Therefore, the current approach used by BERD means there is a substantial amount of R&D carried out by small businesses that has not previously been captured in the BERD statistics.

Microdata sharing between ONS and HMRC has supported analysis of why both sources differ. The starting point was a comparison of the populations for each output, for example, the total number of businesses each source is estimating for. This showed that the ONS BERD population is comprised of approximately 40,000 businesses in Great Britain (GB) in 2021, whereas the HMRC R&D statistics represent around 84,600 UK companies in the financial year 2020 to 2021. Comparisons of the microdata showed two main findings. Firstly, for businesses in both datasets there was a good correlation regarding the total value of R&D expenditure recorded. This gave confidence that the data being collected were broadly consistent across both sources.

Secondly, where businesses were not present in the BERD population but had submitted an R&D tax credit claim, a common characteristic was that a large proportion had never been sampled by wider ONS business surveys because of the small size of their business. This re-confirmed the under coverage of small businesses on BERD.

To better represent the small business population, ONS plans to introduce an interim methodological improvement for producing BERD in the short term. Further detail of the methodology (Section 5) and impact of these changes (Section 6) are covered later in this article. Once the improvement is introduced, this should no longer be a factor in the difference between the HMRC and ONS statistics.

Industrial

The use of feeder surveys to inform the BERD population introduces additional complexities. Surveys like the ABS focus on certain sectors of the economy. The ABS captures the non-financial economy, therefore does not identify businesses from the financial sectors that carry out R&D. These sectoral constraints may lead to under coverage in the BERD statistics in these sectors, and further explain the difference with the HMRC R&D statistics.

R&D performed overseas

Both sources collect data on the value of R&D performed by UK businesses, however there are conceptual differences between what is in scope for each source that should be considered when comparing outputs.

ONS' BERD survey collects and includes the value of R&D performed by UK businesses operating overseas, but only where the work is regarded as UK owned and controlled, not necessarily purchased externally. This is the correct concept to follow for the purpose of measuring R&D in the UK National Accounts.

For the purposes of claiming R&D tax credits, purchases of R&D overseas by UK businesses can be eligible, with slightly different rules in the two schemes. These include where the R&D activity is not being performed in the UK or by a UK-owned business. This purchased R&D activity would be included in HMRC's estimates of R&D expenditure where it is part of a tax credit claim but would not be reported as performed R&D in the UK BERD survey.

HMRC has produced statistics based on recent research of businesses' R&D expenditure. These indicate that in the financial year 2019 to 2020, the level of qualifying expenditure on overseas R&D for which tax credits were claimed was 5% (£2 billion) of the total. This expenditure will not be recorded in BERD and is one of the main reasons why the figures from both sources will never equate.

Error and fraud in tax credit statistics

In addition to the methodological differences there may be erroneous or fraudulent R&D tax credit claims present in the HMRC R&D statistics that will contribute to a higher estimate of expenditure on R&D. HMRC estimates that 4.9% of the overall estimated cost to the Exchequer of R&D tax reliefs is attributable to error and fraud, with a level of 7.3% for businesses claiming under the SME scheme and 1.1% among businesses claiming Research and Development Expenditure Credit (RDEC) relief. This equates to £469 million overall (£430 million from the SME scheme and £39 million from the RDEC scheme) for the financial year 2021 to 2022.

Other measurement differences

Communication of definitions

Both BERD and HMRC R&D statistics use internationally recognised definitions outlined in the Frascati Manual to define R&D. Both outputs have different ways to communicate these and what should be in scope is open to an individual's interpretation of the guidance. This can lead to differences, although it is not possible to quantify how much of the difference between sources is because of different interpretations of the guidance.

Sampling error

As a survey, BERD is based on a sample of responses from the population rather than information from all businesses in that population, as this is timelier and more cost-effective. This brings uncertainty as to how close the estimates are to the true population value. ONS are developing confidence intervals for the BERD estimates to be published in November 2022 to help users to understand the degree of confidence in the outputs and how much this may contribute to differences with the HMRC R&D statistics.

Weighting error

HMRC R&D statistics are produced at a point where claims for R&D tax credits for the year in question can still be submitted. The statistics for the most recent year are grossed up to account for returns that are expected to be submitted. This means that the HMRC R&D statistics for the latest year (currently financial year 2020 to 2021) are provisional and subject to uncertainty. The uncertainty may also contribute to differences with the ONS BERD estimates.

Time period

BERD and HMRC R&D statistics collect data for different time frames. At the highest level, BERD statistics collect data on a calendar year basis, while HMRC R&D statistics collect data for businesses with an accounting year end that falls within a financial year. There are some exceptions to this, with businesses able to report in the BERD survey on a different time period if the correct time period is unavailable. Analysis indicates that in most years this difference would be small. The period from 2020 onwards may see greater differences because of the UK coronavirus (COVID-19) lockdowns, which fell into different calendar or financial years.

5 . Interim methodological improvement to Business Enterprise Research and Development (BERD) statistics

Improving coverage of smaller businesses would ideally be done at the point of collection, but for data already collected this is not feasible. Improving the methods retrospectively is difficult, especially when the period covered includes the coronavirus (COVID-19) pandemic during which business behaviour will have differed. A wide range of methods to adjust for the under coverage issue were considered, and the final approach has been peer reviewed and agreed by methodological experts and by one of the Office for National Statistics (ONS) Economic Expert Fellows.

To account for the under coverage in the Business Enterprise Research and Development (BERD) survey population we have compared the number of R&D businesses identified by the BERD survey with the number identified by the Annual Business Survey (ABS).

The BERD statistics represent approximately 30,000 businesses – but the ABS identifies far more businesses that do R&D using the same definition. As the ABS only asks whether the businesses do R&D, and not the amount, we checked to confirm the average amount of R&D activity was the same for R&D businesses identified by both the ABS and BERD surveys. This was done by matching two years of ABS and BERD data to HM Revenue and Customs (HMRC) R&D statistics and calculating both the median and mean values. This step was for checking purposes only, the HMRC R&D tax credit data was not used in the calculation of our uplift factors.

This meant that the difference between the estimates of the number of R&D businesses identified by the two surveys could be used to uplift or weight the BERD statistics. This uplift directly accounts for the growth in R&D activity recently seen in small to medium-sized business, which had not yet had time to feed into the BERD population. This under coverage of R&D activity is not seen in larger businesses, so the uplifts were calculated by sizeband to account for this. Additionally, the growth in activity had different trajectories in different industries, so the uplifts were also calculated by the BERD Published Product Groups (PPG).

This resulted in uplifts by sizeband by PPG, which were then applied to published BERD statistics at these same levels to create a granular and proportionate adjustment to the level of BERD statistics. The BERD data for Northern Ireland were uplifted in a very similar way.

The final step was to maintain the published growth in BERD statistics over the years, as the uplifts were designed to adjust levels and not growths. So, after adjusting the level of 2018 BERD statistics, the last pre-coronavirus pandemic year, when both BERD statistics and uplift calculations were considered to be most robust, the published BERD growths 2018 to 2019 and 2019 to 2020 were used to calculate 2019 and 2020 adjusted statistics.

Conditional on the UK-level growths being protected, the published growths in PPG and devolved administration statistics were maintained as far as possible.

This interim solution will be used for the estimates due to be published in November 2022. Work is underway to develop more robust sampling methods for drawing the BERD sample for the 2022 reference period which will be published in November 2023. We expect, though, the interim methodological improvement to be the most substantial change to the levels of business R&D.

We welcome comments on the approach we have taken, particularly to inform our longer-term development work. Please send any comments to Annual.Developments@ons.gov.uk.

6 . Impacts of interim methodological improvement

Impact on Business Enterprise Research and Development (BERD)

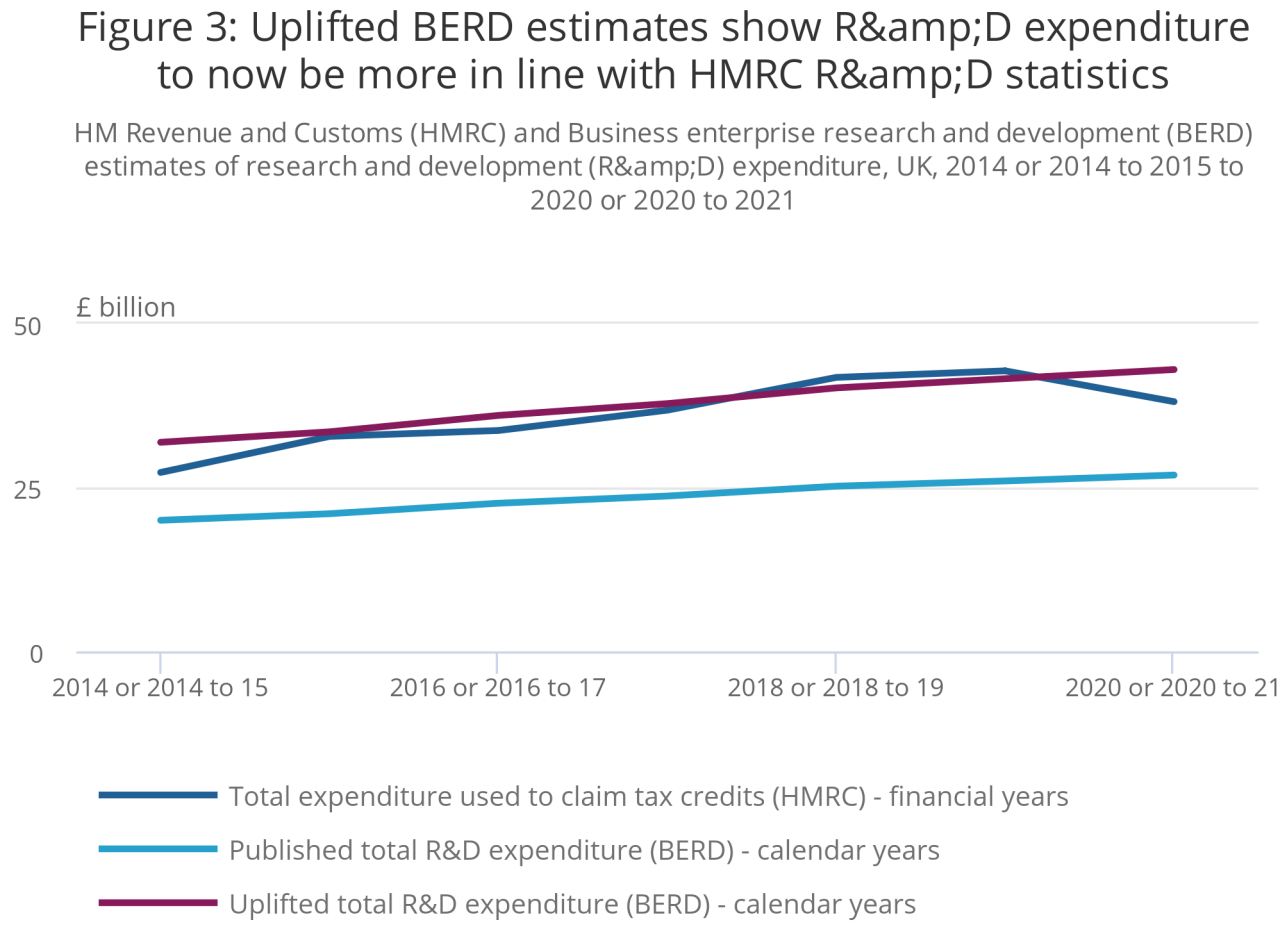
To illustrate the impact of the under coverage in the BERD survey population, the methodology outlined in Section 5 has been applied to published BERD estimates from 2014. The uplift has been applied in 2018 only and published BERD growth rates preserved and applied to this to compile the other years (Figure 3). In 2018 there was a change in the research and development (R&D) filter question on the Annual Business Survey (ABS) which may introduce an inconsistency in the approach between periods prior to 2017 and 2018 onwards.

In the most recent period, the value of expenditure on R&D performed by UK businesses in 2020 would be approximately £43.0 billion compared with £26.9 billion that was previously published in BERD. This equates to an underestimate of approximately £16.1 billion.

Comparing this to HM Revenue and Custom's (HMRC's) latest estimate, the uplifted BERD estimates for 2020 are above those for the equivalent financial year (2020 to 2021). In this most recent year, HMRC's estimates fall while the BERD estimates rise. As discussed in Section 4, there are several other reasons why this could be the case. International experiences also indicate that such fluctuations sometimes occur. See Organisation for Economic Co-operation and Development (OECD) Figure 19. Trends in BERD and government tax and direct support for BERD, 2000 to 2019.

Figure 3: Uplifted BERD estimates show R&D expenditure to now be more in line with HMRC R&D statistics

HM Revenue and Customs (HMRC) and Business enterprise research and development (BERD) estimates of research and development (R&D) expenditure, UK, 2014 or 2014 to 2015 to 2020 or 2020 to 2021



Source: Office for National Statistics - Business enterprise research and development, HM Revenue and Customs - research and development tax credit statistics

Notes:

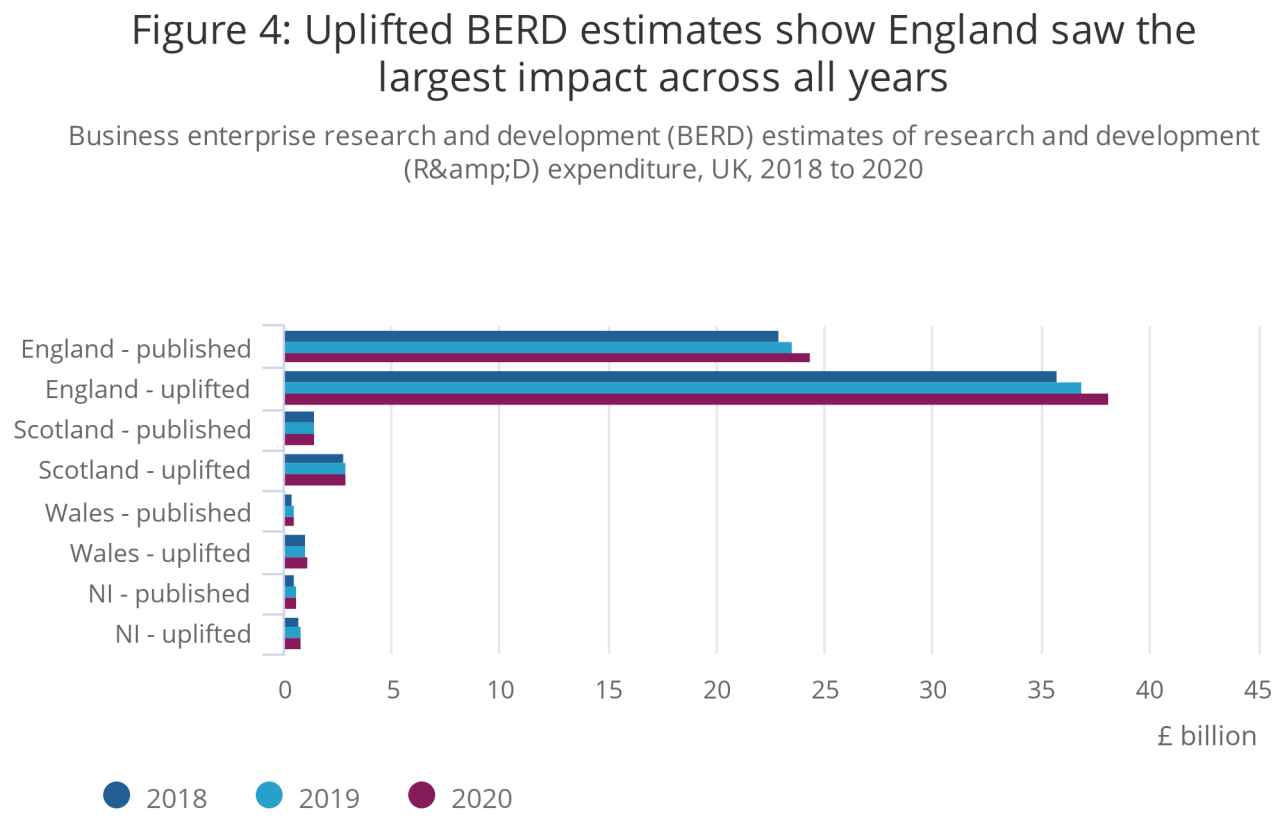
1. Two time-period options are presented on the x axis as BERD statistics collect data on a calendar year basis, while HMRC R&D statistics collect data on a financial year basis.

Analysing the data broken down by country (Figure 4) shows that England has the largest value increase from this enhanced methodological approach with data being revised upwards by £13.8 billion to £38.2 billion in 2020. The estimate for the value of expenditure on performed R&D for both Scotland and Wales would more than double, increasing by £1.5 billion and £0.6 billion respectively in 2020.

The Office for National Statistics (ONS) have also been working with the Northern Ireland Statistics and Research Agency (NISRA). NISRA produce R&D statistics for Northern Ireland and compile data in a similar way to the ONS, therefore published BERD estimates for Northern Ireland are also underestimated. NISRA have adopted the method outlined in Section 5 and applied this to their own estimates, showing an increase of £0.2 billion in 2020.

Figure 4: Uplifted BERD estimates show England saw the largest impact across all years

Business enterprise research and development (BERD) estimates of research and development (R&D) expenditure, UK, 2018 to 2020



Source: Office for National Statistics - Business enterprise research and development

Wider impacts

BERD estimates feed into the Gross Domestic Expenditure on Research and Development (GERD) statistics. The interim methodology for BERD outlined in Section 5 will be incorporated into the GERD release.

BERD estimates also feed into National Accounts outputs. To compile the UK National Accounts, which include important economic statistics such as Gross Domestic Product (GDP), a large number of sources are used. In accordance with the National Accounts revision policy, revisions to source data are taken into the national accounts within an annual cycle which culminates in an annual publication known as the Blue Book.

Timing and decisions around the scope of Blue Book changes sometimes result in a period of inconsistency between source data statistics and numbers delivered into the national accounts. The earliest opportunity to provide revised BERD estimates will coincide with completion of the next stage of development, including new sampling methodologies which will be in place for BERD, published in November 2023. At this stage we are unable to quantify the impact of these changes on GDP; R&D is a small component of GDP. The implication of this is for a period of time following the publication of results in November 2022, BERD estimates will be inconsistent with Research and Development statistics in the national accounts. We will implement our improved R&D estimates at the earliest opportunity into the national accounts.

7 . Future developments

The Office for National Statistics (ONS) are committed to improving the quality of data across its suite of business surveys to ensure they remain relevant and responsive to user needs. The first stage of this work focuses on the research and development (R&D) surveys by addressing the under coverage in the BERD survey population as outlined in this article.

The methodology outlined in this article to account for the under coverage in Business Enterprise Research and Development (BERD), will be implemented and used to compile estimates for the 2021 reference period. These estimates will be published in the next BERD release scheduled for 17 November 2022. Although a significant improvement, this should be considered an interim solution. Work is now underway to develop new sampling methodologies for BERD which may lead to future revisions, although we anticipate these not to be on the same scale as outlined in Figure 3.

As described in our most recent Gross Domestic Expenditure on R&D (GERD) release, we have been reviewing data sources used to measure R&D activity in the higher education sector and have identified a new, more comprehensive data source. We will be looking to incorporate it into the next GERD release also scheduled for publication on 17 November 2022. This release will also include the revised BERD estimates from 2018 onwards.

We aim to enhance the R&D surveys due to be dispatched in 2023 by moving data collection online and exploring additional questions or breakdowns in response to user feedback gathered earlier this year. We aim to use more modern data collection technologies to ensure we can respond more promptly to changes in future.

8 . Related links

Business enterprise research and development, UK
Bulletin | Released 19 November 2021
Annual research and development (R&D) spending and employment by UK businesses, including data by product category and industry, civil and defence, and regional spread.

Business Enterprise Research and Development Survey QMI
QMI | Released 20 November 2020
Quality and Methodology Information for UK business enterprise research and development statistics, detailing the strengths and limitations of the data, methods used, and data uses and users.

The Power of Innovation: How the ONS is transforming R&D statistics
Blog | Released 21 September 2022
How the Office for National Statistics (ONS) are enhancing the research a development (R&D) statistics we collect, which includes improvements to methodology, the questions we ask businesses, and the sources for our data.

Corporate tax: Research and Development Tax Credits
National statistics | Released 29 September 2022
These statistics provide information about Research and Development Tax Credits, their cost, and the nature of the companies claiming them.

9 . Cite this article

Office for National Statistics (ONS), released 29 September 2022, ONS website, article, Comparison of ONS business enterprise research and development statistics with HMRC research and development tax credit statistics