Office for National Statistics

Sources and methods for public service productivity estimates

Sources and methods information for the Public service productivity: total, UK publication, detailing the main concepts, output and inputs measures by service area.

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1 . Summary

This article sets out the sources and methods used to construct estimates of productivity for total public services, most recently presented in Public service productivity: total, UK, 2019. It contains a summary of the data sources used and a breakdown of how the Office for National Statistics (ONS) calculates estimates of productivity in each service area.

In addition to the annual statistics, we also publish quarterly estimates. While this article focuses on the sources and data used for the annual statistics, a summary of the main differences between annual and quarterly is included in Section 9.

For recent methodological changes, refer to Improved methods for total public service productivity: total, UK, 2019 . Further information on the methodology used and details on the strengths and limitations are included in Public service productivity: total, UK Quality and Methodology Information (QMI).

The main concepts and methods common to all service areas are explained in this section, with specific detail on each service area's output and inputs measures contained in Sections 2 to 8.

Productivity

At the most aggregate level, productivity is the measure of how many units of output are produced from one unit of inputs and is calculated by dividing total output by total inputs. Adopting P, O and I to indicate productivity, output and inputs respectively, and including a subscript *t* for time periods:

$$P_t \ = \ \frac{O_t}{I_t}$$

Total public service output and inputs indices are calculated by aggregating output and inputs for the following service areas:

- healthcare

- education

- adult social care

- children's social care

- social security administration

- public order and safety

- police

- defence

- other government services (this includes general government services, economic affairs, environmental protection, housing, recreation, and other public order and safety)

Total public service productivity is then calculated by dividing this index of output by the index of inputs.

Statistics are published on a UK geographic basis from 1997 to the latest available year, usually two years prior to the publication date.

Output and inputs indices for each service area are aggregated together using their relative general government (combined central and local government) expenditure weight, using data from the UK National Accounts on a Classification of the Functions of Government (COFOG) basis.

Quantity output

Different measurement techniques for output are adopted for different service areas.

For most service areas, output is measured in direct volume terms by the number of activities performed by that service area. Activities are weighted together into a cost-weighted activity index (CWAI). The CWAI calculates the change in the number of activities undertaken, weighting each activity by its cost such that a change of one unit of activity for a high-cost activity has a greater effect on the output than a change of one unit of activity for a low-cost activity. Healthcare and education, as well as adult social care, children's social care, social security administration, and public order and safety, all involve some degree of direct volume measurement in the form of a cost-weighted activity index (CWAI).

Three service areas (police, defence and other public services) are largely "collective" services, and therefore output from these sectors is more difficult to measure directly. Instead, an "output-equals-inputs" convention is applied, where output volume is assumed to equal the volume of inputs used to create them. In this case, productivity is constant.

Within healthcare, we assume that approximately 14% of output is measured indirectly; this output is services delivered by non-NHS providers. It is worth noting that inputs and output are also equal for GP prescribing, however, in this case we calculate the volume of outputs directly with cost-weighted activity.

Similarly, within children's social care, we assume that "output-equals-inputs" for approximately 33% of its output; this output relates to "non-looked after" children, excluding safeguarding.

In total, approximately 41% of output is measured using the "output-equals-inputs" convention, the other 59% is measured directly. All figures stated here refer to Public service productivity: total, UK, 2019.

In our publications, "quantity output" and "non-quality-adjusted output" have the same meaning.

Quality adjustment

Where data are available and relevant, output measures are quality adjusted. Quality adjustments are currently applied to five service areas: healthcare, education, children's social care, adult social care, and public order and safety.

A quality adjustment is, in its simplest terms, a statistical estimate of the change in the quality of a public service. This provides a more accurate picture of the link between output and the desired outcomes, for example, increased attainment in GCSE-level attainment scores for the education service area. In the market sector, quality is accounted for through differences in the prices of goods and services. However, in the non-market sector, there is no market price therefore prices cannot be used. For more detail on quality adjustments, see A guide to quality adjustment in public service productivity measures.

The reasons for quality-adjusting public service output are well-documented and follow from recommendations made in the Atkinson Review (PDF, 1.07MB).

"Quality-adjusted output" describes this concept in our publications.

Inputs

Inputs comprise volume estimates of labour, goods and services (intermediate inputs), and capital assets used in delivering public services. These series are aggregated together to form an overall estimate of the volume of inputs used to provide each of the public services identified in the total public service productivity articles.

For most service areas, inputs are measured indirectly by using current expenditure adjusted by a suitable deflator. In some areas inputs are measured directly, such as the number of full-time equivalent staff.

Deflation

Where direct inputs volume measures are unavailable, or indirect volume measures are more precise, expenditure from the UK National Accounts are deflated by an appropriate price deflator in order to remove the effect of price inflation. Examples of common deflators are the GDP Price Deflator (YBGB), the Index of Labour Costs per Hour (ILCH) and Average Labour Compensation per Hour (ALCH). Where appropriate (for example, common deflators are unavailable or are weak approximations of price inflation for specific service areas) composite deflators are constructed.

Composite deflators are constructed by sourcing more relevant data on the prices and quantities of specific inputs. The changes in the prices of different inputs are aggregated into a Paasche price index, which weights the changes in prices by their relative volumes in the current year.

For example, the growth in average gross pay for different fire and rescue staffing groups (a price change in labour) are weighted together using staffing numbers (the quantity) to create a composite labour deflator. This better approximates the overall price changes in labour for a service area with fairly homogeneous labour inputs.

Public sector procurement data for different service areas are used to create composite intermediate consumption deflators that better reflect price changes in the cost of goods and services relevant to specific service areas. Procurement data are sourced from the Subjective Analysis Return, which is published as an annex to Local authority revenue expenditure and financing.

Therefore, where inputs are measured indirectly, revisions to inputs estimates can result both from changes to expenditure and changes to the deflator used.

Splining

Where data are received on a financial or academic year basis a recognised statistical technique known as splining is used. This technique allows academic year volume estimates and annual financial spending measures to be split into monthly data, which are then re-aggregated to create calendar year figures.

Index numbers

Indices can be used to determine how changes in the monetary value of economic transactions can be attributed to changes in price (to measure inflation) and changes in quantity (to measure sales volume or economic output) over time. Different indices are used depending on the data type and purpose. The approach taken is consistent with ONS methodology guidance, the Consumer Prices Indices technical manual and calculations carried out in the UK National Accounts.

Volume activity series are constructed using a cost-weighted Laspeyres index (base year-weighted arithmetic mean).

This method follows the formula:

$$Q^{0,t}_{Laspeyres\ volume} = \frac{\sum_{i=1}^{n} q_i^t \cdot p_i^{t-1}}{\sum_{i=1}^{n} q_i^{t-1} \cdot p_i^{t-1}} = \sum_{i=1}^{n} w_i^{t-1} \cdot \widetilde{R}_i^{t-1,t}$$

Where w_i^t is the value share of item i in the base period 0, and $R_i^{t-1,t}$ is the volume relative (the ratio of the quantity of an activity to the quantity of the same activity in the base period).

In the context of public service output the weights (w_i) are indicative of the relative value of different activities. Unit costs can be used to approximate the "price" of an activity (p_i) given the difficulty of accurately estimating the relative social and economic value of different activities. However, in practice, expenditure shares from public finance data are generally used to approximate relative value (w_i) of activities. The weights for different activities are those taken from the first year of each activity pair (the base year 0).

For example, if we were combining activity series for each of the devolved UK nations for 2010, we would weight each of the activity growths from 2009 to 2010 for England, Scotland, Wales or Northern Ireland by their respective expenditure shares in 2009.

Where prices indices (for example, deflators) are weighted together, these are constructed using Paasche indices (current year-weighted harmonic mean).

This method follows the formula:

$$P^{t-1,t}_{Paasche\ Price} = \frac{\sum_{i=1}^{n} p_i^t \cdot q_i^t}{\sum_{i=1}^{n} p_i^{t-1} \cdot q_i^t} = \frac{1}{\sum_{i=1}^{n} \frac{w_i^t}{R_i^{t-1,t}}}$$

where w_i^t is the value share of item i in the current period t, and $R_i^{t-1,t}$ is the price relative (the ratio of the price of a good or service to its price in the base period).

For example, data on price changes in the cost of labour, goods or services and their quantities are used to construct composite price indices. Nominal expenditure data are deflated to real expenditure by dividing by the appropriate price index.

Further guidance on indices methodology can be found at ONS's index numbers guidance.

Comparability

Unlike other measures of productivity produced by the ONS, public service productivity estimates include goods and services, as well as labour and capital, as inputs. This is necessitated by the fact that public service output measures are gross output (total output) measures, rather than value added measures as used in labour productivity and multi-factor productivity, meaning that estimates are not comparable. For more information on how to compare the three measures of productivity, see, How to compare and interpret ONS productivity measures.

2 . Healthcare

A detailed explanation of the data sources and methods used to calculate public service productivity estimates for healthcare is given in [Sources and methods for public service productivity estimates: healthcare](#) and more information on the quality and methodology can be found in [Public service productivity estimates: healthcare QMI](#).

Quantity output

The quantity of healthcare is estimated using data on a range of healthcare services provided within:

- hospital and community health services (HCHS); this includes hospital services, community care, mental health and ambulance services

- primary care services, formerly known as family health services (FHS); this includes general practice, publicly funded dental treatment, and sight tests

GP prescribing; this includes prescription drugs dispensed in the community

- on-NHS provision; this includes healthcare funded by the government but provided by the private or third sector and is indirectly measured using the "output-equals-inputs" approach

Of these components, HCHS, primary care services and GP-prescribing output are all measured using data on the number of activities undertaken and their unit costs by service type in a cost-weighted activity index (CWAI). Healthcare quantity is aggregated first by country, and then into a UK aggregate using a cost-weighted Laspeyres index.

HCHS and primary care services activity data used in the output calculations are [adjusted to account for the fluctuations caused by year-to-year changes in the number of working days and total days](#).

[Several methodological improvements](#) were made to the measurement of output for general practice, dental and ophthalmic services from financial year ending (FYE) 2018 onwards. Collectively, along with the far smaller element of NHS web and phone services, these services comprise primary care services.

To measure healthcare output growth between FYE 2019 and FYE 2020, [alternative data sources have been introduced](#) to estimate growth for some services within HCHS, while in previous years NHS England's National Cost Collection (NCC) has been used as the main data source. This choice was made because of the changes to data collection and challenges presented by the coronavirus (COVID-19) pandemic, which affected the comparability of these data between FYE 2019 and FYE 2020 for some services.

Details of the changes can be found in our [methods article](#), and they affect:

- elective care, day-cases and non-elective care

- critical care

- accident and emergency

- mental health care

- ambulance services

- community health services

- high-cost drugs

Note that, as in previous publications, non-NHS provision is calculated using the same deflated expenditure data that are used to calculate inputs and is therefore an "output-equals-inputs" component. The CWAI produced for GP-prescribing is also used in the inputs on an "output-equals-inputs" basis. Therefore, both non-NHS provision and GP-prescribing do not contribute to changes in productivity.

Data sources and geographic coverage for healthcare quantity output:

For hospital and community health services, we include information on inpatients, day cases, and outpatients. For each of these sectors, data from England, Wales, Scotland and Northern Ireland are available. The sources and the time-coverage are:

- NHS Resource Centre from 1997 to 1998 for England

- Welsh Government analysis from 2004 to 2005 for Wales

- Scottish Government analysis from 2004 to 2005 for Scotland

- DH NI (Department of Health Northern Ireland) analysis from 2003 to 2004 for Northern Ireland

For primary care services, we include information on ophthalmic and dental services, and GP consultations. For all these services, data from England, Scotland and Northern Ireland are available. The source and time-coverage are:

- the General Ophthalmic Council and the General Dental Council for England

- GP consultations survey data for England from the period 1997 to 1998 to the period 2007 to 2008, and from the period 2018 to 2019; imputed data from the period 2008 to 2009 to the period 2017 to 2018

- ophthalmic and dental services from Scottish Government analysis from 2004 to 2005 for Scotland

- GP consultations from Scottish Government analysis from the period 2004 to 2005, to the period 2013 to 2014 for Scotland

- DH NI analysis from 2003 to 2004 for Northern Ireland

For GP drugs, we include information on prescriptions, for which data is available from England, Wales, Scotland, and Northern Ireland. The sources and time-coverage are:

- prescription cost analysis (PCA) from 2002 to 2003 for England

- Welsh Government analysis from 2004 to 2005 for Wales

- Scottish Government analysis from 2004 to 2005 for Scotland

- DH NI analysis from 2003 to 2004 for Northern Ireland

For Non-NHS provision, we include information on expenditure, for which data is available from England, Wales, and Scotland. The sources and time-coverage are:

- Department for Health and Social Care (DHSC) from 1997 to 1998 for England

- Welsh Government analysis from 2004 to 2005 for Wales

- Scottish Government analysis from 2004 to 2005 for Scotland

Quality adjustment

[Quality adjustment of public service health output: current method (PDF, 152KB)](#) provides a detailed description of the quality adjustment methodology.

A quality adjustment is applied to the quantity output index where a positive quality adjustment indicates that the quality of healthcare services provided, as defined by the selection of indicators used in the quality adjustment, has improved. A quality adjustment is then applied to UK output, based on the following elements and data from England.

Elements within the hospital and community healthcare sector, which constitute the hospital procedures quality adjustment and are applied to output using a dataset provided by the Centre for Health Economics at the University of York include:

- short-term post-operative survival rates, derived from Hospital Episodes Statistics (HES); short term survival is used to adjust day cases, elective inpatients and non-elective inpatients

- estimates of health benefit from procedures, derived from research studies, ONS Life Tables and Patient Reported Outcome Measures; we apply this adjustment to day cases, elective inpatients and non-elective inpatients

- waiting times from HES; waiting times are used as a quality adjustment for day cases and elective inpatients

Elements within the hospital and community healthcare sector include:

- national patient experience surveys, from NHS England, used as an adjustment for day cases, elective inpatients, non-elective inpatients, emergency care and mental health

Elements within primary care services are:

- aggregate data on clinical measures recorded on GP practice computers, from the quality and outcomes framework, used to quality adjust the GP consultations

Hospital and community health services (HCHS) and primary care services are quality adjusted, but no quality adjustment is applied to GP-prescribing or non-NHS provided services.

Inputs

Labour inputs are mainly measured through a Laspeyres cost-weighted labour index (CWLI), which uses administrative data on the health service's workforce to measure growth in full-time equivalent staff numbers weighted by their cost, in a similar manner to the cost-weighted activity index used for quantity output. However, it should be noted that agency staff are included in intermediate consumption inputs because they are not employed by the NHS, while NHS bank staff are included in labour inputs, because they are NHS employees.

The intermediate consumption of goods and services used in the provision of healthcare is also calculated using expenditure data deflated by relevant deflators to account for the cost inflation faced by the health service. From Public service productivity, healthcare, UK: 2017 onwards, many of the deflators used are taken from the NHS Cost Inflation Index (NHSCII), which is produced by the Department of Health and Social Care. This includes the overall NHSCII, sector-specific components of the NHSCII and a version specific to NHS providers' intermediate consumption produced by the Office for National Statistics (ONS). A change to the methodology for deflating agency staff expenditure, which makes use of mandatory data collections undertaken by NHS England and NHS Improvement on agency staff spending, was incorporated in the data for FYE 2019 onwards.

The volume of capital inputs is measured by consumption of fixed capital, which covers the cost of depreciation of capital goods (items that are anticipated to be in use over several years, such as buildings and vehicles) over time. Data used for this element are estimated in the UK National Accounts using the perpetual inventory method.

The total inputs index is created by weighting the three components of healthcare input together according to their share of total healthcare expenditure recorded in the UK National Accounts. Where data are not provided by a country, it is assumed that this component grows in line with the rest of the UK.

Geographical coverage of inputs data varies across the countries of the UK.

For labour inputs, we include information for hospital and community health services (HCHS), GP services and bank staff. For each of these sectors, data from England, Wales, Scotland, and Northern Ireland are available.

The sources for HCHS and GP services are:

- NHS Digital (NHSD) for England

- Welsh Government for Wales

- Scottish Government for Scotland

- Department of Health Northern Ireland (DH NI) for Northern Ireland

The sources for bank staff are:

- NHS England and NHS Improvement (NHSEI) for England

For goods and services inputs, we include information on HCHS, dental services, ophthalmic services, pharmaceutical services, GP services, community health and miscellaneous services (CHMS), GP drugs, non-NHS provision, agency staff expenditure, welfare food and health administration. For these services, data from England, Wales, Scotland and Northern Ireland is available.

Sources for HCHS and dental services are:

- NHSD for England

- Welsh Government for Wales

- Scottish Government for Scotland

Sources for non-NHS provision, ophthalmic and pharmaceutical services are:

- NHSD for England

- Welsh Government for Wales

- Scottish Government for Scotland

Sources for GP services are:

- NHSD for England

- Welsh Government for Wales

- Scottish Government for Scotland

Sources for CHMS are:

- DHSC for England

- Welsh Government for Wales

Sources for GP drugs are:

- prescription cost analysis (PCA) for England

- Welsh Government analysis for Wales

- Scottish Government analysis for Scotland

- DH NI analysis for Northern Ireland

Sources for agency staff expenditure and welfare food are:

- DHSC for England

- Welsh Government for Wales

Sources for health administration are:

- DHSC for England

Capital inputs include information on UK capital consumption, for which data is available from the UK National Accounts (UK NA).

The geographic coverage for deflators is described below, which are either UK-wide or England only deflators. Where deflators are available for England only, the same rate of price increase is assumed for the other countries of the UK.

Intermediate consumption other than that specified (includes NHS providers) in:

- FYE 2015 to FYE 2020 is deflated using an ONS intermediate consumption-specific version of the NHS Cost Inflation Index (NHSCII) NHS providers non-pay deflator

- FYE 1996 to FYE 2015 is deflated using intermediate consumption other than that specified (includes NHS providers)

Non-NHS provided services in:

- FYE 2015 to FYE 2020 is deflated using the NHSCII NHS providers deflator including both pay and non-pay elements

- FYE 1996 to FYE 2015 is deflated using a non-NHS deflator combining an ONS intermediate consumption-specific version of the Health Service Cost Index (HSCI) and ONS pay cost index covering Hospital and Community Health Services (HCHS) staff

NHS bank staff costs for FYE 2016 to FYE 2020 are deflated using the NHSCII pay cost deflator for NHS providers.

Agency staff costs in:

- FYE 2018 to FYE 2020 is deflated using NHSCII agency cost deflator

- FYE 2015 to FYE 2018 is deflated using NHSCII pay cost deflator for NHS providers

- FYE 1996 to FYE 2015 is deflated using ONS pay cost index covering HCHS staff

General practice intermediate consumption for FYE 1996 to FYE 2020 is deflated using the Consumer Price Index including owner occupiers' housing costs (CPIH).

Dental services in:

- FYE 2008 to FYE 2020 is deflated using NHSCII dental cost deflator and an ONS equivalent for earlier years

- FYE 1996 to FYE 2008 is deflated using a non-NHS deflator combining an ONS intermediate consumption-specific version of the HSCI and an ONS pay cost index covering HCHS staff

Pharmaceutical services (excluding drug costs) in:

- FYE 2015 to FYE 2020 is deflated using overall NHSCII

- FYE 1996 to FYE 2015 is deflated using a non-NHS deflator combining an ONS intermediate consumption-specific version of the HSCI and an ONS pay cost index covering HCHS staff

General ophthalmic services in:

- FYE 2015 to FYE 2020 is deflated using an overall NHSCII non-NHS deflator combining an ONS intermediate consumption-specific version of the HSCI and an ONS pay cost index covering HCHS staff for FYE 1996 to FYE 2015

- FYE 1996 to FYE 2015 is deflated using a non-NHS deflator combining an ONS intermediate consumption-specific version of the HSCI and an ONS pay cost index covering HCHS staff

The inputs for hospital and community health service employees (other than bank staff) working in general practice and GP-prescribed drugs are not deflated as these inputs are directly measured using a cost-weighted labour index or cost-weighted drug index.

Capital consumption inputs are obtained from the national accounts in volume terms and so need no further deflation.

3 . Education

A detailed explanation of the data sources and methods used to calculate quantity and quality output, and inputs for education can be found in [Sources and methods: public service productivity estimates: education](). Methodological improvements to education quality adjustment were recently developed, as explained in the methods articles published in [2021]() and [2022]().

Quantity output

Quantity is the sum of full-time equivalent (FTE), publicly funded pupil and student numbers within these sectors (weighted by cost of education):

- pre-school education, including places funded in the private, voluntary and independent sector (PVI)

- government-maintained primary, secondary and special schools; for England only, city technology colleges (CTCs) and academies are included; all of these figures are adjusted for attendance

- further education colleges

- higher education training of teachers: initial teacher training (ITT)

- higher education training of health professionals

Sources of education output data

Data for quantity of students and expenditure in schools are:

- England - Department for Education (DfE)

- Wales - Welsh Government

- Scotland - Scottish Government

- Northern Ireland - DfE Northern Ireland

Data for quantity of students and expenditure in ITT are:

- England - DfE

- Wales - Welsh Government

- Scotland - Scottish Government

- Northern Ireland - Department of Employment and Learning Northern Ireland

Data for quantity of students and expenditure in health professional training are:

- England - Department of Health

- Wales - Welsh Government

- Scotland - Scottish Government

- Northern Ireland - Department of Health Northern Ireland

Data for quantity of students and expenditure in further education are:

- England - DfE (quantity of students), Education and Skills Funding Agency (expenditure)

- Wales - Welsh Government (quantity of students and expenditure)

- Scotland - Scottish Funding Council (quantity of students and expenditure)

- Northern Ireland - Department for Economy Northern Ireland

Within education, schools account for the predominant share of output because of having a much greater expenditure weight than the other services. Student data are provided on an academic year basis, while expenditure data are provided on a financial year basis. Data in academic and financial years are converted to calendar years by applying a spline process.

Quality output

Attainment for primary and secondary school

Output in primary and secondary schools, city technology colleges (CTCs) and academies, which make up the majority of education output, are adjusted for quality using different attainment measures for each of the devolved nations. As exam performance varies across geographical areas and because education is a devolved policy area that affects the courses studied and exams taken, different quality adjustments are applied to output in each country separately.

Using a "cohort split" approach, attainment data are used as a proxy for change in the quality of education, and the GCSE (or equivalent) results for a given year were applied to quality adjust the output of primary and secondary education for that year. Reception year (in England and Wales), P1 (in Scotland) and Year 1 (in Northern Ireland) are also taken into consideration in these statistics.

The new contributions are outlined in Table 1.

Table 1: Contribution to attainment by year group

Year Group	Contribution to attainment
Reception	2%
Year 1	2%
Year 2	2%
Year 3	2%
Year 4	2%
Year 5	2%
Year 6	3%
Year 7	5%
Year 8	10%
Year 9	15%
Year 10	25%
Year 11	30%

Source: Office for National Statistics - Public service productivity

For attainment data released in the academic year ending 2019, 15% is applied retrospectively to the primary school years (2% of teaching when that cohort were in years reception to 5, and 3% in year 6 from academic years ending 2008 to 2014). The remaining 85% is added retrospectively to secondary school with 5% in year 7 (academic year ending 2015), 10% in year 8 (academic year ending 2016) and so on, with academic year ending 2019 receiving 30% of this score. Where there are incomplete years, that is, where students have received teaching, but have not completed GCSE-level examinations, available contributions are rescaled to total 100%.

In the latest publication, we extended the quality adjustment for primary schools by introducing Key Stage 2 attainment measures, alongside existing measures. These are nationally representative, publicly available measures of attainment of those aged 11 years across the UK, which allow us to consider attainment in literacy and numeracy skills at the end of primary schooling. Consistent with the approach for GCSE or equivalent attainment, we apportion primary school attainment equally between the seven years of primary schooling, since the year in which the test is taken is not the only year that contributes to the attainment. 14% of the national curriculum assessment attainment at Key Stage 2 is apportioned retrospectively to each year of primary school from Reception (or equivalent) to Year 6.

Disadvantaged attainment gap index at Key Stage 2

Disadvantaged pupils are defined by the DfE as those who attend primary school and have been eligible for free school meals at any point in the last six years, children looked after by a local authority and children who left local authority care in England and Wales. Equity of attainment is an important priority for the UK education system. For more information, see Improved methods for total public service productivity: total, UK, 2019.

This quality adjustment is based on data for England, as no equivalent measures are available covering other parts of the UK. As such, we have applied it to the output measure for all parts of the UK.

The disadvantaged attainment gap index is published by the DfE. As the index approaches 0, this reflects the gap between disadvantaged pupils and their peers being closed. Therefore, to be consistent with quality adjustments in public service productivity, the index growth is inverted such that a fall in the index (as it gets closer to 0) reflects an improvement in quality.

To weight the disadvantaged attainment gap quality series together with the other quality metrics in the education service area, the proportion of primary school funding that is specifically pupil premium funding is used. The pupil premium is defined as "funding to improve education outcomes for disadvantaged pupils in schools in England".

Bullying

Our education quality output measure also includes a bullying quality adjustment based on data from the British Household Panel Survey (BHPS) and its successor survey, Understanding Society (USoc). We approximate the severity of bullying by determining the mean life satisfaction of students who reported being bullied (or worried about being bullied) and the mean life satisfaction of students who did not report any bullying. From this, we derive an index, which is then incorporated into the current quality index by weighting the growth rate of the index with the growth rate of the current attainment index. For more information on the introduction of the bullying quality adjustment index, please refer to Improved methods for total public service productivity: total, UK, 2018.

Qualified teacher status

The delivered quantity of initial teacher training (ITT) courses is also adjusted for quality, but the cohort method is not applied. In this case, the proportion of students who achieve qualified teacher status (QTS) each year is used as a quality indicator. ITT quantity in each geographical area of the UK is adjusted using the QTS award rate for England, which is provided by the DfE.

Final index

Several sources have been used to create the quality adjustment for education.

Primary school attainment sources are:

- national curriculum assessments at Key Stage 2, DfE for England

- Key Stage 2 national level results by subject and year, Welsh Government for Wales

- school information dashboard – primary, Scottish Government for Scotland (historic series uses the Scottish Survey of Literacy and Numeracy, the Scottish Survey of Achievement, and the National Survey of 5 to 14 years Attainment)

- levels of progression attainment (historic series uses levels of attainment), Department of Education Northern Ireland (DENI) for Northern Ireland

GCSE, or equivalent, attainment sources are:

- attainment 8 in Key Stage 4 performance, DfE for England

- capped 9 in examination results for pupils aged 15 or 17 years, Welsh Government for Wales

- national 5s and Skills for Work and Personal Development courses pass rates, Scottish Qualifications Authority for Scotland

- threshold measure including English and Maths, DENI

Disadvantaged attainment gap index at Key Stage 2 sources are:

- national curriculum assessments at Key Stage 2, DfE for England

Bullying sources are:

- Understanding Society and British Household Panel Survey

Qualified teacher status sources are:

- initial teacher training performance profiles, DfE

Estimates of quality-adjusted output are carried out in several steps.

Time series data are compiled using:

- pupil numbers, which are adjusted for attendance at primary, secondary and special schools the level of expenditure in each educational service

- the attainment at Key Stage 2, disadvantaged attainment gap index in primary school, GCSE level and the ITT QTS award rate as outlined previously

- the bullying index as outlined previously

The cohort method is applied to the relevant quality-adjustment measures for schools, and these, along with ITT pass rates, are converted into indices. The separate quality indices are then combined using weights informed by the literature (or funding information in the case of the disadvantaged attainment gap index) to create a final quality index for schools.

A chain-linked Laspeyres volume index of quality-adjusted output is produced for each educational sector and aggregated to a UK level.

When education sectors are aggregated together using their relative cost weights, an overall UK level, chain-linked Laspeyres volume index of quality-adjusted output is calculated.

Inputs

The ONS publishes estimates of publicly funded education inputs in the UK from 1997 onwards. The inputs index is an aggregate of three elements: labour, goods and services, and capital, broken down as:

- local authority (LA) direct labour

- central government indirect labour

- goods and services (provision)

- goods and services (administration)

- consumption of fixed capital

A direct measure of LA-maintained schools' labour input is estimated, based on full-time equivalent (FTE) teacher and support staff numbers (split by school and academies for England only) and weighted together using data on salaries from the Annual Survey of Hours and Earnings (ASHE).

Labour force numbers are aggregated by staff type and school type and are adjusted by average hours worked for each school type. Country-specific FTE numbers are weighted by salary data from a number of sources. All data that are collected on an academic year basis are splined to calendar years before aggregating.

The direct labour data are combined with indirectly measured components for central government labour, which also include an estimate for further education inputs and is deflated using the Average Weekly Earnings: Public Administration Index, to form a total education labour inputs index.

Consumption of fixed capital national accounts expenditure data is deflated using a constructed education general government capital deflator. Goods and services expenditure data are split between provision and administration so that relevant deflators can be applied. Provision is deflated using a constructed composite Paasche education intermediate consumption deflator and administration is deflated using the gross domestic product-implied deflator.

The labour, goods and services, and capital indices are then aggregated together using their respective UK National Accounts general government expenditure shares, to form a chain-linked Laspeyres volume index.

Sources of education inputs data and geographic coverage

School staff numbers:

- England: DfE.

- Wales: Welsh Government.

- Scotland: Scottish Government.

- Northern Ireland (teaching staff only): Department for Education Northern Ireland (DENI).

Salary data:

- England: DfE.

- Wales: Welsh Government from 2017 onwards (previously DfE).

- Scotland and Northern Ireland: ONS ASHE (Annual Survey of Hours and Earnings).

- Earnings data for school support staff: ONS ASHE.

Labour, goods and services and capital expenditure:

- Local authority labour expenditure; expenditure: ONS national accounts.

- Central government labour expenditure; expenditure: ONS national accounts

Goods and services expenditure incurred by local authorities:

- Expenditure: ONS national accounts.

- Deflator: constructed education intermediate consumption deflator.

Goods and services expenditure incurred by central government:

- Expenditure: ONS national accounts.

- Deflator: GDP-implied deflator.

Capital expenditure:

- Expenditure: ONS national accounts.

- Deflator: constructed education general government capital deflator.

4 . Adult social care

Adult social care (ASC) services provide care and support to older people, adults with learning or physical disabilities, adults with mental health problems, drug and alcohol misusers, and carers. Provision of ASC is the responsibility of local authorities in the UK. Because of a lack of inputs and output data, measures for Northern Ireland are not included in the ASC productivity estimates.

ASC services include:

- placements in residential and nursing care

- provision of home care services

- day care services

- supported living and accommodation

- "meals on wheels"

- equipment and home adaptions

- care assessments and support services

Local authorities can provide ASC services themselves or contract ASC services from independent sector providers. Our estimates cover both forms of provision.

Quantity output

The measure of ASC output is based on the quantity of social services activities provided, measured in terms of activity – specifically the number of weeks of residential and nursing care provided. The ASC quantity output is produced via a cost-weighted activity index where activity data are available, and on an "output-equals-inputs" basis where they are not.

Activity data is not available for Wales and Northern Ireland, while Scotland residential, and nursing and community care data are included.

England and Scotland activities are weighted together by their share of net expenditure, to generate the overall measure of output growth. These weights are updated annually.

For England, a change in data collection between financial year ending (FYE) 2014 and FYE 2015 resulted in fewer activities being measured. Until FYE 2014, activity data was available for residential care, nursing care, assessments of need, day care, home care, provision of meals and provision of equipment. However, from FYE 2015 onwards, only residential care and nursing care activity data were available to be included in the output index.

Furthermore, where the data are available, services are measured separately for different client groups. These are split by age (people aged 65 years and over and working age adults aged 18 to 64 years) and by primary support reasons, such as physical disability, learning disability or mental health needs.

Services for which activity data are not available are measured using deflated expenditure (including funding from both local authorities and NHS income from FYE 2005 onwards) on an "output-equals-inputs" basis. The proportion of output which was measured on an output-equals-inputs basis increased in FYE 2015 because of the above changes. More information on this change, along with further analysis of the ASC productivity measure for England, can be found in Public service productivity: adult social care, England, FYE 2019 and Public service productivity: adult social care, England, FYE 2020.

Quality output

The quality adjustment for ASC output is based on the concept of adjusted social care-related quality of life from the Adult Social Care Outcomes Framework (ASCOF), the main source of outcomes data for ASC services in England.

Separate quality adjustments have been developed for community care, and residential and nursing care, both using data from NHS Digital's Adult Social Care Survey (ASCS) from FYE 2012 onwards. The ASCS is a sample survey of clients in local authority supported care in England. Coverage includes clients whose care is partly or entirely funded by a local authority, including those in receipt of direct payments, or clients in local authority organised care who are fully self-funding. Full details of this can be found in Section 6 of Public service productivity: adult social care, sources and methods, 2019 update.

Using the data from the ASCS, it is possible to calculate how well clients' needs are met (on a scale from no needs met to no unmet needs) across eight domains:

- control

- personal care

- food and nutrition

- accommodation

- safety

- social participation

- occupation

- dignity

Each level of response on care needs across each of the eight domains is then weighted to account for its importance in affecting quality of life, using weights developed from a separate survey of community care users.

In addition, factors predominantly outside the influence of ASC services, but which affect the likelihood of needs being met, are controlled for to derive the change in social care-related quality of life resulting from changes in ASC service quality.

For community care, factors from the calculations used in the ASCOF are applied to the person-level data in the ASCS to remove the influence on care-related quality of life of clients' age, health status, suitability of clients' home for meeting their needs and clients' ease of travelling around outside in their local environment. As the factors used in ASCOF only relate to community care users, for residential and nursing care, a regression model is used to calculate the impact of ASC services on care-related quality of life, controlling for these external factors.

The quality adjustment is applied separately for residential and nursing care, community care, and for the different client groups listed previously.

Inputs

ASC inputs consist of two main components: public expenditure on ASC services, and deflators measuring changes in the cost of inputs. Of the inputs components, goods and services is the largest. It includes all services contracted from independent sector providers and services purchased by clients using direct payments. Local authorities' intermediate consumption of goods and services is also included.

The quantity of ASC inputs is estimated by deflating expenditure using appropriate deflators. National accounts expenditure data are used for the UK productivity measure, while an alternative data source is used for England-only expenditure – NHS Digital's Adult Social Care Activity and Finance Report and its predecessors. Within the England measure, national accounts data are still used to estimate capital consumption, and the proportion of ASC expenditure on labour inputs, capital inputs and other inputs.

Further details on the current sources and methods for measuring ASC inputs are explained in Public service productivity: adult social care, sources and methods, 2019 update.

Local authority inputs expenditure for the UK

Public service ASC is primarily funded by local authorities in the UK. Local authority social protection expenditure data from the national accounts is used to measure public service expenditure on ASC. This is produced from local authority revenue expenditure and financing data from the Department for Levelling Up Housing and Communities (DLUHC) for England, and equivalent data for Scotland and Wales.

Local authority capital consumption is also measured using data from the national accounts and is estimated using the perpetual inventory method. Because of a lack of inputs and output data, measures for Northern Ireland are not included in the ASC productivity estimates.

There are several adjustments made to the expenditure data from the national accounts to maintain a consistent time series to cover ASC services specifically. The most substantial of these adjustments is to remove housing services expenditure.

Non-local authority ASC expenditure in inputs

Local authority-organised ASC services are also partly funded by care clients themselves and by transfers from the NHS. Because our measures cover only publicly funded services, client contributions that fund ASC services are excluded from the ASC inputs, and output is also adjusted to remove activity funded by client contributions. Local authorities also receive funding for ASC services from the NHS.

NHS transfers to local authorities are measured using the same data source as inputs expenditure for England from FYE 2005 onwards. Because of data availability, NHS transfers are not included in the measure in the years before FYE 2005. NHS funding for ASC services is also not included for the devolved administrations, so England data are used in both the England and UK measures. Symmetrical adjustments are made to the output calculations to remove activity funded by client contributions and include activity funded by the NHS.

Accounting for cost inflation

The list describes the deflators we use on various components of expenditure. A similar approach to deflation is taken for both the UK and England productivity measures.

- Skills for Care (SfC) National Minimum Dataset for Social Care (NMDS-SC), provided by the Department of Health and Social Care (DHSC), is used to deflate local authority and independent sector labour; the source of price data for this deflator is the SfC since FYE 2014, and the Annual Survey of Hours and Earnings (ASHE) used prior to this.

- The Subjective Analysis Return (SAR) Annexe A - part of local authority revenue expenditure and financing - produced by DLUHC, is used to produce a basket of goods representing local authority intermediate consumption; this is then deflated by the ONS' Consumer Prices Index (CPI), Services Producer Price Index (SPPI), Producer Price Index (PPI), Retail Prices Index (RPI), and Average Weekly Earnings (AWE).

- The care cost benchmark data produced by Laing Buisson is used to deflate intermediate consumption for independent sector residential and nursing care.

- Home care costs data, produced by the UK Homecare Association (UKHCA) deflates intermediate consumption for independent sector home care.

- Data collected from local authorities by the ONS and the London Association of Directors of Adult Social Services (ADASS) improvement programme is used to deflate direct payments.

To calculate the final overall inputs index, growth rates from each of the three indices (labour, intermediate consumption including direct payments and capital consumption) are weighted by their respective expenditure shares. This is then splined from financial year to calendar year for reporting at the UK level (estimates at the England level are reported on a financial year basis).

5 . Public order and safety

Quantity output

Within the public order and safety (POS) service area there are four main components:

- fire

- courts, which itself has five further sub-components: magistrates' courts, county courts, Crown Courts, Crown Prosecution Service, legal aid

- probation

- prisons

Police is measured separately to POS and is therefore excluded from these measurements.

For each component, a cost-weighted activity index (CWAI) is constructed. We use direct output measures for all components.

A quality adjustment is not applied to fire protection or county courts services, which deliver civil cases. This is because these services are deemed to have different outcomes to the criminal justice elements of POS and have data limitations.

Fire

Fire output activities are categorised into three groups:

- fire response (FR)

- fire prevention (FP)

- fire special services (FS)

These groups all form part of the fire and rescue service (FRS). Activity measures for the FRS are based on the number of incidents attended for fire response and fire special services activities, and staff hours spent on fire prevention activity.

Appropriate cost weights are based on the [Economic Cost of Fire estimates](#) for different fire incidents. The output measure combines the different activities into a single cost-weighted activity index (CWAI) using the associated unit costs as their weights, and an overall output index is then constructed as a chain-linked Laspeyres index using the previous year's prices.

Fire response services (quality adjustment is not applied to these services) include fire response for dwellings, commercial premises, vehicle, chimney, false alarms, measured by the number of incidents attended and sourced from Home Office data.

Special services response (road and non-road) is measured by the number of incidents attended and sourced from Home Office data.

Prevention is measured by inspections, investigation, community safety, for example fitting fire alarms. It is measured by number of hours of workload and is sourced from Home Office data.

Courts

The output of criminal courts is currently estimated using direct output methods, although some forecasting and estimation is necessary because of gaps in activities and cost data. Separate cost-weighted activity indices for different areas of the courts system are constructed and then further aggregated based on expenditure shares.

Law courts (partially quality adjusted) include crown, county, magistrates' courts, family courts (which cover private, public, divorce and adoption cases). The output is measured by caseload with data sourced from the Ministry of Justice (MoJ).

For civil and family courts, data from the MoJ on applications, hearings and final orders are used to produce a "weighted caseload". Unit costs are periodically sourced from the MoJ and are used as weights for the output index.

For crown courts, data are provided on the number of crown court cases broken down into categories:

- committals for trial: actuals

- cases for sentence: actuals

- appeals: actuals

Historic data on unit costs are used as weights for the output index.

For county courts, growth rates from the activity series within the civil and family courts data are used to predict activity growth in this area. Predictions are informed by historic case data that is no longer available.

For magistrates' courts, a "weighted caseload" is available up to 2014 from which an output index can be calculated. Completed proceedings are counted in 14 case types. Weightings are then applied to each case type, to provide an overall unitary value of caseload. The weights are calculated from large samples of cases and reflect the average time required to complete each type of case.

- Indictable: adult indictable and triable either way offences.

- Breaches: all breaches and revocations of sentences.

- Non-motor summary: non-motoring offences.

- Motoring summary: motoring offences.

- Youth: all youth crime, indictable and summary, including breaches.

- Section 8 Children's Act: Section 8 orders (private law).

- EPOs Children's Act: emergency protection orders.

- Care proceedings: Children's Act care proceedings (public law).

- Other family or child: all other family proceedings and Children's Act cases, for example, adoptions and financial cases.

- Licence sessions: licensing applications heard by licensing committees.

- Licence petty: licensing applications heard by magistrates in petty sessions.

- Other civil work: any other civil complaints, made to obtain an order, for example, dangerous dogs.

- Means enquiries: all means enquires with defendant present.

- Legal aid: all applications for legal aid granted or refused.

Crown Prosecution Service (CPS)

The indices for magistrate's courts and Crown Courts are used to predict activity growth in this area. Both indices are aggregated based on their expenditure shares to approximate the growth in activity for the CPS.

Legal aid

Data on legal representation expenditure and fees are used to construct a cost-weighted activity index for legal aid. Data are categorised by fee types, including:

- lower standard fees

- higher standard fees

- non-standard fees and exempt cases

- second claims for deferred sentencing

Legal Aid (quality adjusted) It includes case type and fee, is measured by prisoner population and number of people under supervision caseload, and has data sourced from the legal aid agency in England and Wales only.

Probation

Output for probation is measured by the number of offenders supervised by the Probation Service. Coverage is for England and Wales only. The criteria for inclusion are:

- offenders supervised by the Probation Service at end of period, under court orders and pre- and post-release supervision

- a person counted only once in the total even if they were subject to several types of sentence at the year-end

Probation (quality adjusted) is measured by number of people under supervision caseload, with data sourced from Her Majesty's Prison and Probation Service.

Prisons

Output for prisons is measured by the average number of prisoners in UK prisons. These data are collected on a monthly basis and coverage is for the whole of the UK.

Prisons (quality adjusted) is measured by prisoner population with data sourced from Her Majesty's Prison and Probation Service, the MoJ, Scottish Prison Service, and Northern Ireland Department of Justice.

Quality output

Full details of the quality adjustments can be found in [Quality adjustment of public service public order and safety output: current method](#).

Quality adjustments are not applied to fire protection or county courts services, which deliver civil cases, as they are deemed to have different outcomes to the criminal justice elements.

Table 2: Public order and safety quality adjustments

Component	Recidivsm (applied from 2020)	Prison safety (applied from 1997)	Custody escapes (applied from 1997)	Courts' timeliness (applied from 2011)
Fire	-	-	-	-
Prisons	29.2%	37.5%	33.3%	-
Probation	100.0%	-	-	-
Courts	-	-	-	-
Magistrates Courts	50.0%	-	-	50.0%
Crown Courts	50.0%	-	-	50.0%
County Courts	-	-	-	-
Crown Prosecution Service	100.0%	-	-	-
Legal Aid	100.0%	-	-	-

Source: Office for National Statistics - Public service productivity

The recidivism adjustment

The recidivism adjustment approximates the effect the Criminal Justice System (CJS) has on reducing the volume and severity of further crimes being committed by those who have gone through it.

This adjustment is composed of three parts, the first being the change in the number of proven re-offences committed by adults and juvenile offenders categorised between crime types. An adjustment is made to adult offenders, to account for differences between cohort characteristics and their likelihood to re-offend. No such adjustment is made for juvenile offenders after 2005. The final adjustment made provides a weighting by which to aggregate together all re-offences. This weighting is based upon the relative severity of the re-offence and is derived from the ONS's [Crime Severity Score for England and Wales](#).

[Data on proven reoffending from the Ministry of Justice](#) has historically been used, alongside other measures, to quality adjust output in the criminal justice system. However, data on reoffending for the last quarter of 2018 and all of 2019 have been affected by the coronavirus (COVID-19) pandemic, as it looks at proven reoffending that occurs within the following year. Proven reoffending has been affected by increased backlog in courts as well as behavioural changes related to lockdowns. The ONS has therefore made a small adjustment to reoffending data in Quarter 4 (Oct to Dec) 2018 to account for this and has held reoffending rates constant for the 2019 period. This is on the basis that it cannot be used as a comparable quality measure during the coronavirus pandemic.

The prisons safety adjustment

The prisons safety adjustment relates to the number of incidents of assaults, self-harm and deaths that occur in prison custody.

We measure the number of incidents per 1,000 prisoners, which are grouped into "Severe", "Less severe" and "Those resulting in a death". These groups are subsequently weighted and aggregated together based on their relative cost. This is achieved by using the total cost to society of workplace injuries as a proxy, taken from the Health and Safety Executive (HSE).

The custody escapes adjustment

The escape adjustment relates to ensuring prisons fulfil the role of public protection and is applied to activities used to measure the output of the prison service.

The measure is based on changes in the difference between the number of escapes and a baseline of 0.05% of the England and Wales prison population – a historic target used by the MoJ. The purpose of this is that as the absolute number of escapes approaches zero, the relative change year-on-year would have a disproportionate effect on a non-baselined quality adjustment index.

The courts' timeliness adjustment

The courts' timeliness adjustment relates to the average time taken for criminal cases to be taken to completion, on the basis that the delivery of a sentence in a timely manner is favourable. However, there is currently no adjustment made to reflect whether there has been fair treatment of the suspect or victims, or to allow the appropriate time for preparations of criminal cases with differing levels of severity or complexity.

For magistrate courts, the measure is based on the mean average time of charge and laying of information to completion. For Crown Courts, the measure captures the average waiting times experienced by all defendants and the mean time from main hearing to completion. As implemented, the measure accounts for changes in the average time taken to completion by criminal courts because increases in volume may reflect a worsening.

Combining the components

For each component, we calculate an overall growth factor to be applied to the basic activity index. For those areas where multiple adjustments are applied, the growth factors are applied on a weighted average basis (Table 2 outlines the weights used). To then aggregate together all the components of public order and safety (POS) – including non-quality adjusted components – they are cost-weighted together to produce an aggregate index of POS quality adjusted output.

Inputs

Inputs estimates are calculated for:

- fire

- courts (including probation)

- prisons

The public order and safety volume of inputs series is a weighted combination of fire, courts (including probation) and prison (chain-linked using the UK National Accounts expenditure weights).

The volume of labour inputs is the current price expenditure on labour deflated by the Index of Labour Costs per Hour (ILCH) for courts and probation, and deflators constructed from salary data from the Annual Survey of Hours and Earnings (ASHE) for fire and prisons. The fire and prisons labour deflators are constructed by weighting together changes in the salaries of the main occupations by their shares of total staff headcount or full-time equivalents in the service area.

The volume of goods and services inputs is the current price expenditure on goods and services deflated by a GDP-implied deflator. The volume of capital inputs is the current price expenditure on the consumption of fixed capital deflated by a constructed combined local and central government public order and safety capital deflator.

6 . Children's social care

Children's social care (CSC) is the provision of social work, personal care, protection or social support services to children in need or at risk. CSC includes, in its output measures, looked-after children, children in need, Sure Start schemes, adoption and child protection activities.

Quantity output

Children's social care activity data are used to estimate part of the output, which is measured directly and categorised as looked-after children (LAC), children in need and child protection services. Expenditure data are used as cost weights to aggregate the components in the direct part of the measure. For the indirectly measured output the "output-equals-inputs" convention is used. The indirectly measured part of the output refers to non-looked-after children (non-LAC) outside of safeguarding services.

LAC are defined by a local authority if a court has granted an order to place them in care, or a council's children's services department has cared for the child for more than 24 hours. Non-LAC are classified as such if they are not taken out of their home environment but are being monitored.

In Public service productivity: total, UK, 2019, approximately two-thirds of CSC output is measured directly in 2019, with the remaining one-third of CSC output measured indirectly.

Activities data for Scotland and Wales are supplied by the Scottish and Welsh Government respectively, and data for England and Northern Ireland are supplied by the Department for Education and the Northern Ireland Department of Education respectively. Adoptions, special guardianship orders, care leavers and safeguarding activities data for Scotland and Northern Ireland are currently not included in the direct activity measurement as corresponding granular expenditure data is not available to create a cost-weighted activity index (CWAI). Therefore, only secure accommodation and non-secure accommodation are measured directly for Scotland and Northern Ireland.

The activities (quantity output measures) used are:

Secure accommodation

- A count of the total number of days during the financial year that LAC spend in placements, including days spent in short-term placement, and excluding unaccompanied asylum-seeking children.

Non-secure accommodation

- Fostering services: activities data on children placed for adoption and foster placements.

- Children's homes: activities data on residential schools and children's homes.

- Other LAC activities data: this is calculated by subtracting the sum of measured LAC activity from total LAC activities.

Adoptions

- A count of the number of LAC who were adopted in the year. Children who are adopted cease to be reported in the data collection for looked-after children.

Special guardianship orders

- The number of LAC who were the subject of a special guardianship order during the year.

Care leavers

- The number of LAC care leavers in the last year eligible for and/or receiving services.

Safeguarding

- A count of the total number of children in need (CIN) and number of children on a child protection plan (CPP). These series are summed together to estimate the total number of children receiving safeguarding services.

Expenditure data are composed of net current expenditure (£ thousands) on the following services:

- fostering services

- secure accommodation

- children's homes

- care leavers

- adoptions

- special guardianships

- other children looked after

- safeguarding

- other non-LAC

- total expenditure on children's and families' services

To calculate an index for LAC, activity in fostering, children's homes and other are aggregated into a single series of non-secure accommodation, with secure accommodation left separate. More information on this approach can be found in Measuring the output of children's social care: an alternative method for looked after children (PDF, 121KB). These two series, the care leavers, adoptions, special guardianship and safeguarding activities are weighted by their expenditure shares to produce a direct measure of CSC output on a financial year basis. These estimates are splined, lagged and backcast to produce a series of appropriate length.

Expenditure on other non-LAC is taken as a residual following the direct output processing, split into components, deflated and aggregated to an indirect output index using the same method as is used in the inputs calculations.

Casemix

The casemix adjustment for CSC was introduced in the [Improved methods for public service productivity: total, UK, 2019](). The casemix adjustment starts in 2012.

In public service productivity, activity measures are combined using expenditure weights to create a CWAI (see Section 1 for more information). This assumes that the value of an activity carried out by the service is reflected in the cost. However, this is not always the case as some services are costlier but associated with lesser outcomes compared with cheaper services that lead to better outcomes. This necessitates the casemix adjustment because, in the absence of granular unit cost data, weighting activities according to their expenditure could overstate the value associated with them.

Since unit cost data is not available for CSC, and there is a known issue in the service area whereby some services (such as residential LAC) are more costly than others but are not associated with better child outcomes (see [Residential care in England, The place of residential care in the English child welfare system](), [The lifelong health and wellbeing trajectories of people who have been in care]()). An adjustment is made to the expenditure weighting of different output series. This captures changes in the cost of delivery that are associated with casemix characteristics.

For example, one casemix characteristic used in the adjustment for LAC is the age of the child. Age is an important factor affecting CSC LAC expenditure because, as the older a child is, the more costly their care is. Therefore, without adjusting for casemix, if a simple count of the number of fostering care days stays the same but more inputs are needed to provide these activities because of the children in foster care being older, productivity will fall. However, if the same fostering activities are measured in a more granular way and if we are able to adjust the cost weights to reflect the age-expenditure relationship, productivity may not have been observed to have fallen at all.

The casemix adjustment is estimated using data on the selected casemix characteristics at a local authority level for England only. The final casemix deflator is applied to the directly measured activity categories of safeguarding, secure and non-secure accommodation, adoptions and special guardianships for each of the devolved administrations.

To estimate the casemix deflator for a service, a regression is run using the specification:

$$C_{LA,t,s} = \beta_0 + \beta_{n,t,CIN} n_{LA,t,s} + \beta_{f1,t,s} f1_{LA,t,s} + \beta_{f2,t,s} f2_{LA,t,s} + \ldots + e_{LA,t,s}$$

Where: *LA* is the local authority
t is the year considered
s is the expenditure
C is the deflated expenditure
n is the number of children (safeguarding or LAC)
f1 is the volume output with casemix factor 1
f2 is the volume output with casemix factor 2
e is the error term

Observations are weighted by the volume of outputs $n_{LA,t,s}$

$B_{n,t_{CIN}}$ is the incremental expenditure associated with one unit of output that has no casemix factors ($n_{LA,t,s}$). $B_{f1,t,s}$ is the incremental spend associated with one unit of output that has casemix factor 1, relative to a unit of output that does not have casemix factor 1. It is important to note that these coefficients do not have the same interpretation as a unit cost.

From the regression, the local authority's expected spend on casemix in year *t* ($c_{England,t|t,s}$) can be estimated as well as the expected spend in year t if the casemix were instead the casemix of the following year *t* ($c_{England,t+1|t,s}$) The year-on-year change in expenditure attributable to change in casemix is calculated as follows:

$$i_{t+1,s} = \frac{c_{England,t+1|t,s}}{c_{England,t|t,s}}$$

The casemix adjustment is estimated using the same methodology but different data according to whether the service is LAC services or safeguarding. The data that feeds into the adjustment is as follows:

LAC casemix data

- Number of LAC aged 10 years or over, published by the Department for Education (DfE).

- The number of LAC on 31 March, published by the DfE.

Safeguarding casemix data

- Children in need primary need code at referral, published by the DfE.

- The percentage of children in need on 31 March with any disability, or by specific disability, published by the DfE.

- The percentage of children in need with a child protection plan, published by the DfE.

To reach a single index of directly measured casemix-adjusted and quality-adjusted activity, the growth rate of the casemix-adjusted and quality-adjusted series is calculated for each service area. The contribution to growth of direct output of each CSC service is calculated by multiplying this growth by the corresponding expenditure weight to create a chain-linked Laspeyres volume index at the UK level.

The contributions to growth are also used to combine the indirect output with direct output. The growth in indirect output is multiplied by the share of expenditure spent on the indirect portion of total CSC spend, and growth in direct output (casemix-adjusted and quality-adjusted) is multiplied by the share of expenditure spent on direct output to produce the final output series for CSC.

Quality output

Quality adjustment is applied to the quantity output index with a positive quality adjustment indicating that the quality of children's social care (CSC) services provided has improved. The quality adjustment series included in the CSC service area is applied to the corresponding directly measured activities.

Quality adjustment in CSC was first introduced in Improved methods for total public service productivity: total, UK, 2019.

Quality adjustment data for England comes from the DfE, and for Wales, quality data comes from the Welsh Government. Where quality adjustment data are not available for the devolved administrations, England data is used instead. This particularly affects Scotland and Northern Ireland where suitable quality adjustment data are not available.

Quality output measures used in CSC

Re-referrals and re-registrations, which start in 2012.

- These data are applied to the safeguarding activity of CSC.

- Children in need re-referral rate, measured as the percentage of children referred within 12 months of a previous referral using data from the DfE in England and Welsh Government data for Wales.

- Child protection plans starting in the year 2012, which were a second or subsequent plan, measured as the percentage of child protection plans that were repeat plans using data from the DfE in England; up to date data are not available for Wales, and therefore Wales safeguarding activity uses the England re-registrations quality adjustment.

- Since safeguarding activity is not measured for Scotland and Northern Ireland, no re-referrals and re-registrations quality adjustment is applied to them.

- This measure is lagged by one year on the basis that the quality of the service in a particular year may be lower if in the following year there is a higher rate of re-referrals and re-registrations.

Placement stability, which starts in 2010.

- These data are applied to the LAC activity of CSC.

- Number of placements a child has been placed in in the last year; measured as the percentage of LAC with two or more placements during the year using data from the DfE in England and Welsh Government data in Wales; no suitable data is available for Scotland and Northern Ireland, and therefore the England placement stability quality adjustment is applied to these countries.

- An increase in placement stability is treated as an increase in quality.

Care leavers, which starts in 2014.

- These data are applied to the care leavers activity of CSC.

- The percentage of care leavers living in suitable accommodation; this data is only available for England using data from the DfE.

- Percentage of care leavers that are not in employment, education or training (NEET); this data is available from the DfE for England and the Welsh Government for Wales.

- Since care leavers' activity is not measured for Scotland and Northern Ireland, the care leavers quality adjustment is not applied.

For series whereby an increase in the measure reflects worse outcomes, the inverse is taken so that the quality adjustment index reflects a fall in quality.

Quality adjustment is applied to each individual area of CSC activity (for safeguarding, non-secure accommodation, secure accommodation, adoptions, special guardianships and care leavers). For safeguarding and care leavers for England, each have two indicators of quality, which need to be combined into a single index of safeguarding quality and care leavers quality. An equal weight is attributed to the suitable accommodation measure and the NEET measure for care leavers. For safeguarding, weights for re-referrals and re-registrations correspond to the percentage of safeguarding expenditure on children in need and children on child protection plans, respectively (84% and 16% in 2019).

A chain-linked Laspeyres volume index of quality-adjusted output is produced for safeguarding, care leavers and secure and non-secure accommodation by country. No quality adjustment is applied to adoptions or special guardianship orders, these are chain-linked Laspeyres volume indices.

Inputs

Inputs for CSC are based on expenditure data collected from England, Scotland and Wales for financial year ending 2001 onwards. UK national accounts expenditure is used for each component of inputs.

The volume of labour inputs is calculated by deflating expenditure by a constructed pay deflator. Before 2011, labour expenditure is deflated using salary data from the Annual Survey of Hours and Earnings (ASHE), mapped by Standard Occupational Classification (SOC) codes. From 2011 onwards, the Index of Labour Costs per Hour (ILCH) deflator is used.

The volume of goods and services inputs is calculated by deflating expenditure by a constructed composite Paasche deflator. The wages element is deflated by the pay deflator used in the labour inputs estimates.

The volume of capital inputs is calculated by deflating consumption of fixed capital by a constructed social protection local government capital deflator, using ONS price indices.

Finally, the three components of inputs are aggregated together, using their relative expenditure weights to produce a UK estimate of children's social care inputs.

7 . Social security administration

Quantity output

Social security administration (SSA) is the administration and implied costs associated with administering different types of benefits including the processing of new benefit claims and maintaining existing benefit load. SSA output is a quarterly measure of the output associated with these in volume terms.

In total, there are 29 sub-component activity series in the SSA output system, covering a variety of benefits and activities (such as State Pension, Housing Benefit, Disability Living Allowance, Child Benefit and Incapacity Benefit), each with a corresponding unit cost series. These sub-components are aggregated to form a chained volume measure of SSA output. Data suppliers include the Department for Work and Pensions (DWP), HM Revenue and Customs (HMRC) and Ministry of Defence (MoD).

The roll-out of Universal Credit created additional challenges for SSA output measurement in 2018 and 2019. Universal Credit combines the benefits:

- Job Seekers' Allowance

- Income Support

- Housing Benefit

- Child and Working Tax Credits

- Employment and Support Allowance

2018 and 2019 saw a significant transfer of legacy benefits to Universal Credit. However, up-to-date unit cost estimates for Universal Credit in 2018 were not available. The use of legacy unit cost data in our methods was judged to likely over-estimate the volume of social security output when evaluated against alternative data sources on claims and SSA expenditure. We have therefore made an adjustment to the volume of Universal Credit claims and load to mitigate for this.

We will review methods of social security administration output measurement in the future, with the aim of incorporating newer unit cost estimates that better reflect changes in how Universal Credit data are collected and reported.

Inputs

To calculate an index for inputs, current price expenditure drawn from the national accounts is deflated to produce a constant price series.

Compensation of employees is deflated using the [Index of Labour Costs per Hour (ILCH)](). Expenditure data for goods and services is obtained from net expenditure on intermediate consumption, and then deflated by a constructed composite Paasche deflator. Net expenditure on capital consumption is deflated by a constructed central government capital deflator using ONS price indices.

Changes in the constant price series are weighted according to their expenditure share, and a Laspeyres volume index of inputs is constructed.

8 . Police, defence and other government services

For these services, the outputs are measured by their respective volume of inputs ("output-equals-inputs"). This happens because of their largely collective consumption, the difficulty in identifying and measuring total output, and the difficulty in placing a value on services supplied, as there are no market transactions.

Police

Police inputs are estimated by deflating expenditure on labour, goods and services, and capital.

The volume of local government labour inputs is measured directly from data on full-time equivalent employees (FTEs) and relative salaries for different groups. FTE data are sourced from Police workforce statistics for England and Wales and Workforce statistics for Police Scotland. Equivalent breakdowns for Northern Ireland are not available.

The volume of central government labour inputs is measured indirectly. Expenditure data are deflated by the Average Weekly Earnings (AWE) Index for Public Administration and Improved methods for total public service productivity: total, UK, 2018 details an adjustment made to police expenditure data from 2013 onwards.

The deflator for goods and services expenditure is constructed from subjective analysis returns (SAR) within local government financial statistics and Producer Price Indices.

The deflator for capital consumption is constructed on a local and central government basis to deflate the respective UK National Accounts expenditure data, using ONS price indices.

Net expenditure on capital consumption is deflated by a constructed central government capital deflator using ONS price indices.

A cost-weighted Laspeyres volume index is then calculated for the volume of police inputs, using chain-linked expenditure shares, and assumed to equal the volume of police output.

Defence

The volume of inputs is estimated by deflating current price expenditure on defence by a derived deflator. This is based on the Classification of the Functions of Government (COFOG).The deflator is derived from current price expenditure on defence and constant price military defence expenditure.

The resulting constant price expenditure series on defence is converted into an index and assumed to equal the volume of defence output.

Other government services

Central government expenditure data is obtained for:

- general public services, for example, executive and legislative organs, basic research

- economic affairs, for example, general economic, commercial and labour affairs including transport, agricultural, forestry and fishing

- environmental protection, for example, waste management, pollution abatement

- housing and community amenities, for example, housing development, water supply and street lighting

- recreation, culture and religion, for example, recreational and sporting activities, broadcasting and publishing

- other public order and safety, for example, research and development

Total current expenditure on these categories is deflated using the GDP-implied deflator to obtain a constant price expenditure series. This series is then used to generate an index of volume of inputs, which is assumed to equal the volume of output.

9 . Difference between annual and quarterly statistics

Alongside the annual estimate of public service productivity (1997 to 2019), which is badged as a National Statistic, we also publish quarterly experimental measures of total public service productivity.

The quarterly series offers a timelier measure, as the annual series has a significant time lag.

However, compared with the annual estimates, it does not include:

- quality adjustments

- granular data on activity and unit costs – cost-weighted activity indices have poorer coverage of services and use less granular data

- full breakdowns by Classification of the Functions of Government (COFOG) – inputs estimates are calculated on an industry basis instead

The inputs for the quarterly estimates are based on ONS current price expenditure on labour, intermediate consumption, capital, and social transfers in kind (STIK). Appropriate deflators are applied to approximate the volume of inputs from expenditure data. For more recent quarters, full-time equivalent (FTE) data derived from the ONS public sector employment estimates are used instead to calculate labour inputs for health, education, social protection, fire and justice. Deflated expenditure data on NHS bank staff is also introduced for later quarters.

The output only accounts for the volume of activity, not the quality of output, and uses non-seasonally adjusted ONS chained volume measures (CVM).

Inputs and output of experimental quarterly estimates of productivity are seasonally adjusted at the total level.

Expenditure and CVM data are consistent with non-seasonally adjusted quarterly national accounts (QNA) data as published in ONS breakdowns of General Government final consumption expenditure. However, published quarterly productivity estimates use different seasonal adjustment methods and may differ from seasonally adjusted data published in QNA.

More information can be found in our previous article.

10 . User and stakeholder needs

The Office for National Statistics (ONS) actively seeks feedback from users of its public service productivity statistics to inform its future work priorities. We are particularly interested in user views on the value of these statistics to inform policy debates and research projects within the academic and national accounts fields. The updated Quality and Methodology Information (QMI) for the total public service productivity article includes further information on user needs and perceptions.

We use various methods to engage with users about our statistics, including regular stakeholder engagement, pre-publication quality assurance from government experts, user consultation meetings and pre-announced methods changes, such as Improved methods for total public service productivity: total, UK, 2019. Any feedback or comments are welcome and can be sent to productivity@ons.gov.uk.

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