Office for
National Statistics

Public Service Productivity Estimates: Education 2013

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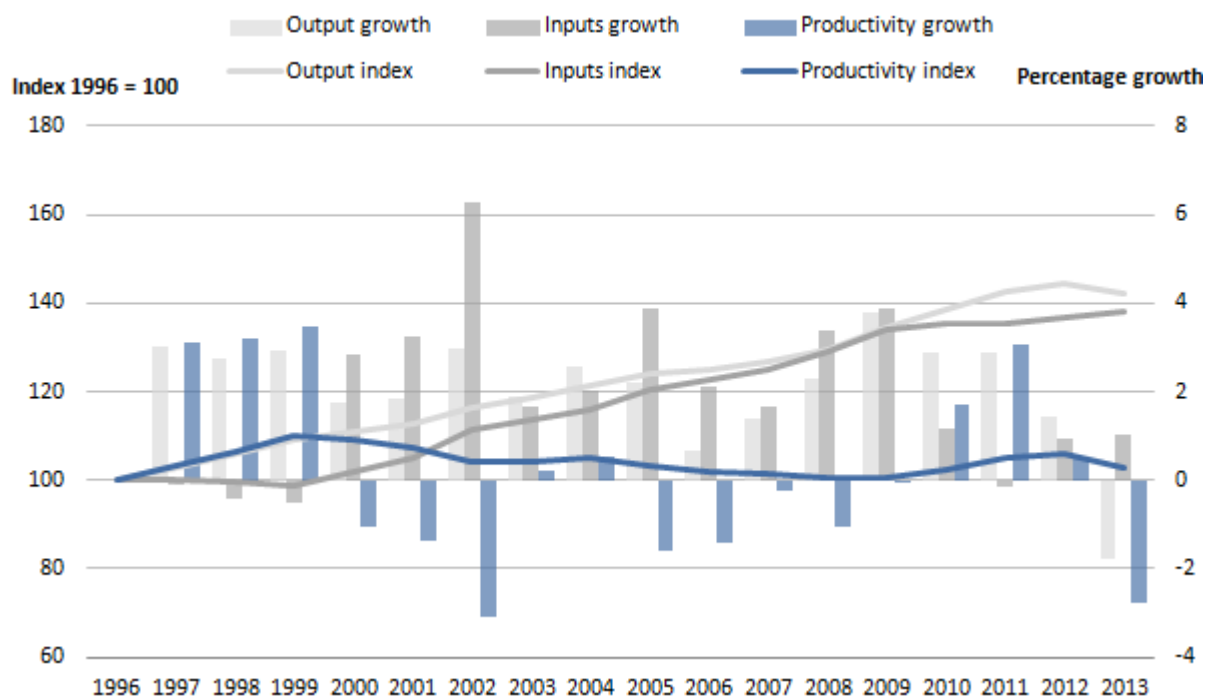
Abstract

This release contains updated estimates of output, inputs and productivity for public service education in the UK between 1996 and 2012, in addition to new estimates for 2013. Education output is the quantity of education delivered adjusted for the quality of delivery. The quantity is measured as the number of students adjusted for absence and the quality is measured based on student examination performance. Education inputs are composed of labour, goods and services, and consumption of fixed capital. Productivity is estimated by comparing growth in the total amount of output with growth in the total amount of inputs used.

Main points

- The annual average growth rate of public service education productivity from 1996 to 2013 was 0.2% a year compared with the annual average growth for 1996 to 2012 of 0.4%.
- In 2013, productivity fell by 2.8% due to inputs growth of 1.0% combined will a fall in output of 1.8%.
- This is the second-lowest annual fall in education productivity across the series; the lowest being 3.1% in 2002, and follows 3 years of productivity growth from 2010 to 2012.
- The fall in quality adjusted output in 2013 was the first in the series due to a negative contribution of the quality adjustment of 2.2% offsetting a small growth in the quantity of output of 0.4%.
- Changes in quality adjusted education output and productivity in recent years should be considered in the context of recent qualifications reforms which impact on comparability of attainment data over time.
- Education inputs growth of 1.0% in 2013 is below the series average of 1.9% as a result of lower growth in goods and services.

Figure 1: Public service education output, inputs and productivity indices and growth rates, 1996 to 2013

UK

Source: Office for National Statistics

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(28 Kb)

[Reference table 1: Growth rates and indices for public service education inputs, output and productivity, 1996 to 2013 (1.86 Mb Excel sheet)](#)

Introduction

This release contains updated estimates of output, inputs and productivity for public service education in the UK between 1996 and 2012, in addition to new estimates for 2013. Figures are published on a calendar year basis for consistency with the UK National Accounts. Our public service productivity estimates were developed in response to the recommendations of the Atkinson Review on the measurement of government output and productivity for the National Accounts[1].

[(1.86 Mb Excel sheet)](#)

Public service education productivity is estimated by comparing growth in the total amount of education output with growth in the total amount of inputs used. Productivity will increase when more output is being produced for each unit of input compared with the previous year. Estimates of output,

inputs and productivity are given as both growth rates which show the change from the previous year, and as indices which show the overall trend over time compared to the base year in 1996.

Estimates are constructed using data from each of the devolved administrations where available, with their individual growth rates weighted together by their relative share of total UK education expenditure. Trends in output, inputs and productivity for England tend to drive the overall UK trend as England has the largest expenditure share; therefore, much of the additional context provided in this article to aid interpretation of the estimates relates to the English education system.

Education output is the quantity of education delivered adjusted for the quality of delivery. The quantity is measured as the number of students adjusted for attendance and the quality is measured based on student examination performance. Education inputs are composed of labour, goods and services, and consumption of fixed capital. Further information on methods is available in our sources and methods paper[2].

It is important to note that while these productivity estimates provide a measure of the amount of output which is produced for each unit of input, they do not measure value for money or the wider performance of public education services. They do not indicate, for example, whether the inputs have been purchased at the lowest possible cost, or whether the desired outcomes are achieved through the output provided.

The estimates in this release have an open revisions policy, meaning that each time a new article is published revisions can occur for the whole of the time period. The majority of changes in this article are due to a new quality adjustment measure for England and changes to the treatment of academies which is explained in the previously published methods change paper[3].

Notes

1. Atkinson (2005) Atkinson Review: Final Report. Measurement of government output and productivity for the National Accounts (1.1 Mb Pdf)

2. ONS (2012) Sources and Methods for Public Service Productivity Estimates: Education (313.6 Kb Pdf)

3. ONS (2015) Methods change in public service productivity estimates: education 2013 (182.8 Kb Pdf)

Output quantity

Public service education output consists of estimates of the quantity of education delivered adjusted for changes in the quality of delivery. The quantity of output is measured as the number of students adjusted for absence for each of the following sectors which are weighted together to produce an overall output quantity series:
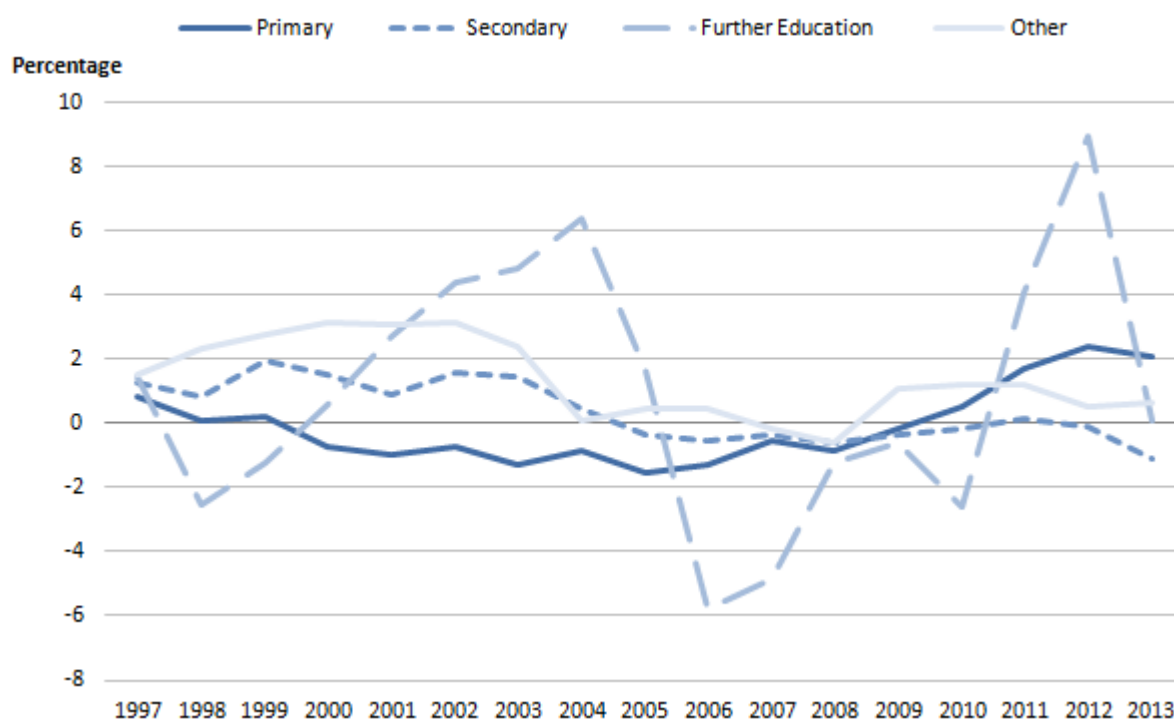
• pre-schools
• publicly funded private, voluntary and independent pre-school places (PVIs)

- primary schools (Local Authority maintained and academies)
- secondary schools (Local Authority maintained and academies)
- special schools (Local Authority maintained and academies)
- further education
- higher education initial training of teachers (ITT)
- higher education training of health professionals

Figure 2a shows the quantity output growth by sector before it is weighted by expenditure share. Figure 2b presents this information after weighting, showing how growth in each sector contributes to the growth in overall output quantity. For ease of interpretation, separate contributions are reported for primary schools, secondary schools and further education and the remainder are grouped as other.

Figure 2a: Public service education quantity output volume growth by sector, 1997 to 2013

UK

Source: Office for National Statistics

Notes:
1. "Other" is a weighted aggregation of the growth rates for pre-schools, publicly funded private, voluntary and independent pre-school places, special schools, initial training of teachers and, training of health professionals.
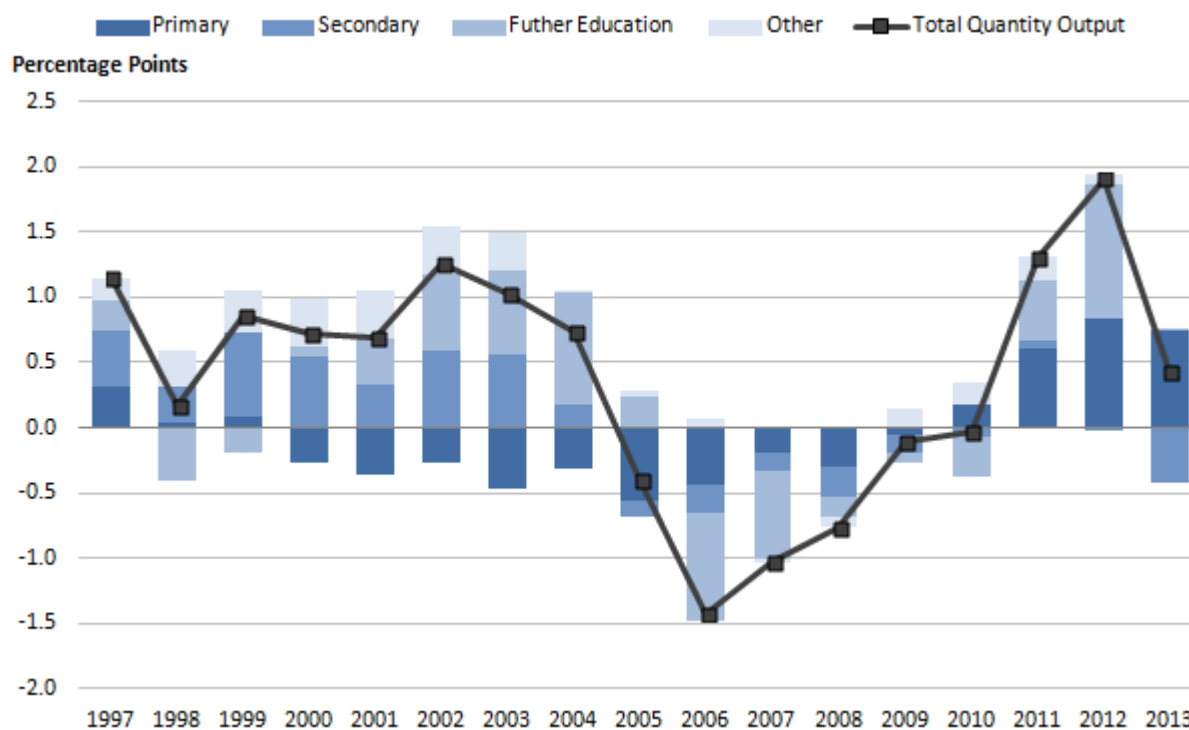
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Figure 2b: Public service education contributions to quantity output growth by sector, 1997 to 2013

UK

Source: Office for National Statistics

Notes:

1. "Other" is the sum of the contributions to growth for pre-school, publicly funded private, voluntary and independent pre school places, special schools, initial training of teachers and training of health professionals.

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Between 2000 and 2009, the number of students in primary schools fell each year with the largest fall of -1.6% in 2005 (Figure 2a). From 2010, primary school pupil numbers grew at an increasing rate with the largest growth in the series of 2.4% in 2012. There was a slightly smaller growth of 2.1% in 2013.

From 2005, secondary schools also saw a fall in output, reflecting the previous periods' smaller cohort of primary school students going into secondary schools. The trend in growth rates between primary and secondary schools is not identical because the secondary school category contains all-through schools which include primary aged pupils, and there is movement of pupils between the public and private education sectors.

Primary and secondary schools have the largest shares of expenditure at 35.3% and 38.2% respectively in 2012[1], together making up nearly three-quarters of total expenditure. Despite its large expenditure share, small growth rates in secondary school output quantity from 2004 to 2012 contribute a little to overall quantity growth (Figure 2b). Primary schools, along with further education, are seen to be driving the growth in output in the last 3 years of the series. In 2013, a negative contribution from secondary schools of 0.4 percentage points (mirroring a negative contribution from primary schools of 0.3% in 2008) does not quite offset the strong positive contribution of 0.7% from primary schools, leading to a small rise in overall output quantity.

Further education output quantity grew by 0.1% in 2013 compared with the annual average growth from 1996 to 2012 of 0.9%[2], though further education growth is more volatile than primary and secondary schools. Further education's expenditure share is small and has been decreasing over time, from 16% in 1996 to 12.4% in 2012.

In September 2013, the school leaving age in England was changed from 16 to 17 years. Any increase in further education output quantity as a result of this change is not reflected in further education output quantity growth of 0.1% in 2013 for a number of reasons:

- only part of this change is captured in the 2013 calendar year, as the 2013 calendar year is comprised of part of the 2012 to 2013 academic year and part of the 2013 to 2014 academic year
- upon leaving secondary school, 88% of English students already chose to enter into further education in 2012 to 2013 leaving limited capacity for further growth[3]
- the change occurred in England only therefore figures for Scotland, Wales and Northern Ireland are unaffected

Higher growth rates for the "Other" category between 1997 and 2003 are driven by large growth rates for publicly funded pre-school education, which coincides with the introduction by all UK administrations between 1998 and 2002 of a free, part-time early education place for 3 and 4 year olds. The remaining sectors contribute little to the overall trend due to a combination of small growth rates and a low expenditure shares. From 2004 to 2013, the contribution to output quantity growth from other sectors has been between -0.1% and 0.2% in every year. In the latest year, 2013:

- special schools witnessed a small positive growth in output quantity of 1.1%, continuing a trend of small positive growth starting in 2008
- training of health professionals quantity output fell by 3.3% which was smaller than the 5.3% fall in 2012, though both of these growth rates are low compared to growth of around 10% in each year in the series up to 2004. High growth rates early in the series coincide with reforms to the training of nurses requiring them to obtain diplomas or degrees.
- ITT growth rates were positive for the first time since 2009 at 1.9% – this is likely to be a reflection of the reform of teacher training in England which opened up 5,000 more spaces in 2013[4]

Reference table 2: Output quantity, expenditure shares and contributions to growth by education sector, 1996 to 2013 (73 Kb Excel sheet)

(28 Kb Excel sheet)

Notes

1. To combine growth rates for each component, expenditure shares for the previous year are used in the calculation of a Laspeyres index. For more information, see Robjohns (2006) : Methodological Note: Annual chain-linking (58 Kb Pdf)

2. Average growth rates for cumulative growth across the whole series are geometric means calculated using the formula:

    [(index in current year/index in base year)^(1/(number of years-1))]-1

3. DfE (2015) Destination of KS4 and KS5 pupils 2014-2015 (provisional)

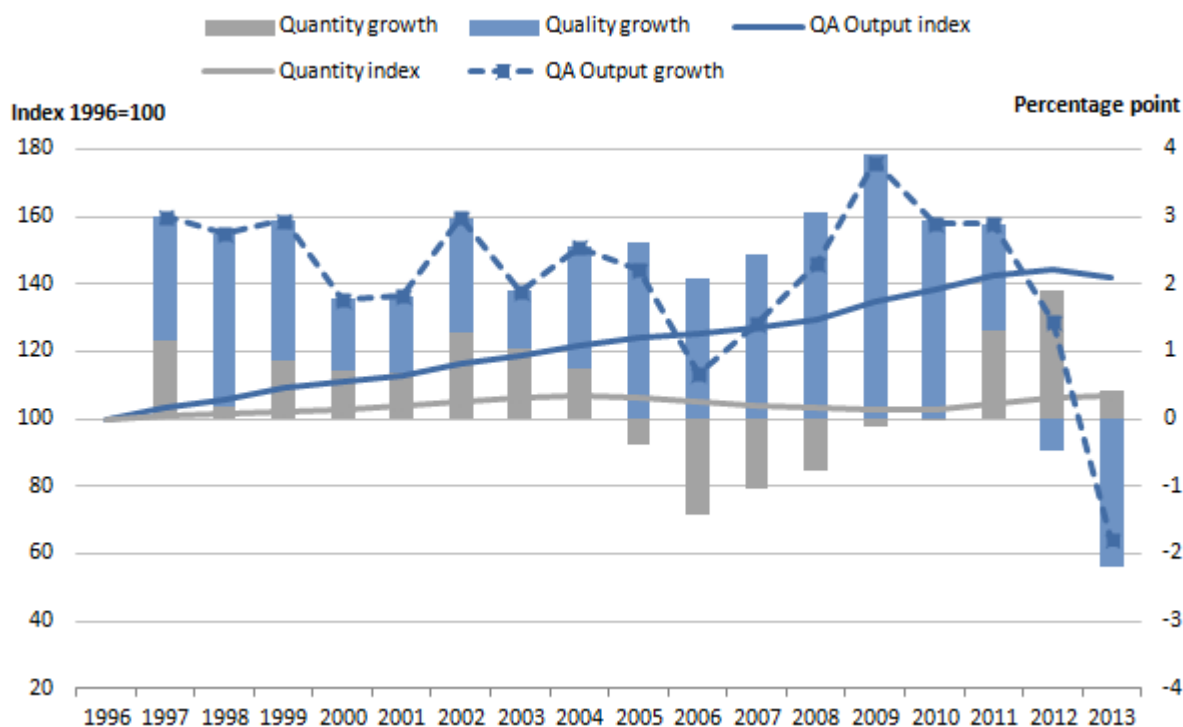4. DfE (2012) New school-led teacher training programme announced

Output quality

In line with the recommendations of the Atkinson Review[1] a quality-adjustment is applied to the estimate of education quantity. Quality of education is challenging to measure as it encompasses many aspects of a child's education; therefore, due to the practicality of what it is possible to consistently measure, exam performance is used as a proxy for quality. The method applied to all primary and secondary schools for England has changed since the previous article. The use of Key-Stage 4 (GCSE) all examination average point scores (APS)[2] has been replaced by the use of Level 2 attainment[3] at age 16 from 2008 onwards. For the period up to 2008, APS continue to be used. More information on this change and its impact on previously published estimates, can be found in the revisions section of this article as well as the associated methods change paper[4]. The new quality adjustment for England is applied for Northern Ireland and APS continue to be used for Scotland and Wales. For ITT, the proportion of students who achieve Qualified Teacher Status (QTS) each year is used as a quality adjustment. No quality adjustment is applied to the other sectors.

Figure 3 shows the contribution of quality adjustment to the total output. The quantity output index throughout the series has remained fairly constant with an annual average growth rate of 0.4% between 1996 and 2013 with changes likely to reflect changes in the school age population. Given schooling is compulsory from the age of 5 in the UK, population trends are directly reflected in the pupil census data that are used in the estimates of education quantity. The trend of increasing output over time in the quality adjusted output index is therefore being driven almost entirely by changes in the quality measure.

Figure 3: Public service education quantity and quality adjusted output indices and growth rates, 1996 to 2013

UK

Source: Office for National Statistics

Notes:

1.   QA = Quality Adjusted

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The impact of the quality adjustment on ITT is small, with the application of the quality adjustment changing the contribution of ITT to total output growth by no more than 0.01 percentage points in any year. Thus the impact of overall quality adjustment is almost entirely a result of the adjustment to primary and secondary schools.

Overall, the impact of the quality adjustment was positive in all years from 1997 to 2011 and has increased the annual average growth rate of output over the whole series from 1996 to 2013, from 0.4% to 2.1%. Quality adjusted output continued to grow in 2012 due to strong quantity growth of 1.9% despite a negative contribution of the quality adjustment of 0.5 percentage points. In 2013, smaller output quantity growth of 0.4% combined with a strong negative contribution of -2.2 percentage points from the quality adjustment led to the first fall of quality adjusted education output of 1.8%.

Caution should be used when interpreting the change in the quality adjusted output trend from 2008 onwards. Over this period there have been changes to the examinations which count towards school performance statistics in England, which has influenced both the number and type of examinations sat by some pupils. As a result, some of the change in attainment statistics used for quality adjustment may not be entirely caused by changes in the quality of education provided. In particular, changes to school performance tables announced by the Department for Education – as a result of Professor Alison Wolf's review of vocational education[5] – limited the size and number of non-GCSEs that counted towards performance which impacted on attainment statistics from the academic year 2012 to 2013[6].

Reference table 3: Quantity and quality adjusted output indices and growth rates for public service education, 1996 to 2013 (28 Kb Excel sheet)

Notes

1. Atkinson (2005) Atkinson Review: Final Report. Measurement of government output and productivity for the National Accounts (1.1 Mb Pdf) (1.1 Mb Pdf)

2. DfE (2014) Examination point scores used in the 2014 school and college performance tables

3. Level 2 attainment equates to achievement of 5 or more GCSEs at grade A*-C or an eligible Level 2 vocational qualification of equivalent size see DfE (2015) Level 2 and 3 attainment by young people in England

4. ONS (2015) Methods change in public service productivity estimates: education 2013 (182.8 Kb Pdf)

5. The Wolf Report (2011) - Review of Vocational Education

6. DfE (2015) Revised GCSE and equivalent results in England, 2013 to 2014

Inputs

Inputs to publicly-funded education are broken down into 3 components, weighted together using their share of total education expenditure:

- labour: full-time equivalent teacher numbers, support staff and central government expenditure on labour services
- goods and services: the purchase of goods and services which could include anything from exercise books to lighting and heating
- consumption of fixed capital: the amount of capital stock used each year made up of depreciation and other capital charges

Figure 4a shows inputs growth by component before it is weighted by expenditure share. Figure 4b presents this information after weighting, showing how growth in each component contributes to the growth in overall education inputs.

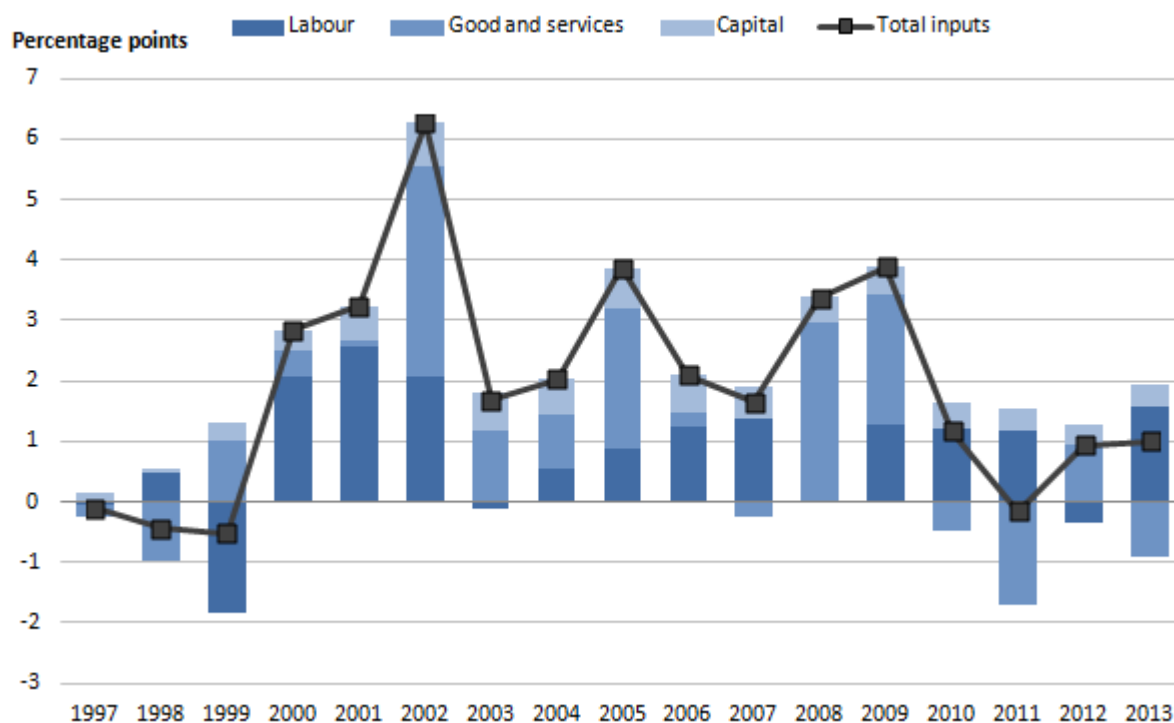**Figure 4a: Public service education inputs volume growth by component, 1997 to 2013**

UK

Source: Office for National Statistics

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(27.5 Kb)

Figure 4b: Public service education contributions to inputs growth by component, 1997 to 2013

UK

Source: Office for National Statistics

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From 1996 to 2013, the annual average growth rate of labour inputs was 1.3%, with highest growth rate of 4.0% in 2001 and the largest fall of 2.9% in 1999. In 2013, labour inputs grew faster than average at 2.6% due to an increase in the number of support staff. This coincides with an extra 5,000 places on teacher training schemes in England which provided paid placements in schools. In 2012[1] labour expenditure accounted for 61% of total public service education spending and labour was the dominant contributor to total inputs growth prior to 2002. The contribution of labour inputs has been smaller in more recent years, though the positive contribution of 1.6 percentage points in 2013 drives the overall positive growth rate in this year.

Goods and services is a volatile component and had an expenditure share of 26% in 2012. Growth in goods and services is positive in the majority of years until 2010 and years with very high growth in goods and services such as 2008 and 2009 drive the strong growth in the total volume of inputs in these years.

After an initial increase in growth rates of fixed capital consumption from the start of the series to the largest growth of 5.2% in 2002, growth rates have decreased over time to 2.8% in 2013. Capital

consumption has a small expenditure share of 13% in 2012 and consequently contributes relatively little to the growth rate of total inputs in each year.

Overall, public service education inputs have grown in every year of the series since 2000, with the exception of a marginal fall of 0.2% in 2011 where a fall in the volume of goods and services offsets an increase in the volume of labour. From 2010 onwards, the growth rate of inputs has slowed, with an annual average growth rate over the period 2010 to 2013 of 0.7% compared with the annual average growth rate of inputs over the whole series from 1996 to 2013 of 1.9%.

Reference table 4: Public service education inputs, expenditure shares and contributions to growth by component, 1996 to 2013 (55 Kb Excel sheet)
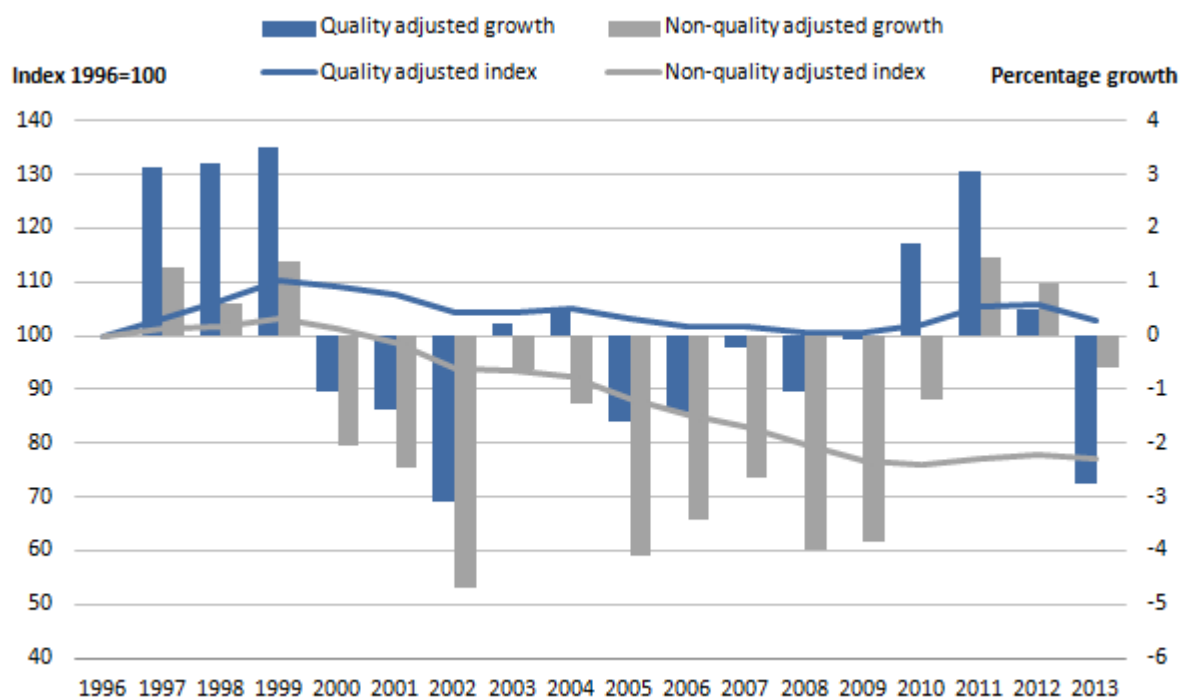
Notes

1. To combine growth rates for each component, expenditure shares for the previous year are used in the calculation of a Laspeyres index. For more information, see Robjohns (2006) : Methodological Note: Annual chain-linking (58 Kb Pdf)

Productivity

Public service education productivity is estimated by comparing growth in the total amount of education output with growth in the total amount of inputs used. Productivity growth will occur when output growth is greater than inputs growth; that is, when more output is being produced for each unit of input compared to the previous year.

Figure 5: Public service education productivity indices and growth rates, 1996 to 2013

UK

Source: Office for National Statistics

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(28 Kb)

Figure 5 compares the trends in education productivity calculated using both quantity and quality adjusted output.

Non-quality adjusted education productivity grew slowly between 1996 and 1999 caused by low output growth of less than 1.2% in each year combined with a slight fall in inputs of 0.5% or less. Non-quality adjusted education productivity then declined between 2000 and 2010 as a result of a switch to strong inputs growth outstripping slow growth or falls in output quantity which only exceeded 1% in 2002 and 2003. In particular, falls in productivity between 2005 and 2010 reflect falls in the number of students in primary, secondary and further education while inputs continued to rise.

In 2011 and 2012, non-quality adjusted education productivity grew for the first time since 1999 with renewed growth in the quantity of output driven by growth in the primary and further education sectors. Non-quality adjusted productivity fell again in 2013 as continued inputs growth of 1.0% exceeded slower quantity output growth of 0.4%.

The quality adjustment added a large amount to output growth between 1996 and 1999, leading to much stronger productivity growth in the quality adjusted series. The quality adjustment continued to

be positive from 2000 to 2011 reversing falls in non-quality adjusted productivity in 2003, 2004 and 2010, though quality adjusted productivity still fell on average between 2000 and 2010 by 0.6% per year.

In 2011, the positive impact of the quality adjustment more than doubled productivity growth to 3.1%, the largest productivity growth in the series since 1999. In 2012, the contribution of the quality adjustment was negative for the first time reducing productivity by 0.5 percentage points. The quality adjustment continued to have a negative impact in 2013, increasing the existing fall in non-quality adjusted productivity from 0.6% to 2.8%. This was composed on an input growth of 1.0%, a non quality adjusted output increase of 0.4% and reduction to output of 2.2 percentage points from the quality adjustment.

Caution should be exercised when interpreting the trend in the quality-adjusted productivity series in recent years due to changes to the examination system and performance tables in England. These changes may impact on the comparability over time of the attainment data used for the quality adjustment, particularly in the period from 2012 to 2013[1].

Over the whole series from 1996 to 2013, non-quality adjusted productivity fell by an average of 1.5% per year. This becomes an annual average growth of 0.2% when the quality adjustment is applied.

Reference table 1: Growth rates and indices for public service education inputs, output and productivity, 1996 to 2013 (1.86 Mb Excel sheet)

Notes

1. DfE (2015) Revised GCSE and equivalent results in England, 2013 to 2014

Revisions

In this release, there have been major revisions from 2008 to 2012 due to changes in the method of quality adjustment for England and the treatment of academies. A detailed account of these changes and their impact on previously published estimates of public service education output, inputs, and productivity can be found in the previously published methods change paper[1].
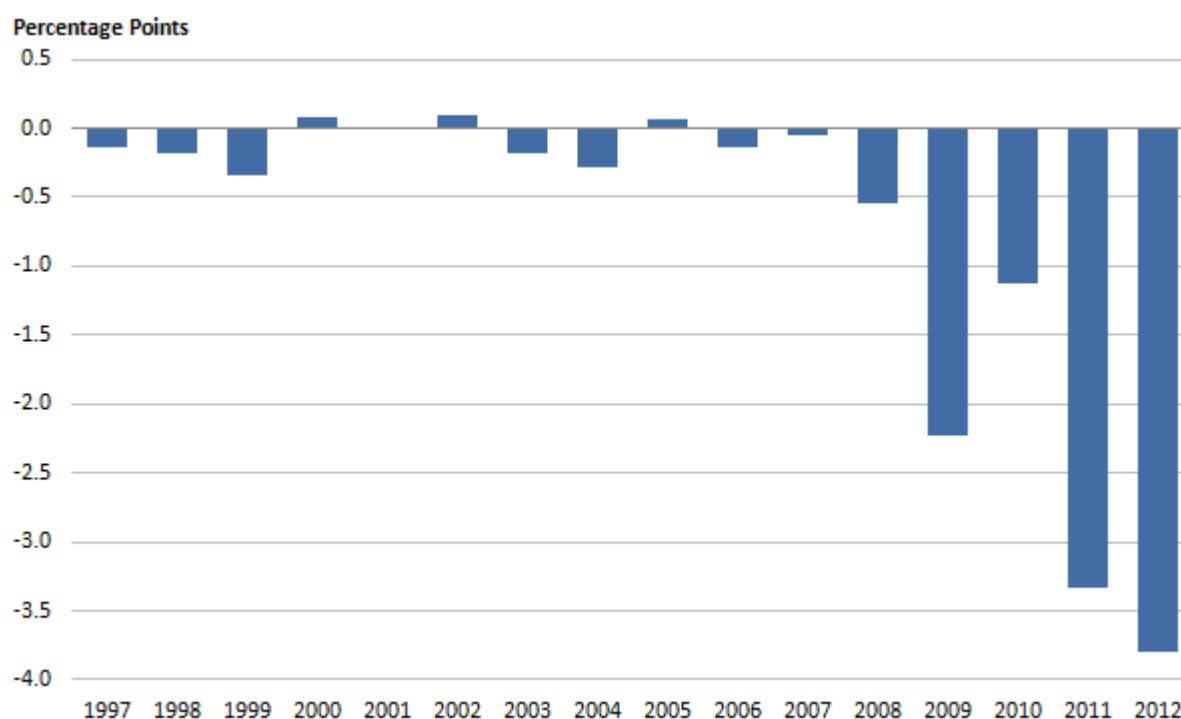
The method for quality adjusting output for England has been changed from using Key-Stage 4 all examination, Average Point Score to using Level 2 attainment statistics from 2008 onwards. Changes in 2013 to the method of calculating Key-Stage 4 Total Average Point Score means there is a structural break in the attainment series and it would not be possible to apply the APS attainment measure on a consistent basis. Evidence also suggests that significant increases in the APS in England between 2008 to 2009 and 2012 to 2013 can, in part, be attributed to increases in the number of non-GCSE examinations taken and are not fully reflective of changes in education quality. The selected Level 2 attainment statistics provide a consistent historical time series which will also be more resistant to future planned changes in the education system. Prior to 2008, APS continue to be used.

The second change was to the treatment of academies, which we are now treated in the same way as all other state-funded schools in the calculations of both output and inputs. This creates a more realistic time series which avoids spurious changes in inputs caused by conversion of maintained schools to academies since 2010.

Figure 6 illustrates revisions as a result of these changes and other small revisions to source data. The largest change to quality adjusted education productivity was in 2012 where upward revisions to inputs of 3.2 percentage points combined with small downward revisions to output of 0.5 percentage points lead to a downward revision in productivity growth of -3.8 percentage points from 4.3% to 0.5%.

Figure 6: Revisions to public service education productivity growth rates, 1997 to 2012

UK

Source: Office for National Statistics

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(26.5 Kb)

[Reference Table 5: Revisions to previously published public service education estimates of output, inputs and productivity, 1996 to 2012](#) (273.5 Kb Excel sheet)

Notes

1. ONS (2015) [Methods change in public service productivity estimates: education 2013 (182.8 Kb Pdf)](#)

Background notes

1. Data availability issues

   The data in this release have been based on 2013 to 2014 data for both inputs and output as this is the latest complete set of data available. The final external dataset used in this release was available in December 2014 and has been incorporated with the rest of 2013 to 2014 data for inclusion in this release. However, the condition of the quality adjustment data was deemed unacceptable and finding its replacement caused considerable delays to the release of this article.

2. Chain linked Laspeyres volume index

   A methodology paper by [Robjohns (2006) explains how we annually chain-links data series (58 Kb Pdf)](#). This technique of annually updating the base period weights produces a rate of change in volume terms over the reference period for the data series. we use this technique to produce estimates of the volume of output and inputs for public service education, and other measures of government services such as health care and social services. See ONS (2008) for more information on this method and how Laspeyres volume indices are calculated for the estimates in this article.

3. Interpreting estimates of public service education productivity

   It is important to recognise that the productivity statistics published in this article are based on a concept of output as measured by government final consumption expenditure rather than government or state production. This follows from the submission of the estimates of the volume of government output that are used in this article (prior to any quality-adjustment) to the GDP (E) (expenditure) side of the UK National Accounts. This means that we are using a measure of government-purchased output, regardless of what type of business unit produced the output.

   In the case of education, most expenditure is used to fund state providers of education services and its administration. There is, however, a growing component of expenditure on private or voluntarily-provided education services which is now counted as a component of government output in our articles, even though it is provided (or supplied) by business units which are classified as private business or NPISH (Non-Profit Sectors Serving Households) units in the National Accounts.

   Traditional measures of productivity, including those we published, use a supply or production framework. These measures of productivity use Standard Industrial Classification (SIC 07) categories of production as the measure of output and are on a gross value-added (GVA) basis. Input measures count the labour (jobs or hours) used in the production of these goods

and services to estimate labour productivity series such as those we produced. Multi-factor productivity estimates include labour and capital services as inputs.

The interpretation of the expenditure-based productivity estimates presented in this article should therefore be taken as a measure of the technical efficiency with which government is facilitating the provision of education services for individuals in the UK (from whatever type of business unit) not producing that service itself. Caution should therefore be used when considering the differences between productivity measures published using the expenditure approach and those using the traditional production approach. More information on the difference between these 2 approaches in available in a paper published by on our website in June 2015 Comparing Public Service Productivity Estimates (433.2 Kb Pdf).

4. Quality and Methodology Information (QMI)

    A QMI report, Public service productivity estimates: Education (167 Kb Pdf), describes the intended uses of the statistics presented in this article, their quality and a summary of the methods used to produce them.

5. Statistical contact information

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6. Acknowledgements

    We would like to acknowledge contributions to the analysis and presentation of these statistics from Diana Kliesmentyte, Ashley Nanton, Anne Gingell, Lauren Bulleyment, Geoff Bright and Jamie Pritchard within ONS, and thank colleagues in the Department for Education and the devolved administrations for providing data and quality assurance.

7. Details of the policy governing the release of new data are available by visiting www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html or from the Media Relations Office email: media.relations@ons.gsi.gov.uk

    These National Statistics are produced to high professional standards and released according to the arrangements approved by the UK Statistics Authority.

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