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# Comparing public service productivity estimates with other productivity estimates

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## Introduction

Productivity is concerned with the relationship between economic inputs and economic outputs and is an important indicator of efficiency in an economy. ONS publishes estimates of productivity across a range of individual public services (including health and education) and aggregate estimates for total public services. This information note provides an introduction to how these estimates compare against other ONS productivity estimates for '[government services](#)' and the [market sector](#)<sup>1</sup>.

## Acknowledgements

Thanks are due to former ONS colleagues Harry Ravi and Daniel Jones who prepared an early draft of this information note.

## Main points

- ONS measures of public service productivity are not directly comparable with other ONS productivity estimates on labour productivity and multi-factor productivity (MFP), due to different definitions of outputs and inputs.
- Despite these conceptual differences, comparisons show that total public service productivity estimates and the nearest equivalent measure of 'government services' productivity follow broadly similar long-term trends for the decade between 1997 and 2007, before diverging in recent years.
- Up to 2007, both measures show much weaker productivity growth in the public sector compared to the rest of the economy.
- Since 2007, total public service productivity has grown faster than the nearest equivalent measure for 'government services' and also faster than productivity across the rest of the economy.

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<sup>1</sup> These and other terms are explained in a [Glossary](#) at the end of this note.

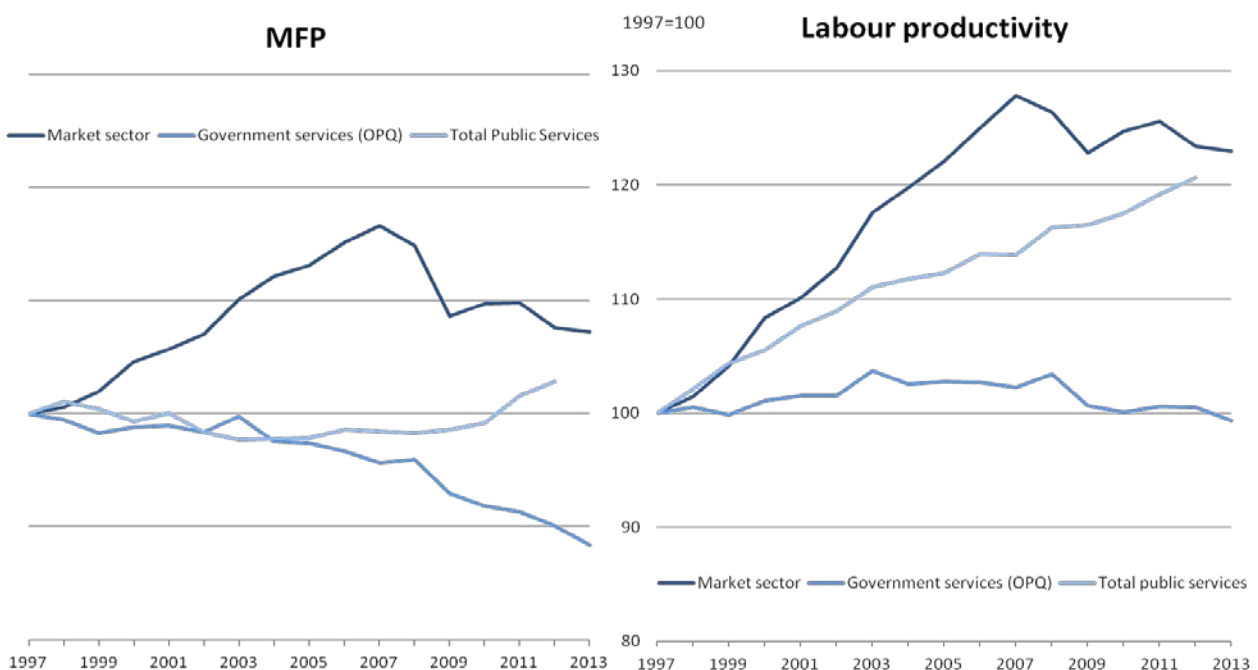
- Some of the difference between public service productivity and government services productivity since 2007 can be attributed to quality adjustments, which are included in the public service measure but not in other ONS productivity estimates.
- Public service productivity growth in recent years has also been buoyed by weaker growth of labour inputs than recorded in the nearest equivalent estimates for 'government services'.
- Measures of total public service productivity and individual service areas such as education, health, and social security administration are most useful to compare trends within the public sector over time, and whether the government is broadly improving the efficiency of how it provides public services.

## Productivity trends

**MFP** for 'government services' (industries [OPQ](#)) is the nearest equivalent to published total public service productivity. Trends in these two series have diverged since 2007.

**Labour productivity** in total public services has grown faster than in 'government services' and closer to the trend observed in the market sector.

Figure 1: MFP and Labour productivity



The left panel of figure 1 shows MFP using the standard industry breakdown for government services (industries OPQ) and for the market sector. These estimates are taken from the latest

[Multi-factor productivity](#) release on 23 January 2015. This panel also shows headline productivity for total public services, taken from the latest [Total Public Service](#) productivity release on 6 February 2015.

MFP productivity in government services and in total public services was broadly similar between 1997 and 2007. Since then, however, the productivity trends have diverged.

- Annual average MFP growth for the OPQ industries was -0.4% between 1997 and 2007, compared to -0.1% for average total public service productivity growth.
- Annual average MFP growth for the OPQ industries between 1997 and 2012 was -1.2%, compared to 0.9% for total public services over the same period.

Differences in the methods of estimating output and inputs for government services and total public services cause these different trends, and also explain why total public service productivity estimates cannot be directly compared to estimates of market sector productivity.

The difference between total public service and government service productivity from 2008 is caused by a combination of faster growth of total public service output due to the inclusion of quality adjustments for healthcare and education output, and slower growth of total public service labour inputs which do not fully account for changes in workforce composition.

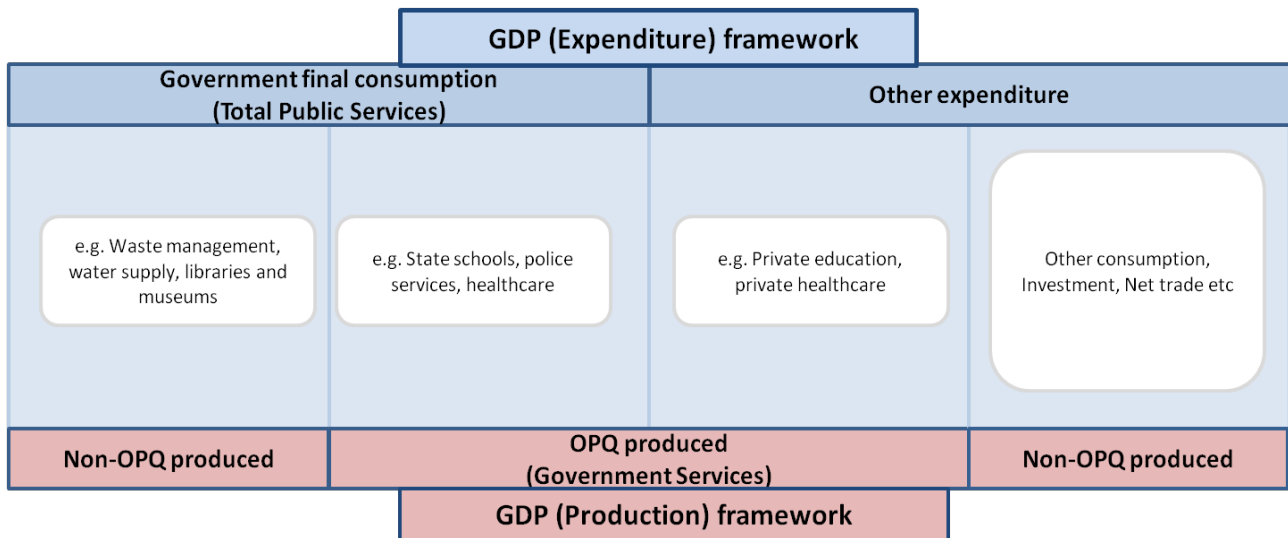
The right panel shows labour productivity (output per hour worked) for 'government services' and the market sector. These estimates are taken from the latest [Labour Productivity](#) release on 1 April 2015. Also shown is a previously unpublished series for labour productivity in total public services. Market sector output per hour grew much faster than government services up to 2007. Since 2007, labour productivity in the market sector has been broadly flat, more in line with the long-run trend in labour productivity in government services. Labour productivity in total public services has grown faster than in industries OPQ. This mainly reflects faster output growth of total public services. Labour inputs have grown at broadly similar rates in the two frameworks, despite coverage and methodological differences.

## Outputs

**Output of total public services is a volume measure based on government final consumption expenditure on 10 service areas of government and includes quality adjustments for healthcare and education.**

**Output of government services is a volume measure of value-added in production in industries OPQ.**

Figure 2: Coverage of outputs



Conceptually, output of public services is deflated expenditure on the functions of government such as health and education. Since no actual prices exist for most of these activities, volume estimates of output for public services are derived from activity measures such as the number of operations performed and number of pupils taught<sup>2</sup>. In the accounting framework for economic statistics, this views government as a consumer of services such as NHS operations and primary schooling. Note that ‘consume’ here means ‘undertake expenditure on’; it does not mean that government is the ultimate consumer of these services.

ONS measures of MFP and labour productivity view output in the production sense of goods and services flowing from the use of factors of production (labour and capital). To avoid double-counting, output is measured as value-added (GVA), net of goods and services used up in the production process. This framework uses a generic industry classification and does not explicitly identify output of government or the public sector. Public administration, defence, health, social care and education are conventionally referred to as ‘government services’ in this framework although this heading also includes private sector organisations classified to these industries.

Clearly there are links between these concepts, as shown in figure 2, which shows schematically the distinction between government as consumer (total public services estimates) and government as producer (government services estimates). However, the correspondence is not exact. For example some functions of government such as refuse collection are not classified as ‘government services’, and services such as private education and healthcare are classified to ‘government services’ in the production account but produced and consumed by the private sector.

In the wider economy prices can be used to indicate quality – whereas the price mechanism is much weaker or non-existent in the provision of public services which are mainly consumed free at the point of use. Accordingly, output for total public services is adjusted to take account of changes in the quality of services delivered in healthcare and education. The healthcare quality adjustment reflects changes in how well the service delivers intended outcomes (including survival rates,

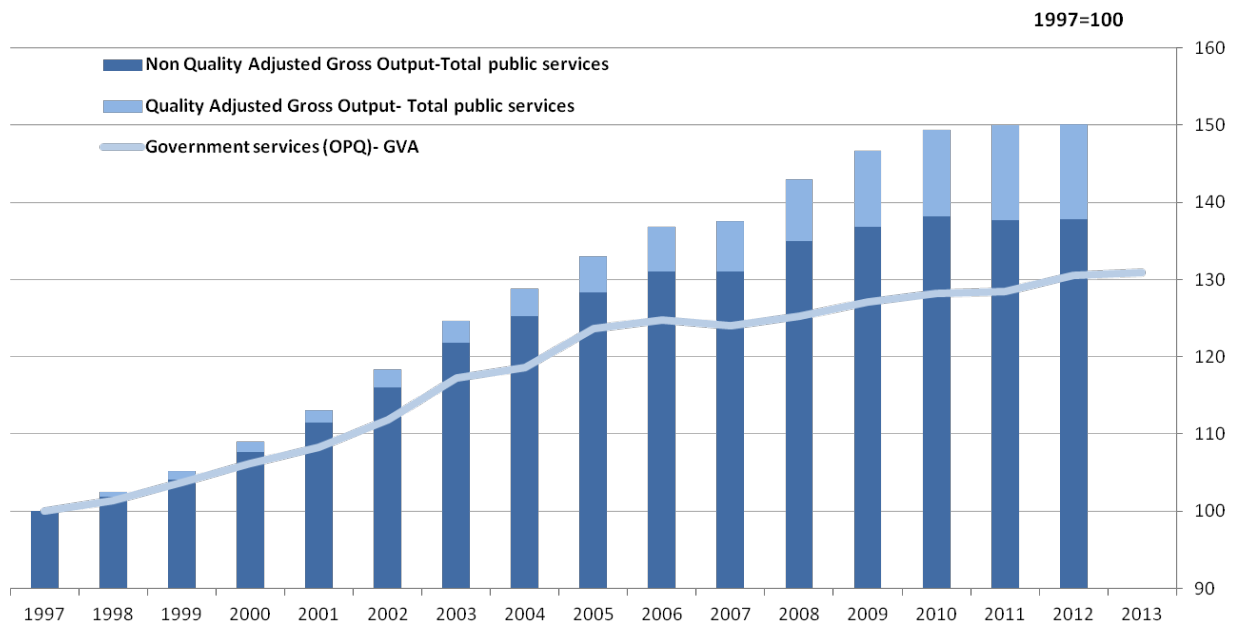
<sup>2</sup> Activity based (direct) output measures are used for around two-thirds of government activities in expenditure terms. For the remaining third, output volumes are indirect and are set equal to deflated inputs.

health gains and waiting times) and changes in patient experience measured by the National Patient Survey and GP targets. The education quality adjustment is based on changes in the attainment of pupils aged 15-16 measured through GCSE or equivalent examination results.

As education and healthcare together made up 54% of government expenditure in 2012, quality adjustment has an impact on the overall growth in public service output (Figure 3). The quality adjustment has been positive in all years and has increased since 2007. Such quality adjustments are not made for estimates of government services output, consistent with European statistical reporting requirements. This accounts for some of the faster growth of total public service output compared with GVA for industries OPQ.

Differences between non-quality adjusted total public service output and output of industries OPQ reflect (i) differences in coverage noted above and (ii) methodological differences between the expenditure and production systems in the national accounts.<sup>3</sup>

Figure 3: Trends in outputs



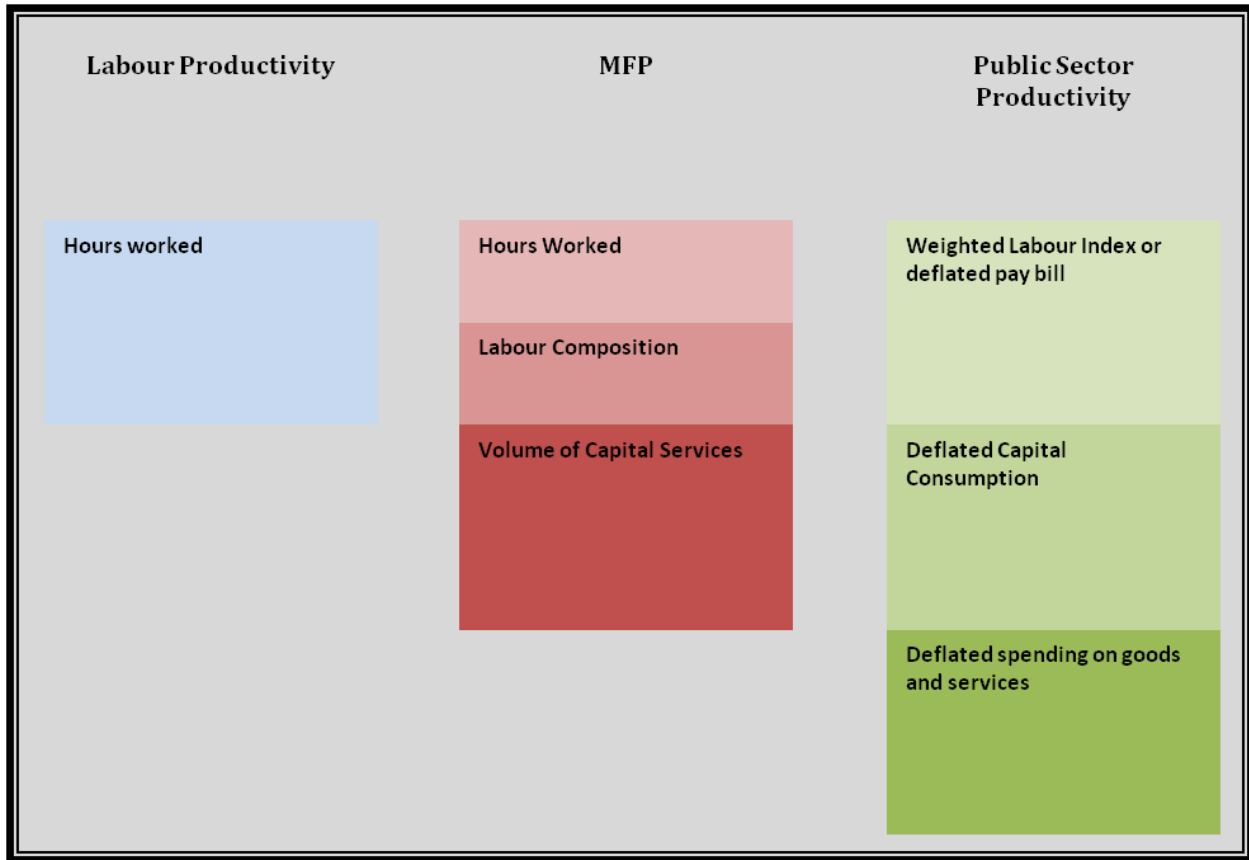
## Inputs

**Total public service inputs include procurement of goods and services as well as labour and capital inputs, while government services inputs only include labour and capital inputs.**

**Additionally there are differences of coverage and methodology in the measurement of labour and capital inputs between total public services and government services.**

<sup>3</sup> The numerical relationship between output concepts in current price terms (before deflation) is shown in [Annex 2](#).

Figure 4: Coverage of inputs



**Labour productivity** uses labour as the input measure. This can be hours worked, or the number of workers or jobs. ONS recommends use of hours worked, which takes account of changes in average hours worked over time. In this case, labour productivity is defined as output per hour.

**MFP** uses hours worked too, but also takes account of movements in the composition of the workforce. For example, an increase in an hour worked by a highly skilled worker is treated as a larger increase in labour input than an additional hour of unskilled labour. Further information on labour composition is available on the ONS [Quality Adjusted Labour Input](#) home page. Additionally, MFP takes account of changes in the input of capital services into the production process. Capital includes tangible assets such as offices, factories, machinery and equipment, and intangible assets, such as software. Unlike labour, capital services cannot be observed and have to be estimated from asset accumulation over prior years. Further information on capital services is available on the ONS [Volume Index of Capital Services](#) home page.

Measurement of inputs for **public service productivity** varies by service area. In health and education, labour input is measured directly using staff numbers and taking account of movements in worker types. For example, teachers have a higher weight than teaching assistants. Labour inputs for other government services such as social care, public order and safety and police are measured indirectly using the total pay bill and movements in the skill mix of the workforce can be picked up in higher payroll expenditure, which when adjusted for pay inflation can indicate a greater volume of labour input. Capital inputs for all service areas other than education are

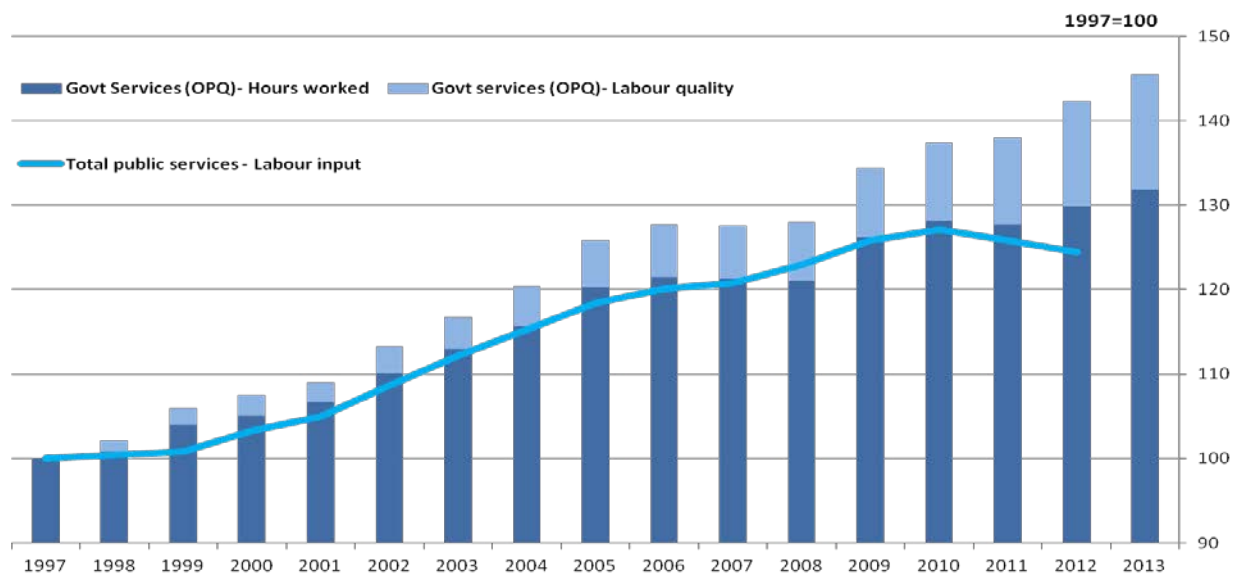
measured as deflated capital consumption. Capital input to education uses estimates of capital services.

Lastly, because the public service output measure is expenditure based, the inputs also include goods and services ‘used up’ in the delivery of public services. Examples include services provided by agency and contract workers, energy and consumables.

For each service area, movement in overall inputs combines movement in labour, capital and goods and services using their relative shares of total expenditure. Overall inputs for each service area are combined to give movement in total public service inputs in a similar way based on the relative share of total expenditure held by each service area. Importantly, these inputs do not enter into measures of labour productivity and MFP because output in these cases is measured net of goods and services used in production.

**Labour inputs for OPQ MFP include adjustments for changes in the composition of the workforce which are only partly accounted for in total public service labour inputs**

Figure 5: Trends in labour inputs



The line in figure 5 shows the overall trend in labour inputs for total public services, with the 2 components of the MFP series shown as stacked columns. The dark blue columns track hours worked in OPQ, and the light blue columns track the effect of composition or quality changes.

Total public services labour input tracks the OPQ hours series fairly well until 2010, but the OPQ labour input series has grown more strongly since then. In particular, hours worked and labour composition both increased in 2012, generating an increase in the composite QALI index of more than 3%. By contrast, labour input to total public services is estimated to have fallen by around 1%.

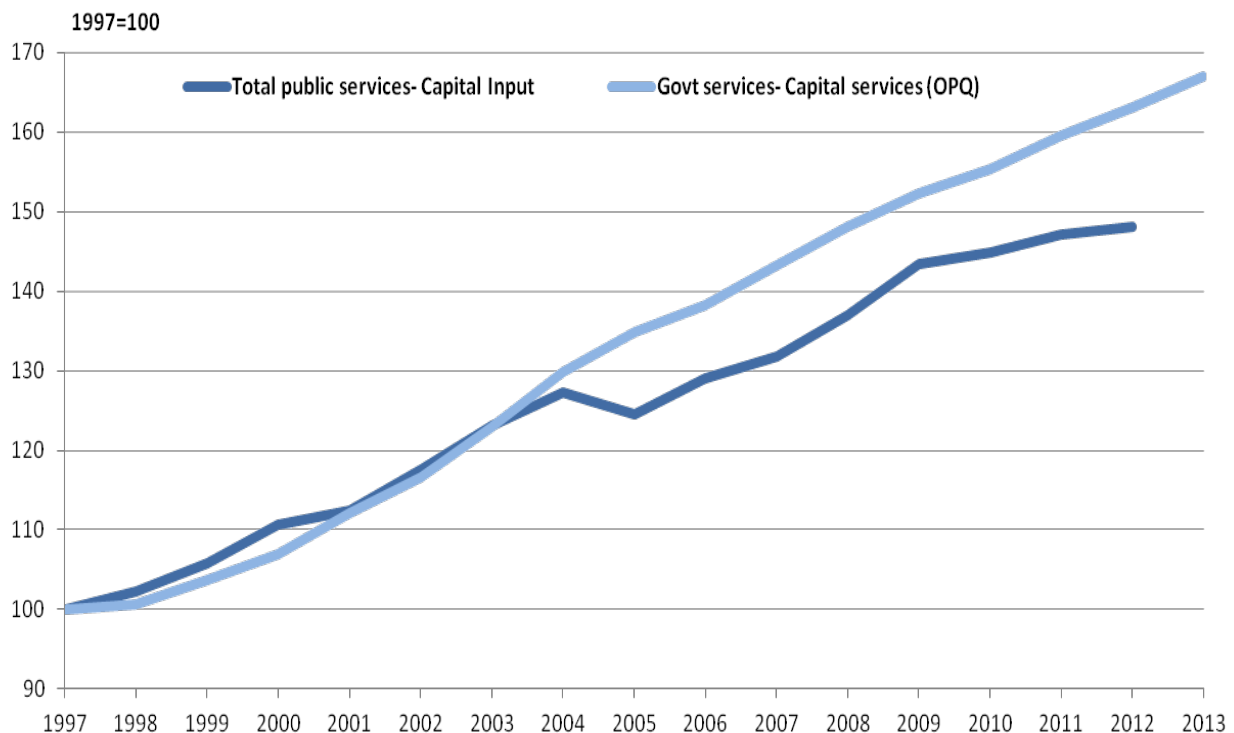
The strength of labour input to ‘government services’ during a period of austerity and public sector job cuts may seem surprising. One likely explanation is growth in hours worked within the OPQ industries but outside the scope of public sector employment. On a rough headcount basis, public sector employment in industries OPQ in 2014 comprised less than 60% of the employment estimate used in the labour productivity estimates for ‘government services’.

**Differences in the measurement of capital inputs are material but have only a small impact on differences in total inputs between government services and total public services**

Government services use the Volume Index of Capital Services (VICS) to measure changes in the volume of capital inputs which measures the capital input into production (Murphy & Franklin 2015). With the exception of education, total public services uses current price capital consumption for each service area taken from the National Accounts converted to a real terms measure using a suitable deflator. Capital input to education is measured using an estimate of capital services taken from the VICS system.

With the exception of a fall in capital inputs for total public services in 2005, capital inputs for government services and total public services have followed a similar increasing trend. However, capital consumption makes up only a small share of total government expenditure, so the impact on overall public service inputs is limited.

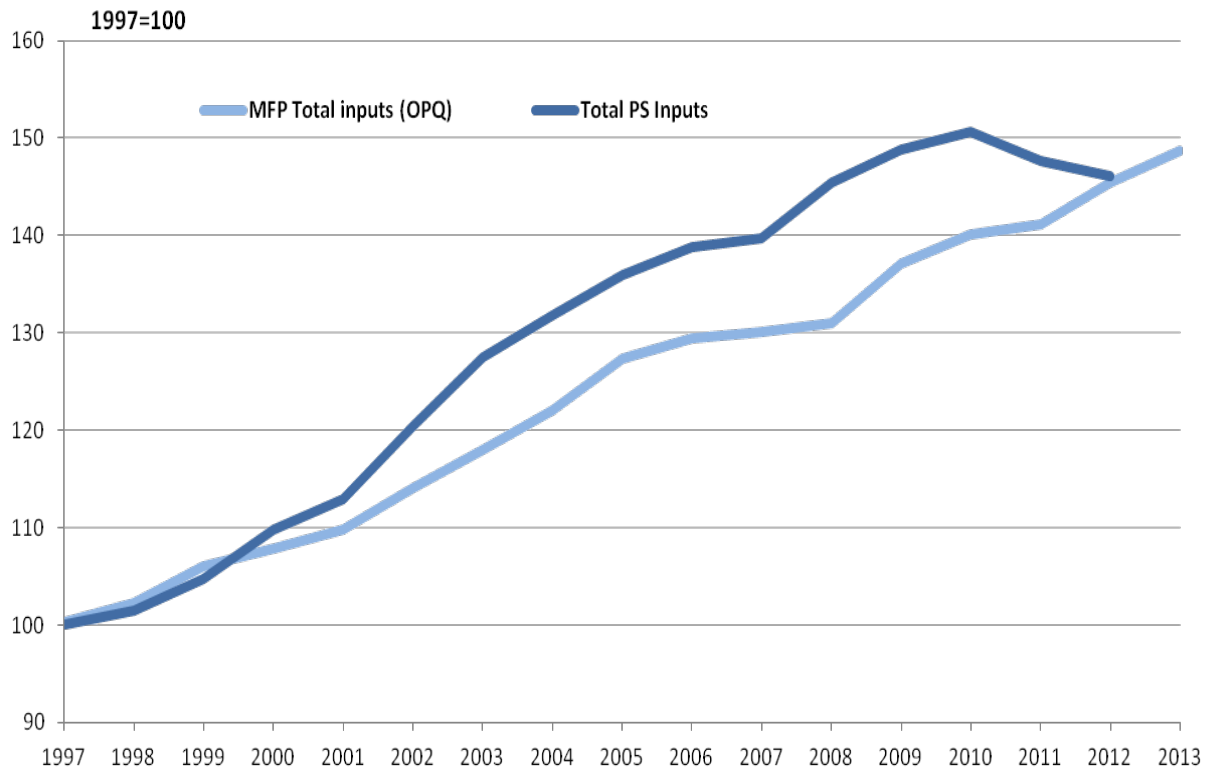
Figure 6: Trends in capital inputs





**Total public service inputs include procurement of goods and services, which are excluded from MFP measures of inputs**

Figure 7: Trends in total inputs



Overall inputs for total public services combine the growth rates for capital inputs, goods and services inputs, and labour inputs using their relative shares of total expenditure. Between 2001 and 2010 total public service inputs rose faster than MFP inputs for ‘government services’, despite both labour and capital inputs rising faster in the latter than the former over the same period, as shown in figures 5 and 6.

The difference between the two measures reflects strong growth in the volume of procurement of goods and services in the total public service inputs estimates. As noted above, this input is absent from the framework used for ‘government services’ MFP estimates.

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## Annex 1: Glossary of terms

**Chained volume measure (CVM)** – a measure which strips the effect of price movements from a current price series to provide an underlying volume series.

**Classification of Functions of Government (COFOG)** – international standard for classification of government activities. Covers healthcare, education, social protection, public order and safety, defence and other services.

**Direct and indirect output measures** – direct measures of public service output are measures of activities such as numbers of operations and pupils in state schools. Indirect measures of public service outputs are measured as volumes of inputs. Direct measures make up about two-thirds of **COFOG** expenditure, and indirect measures about one-third.

**Government services (OPQ)** – a category within **SIC07** comprising public administration and defence (O), education (P), health care and other social and personal services (Q).

**Gross Value Added (GVA)** – a measure of economic output used within the system of National Accounts. GVA is available in current prices and **CVMs**. CVM series are available for the whole economy, by industry (including **OPQ**) and for the **market sector** and are the numerators in **labour productivity** and **MFP**.

**Labour productivity** – measures the amount of **CVM GVA** that is produced by a unit of labour input, measured in the figures provided in this note as hours worked.

**Multi-factor productivity (MFP)** – a decomposition of **GVA** growth into contributions from growth in labour and capital inputs and a residual MFP component.

**Market sector** – a national accounts concept corresponding broadly to that part of the economy which sells its output at meaningful economic prices. ONS publish estimates for market sector **GVA**, employment, **labour productivity** and **MFP**.

**Public services productivity** – ratio of public service outputs to inputs. Public services outputs are volume estimates of expenditure by service area (**direct and indirect measures**) and include **quality adjustments** on education and healthcare outputs. Public service inputs are deflated costs of production.

**Quality adjustments** – adjustments made to direct measures of public service outputs in health and education. Quality adjustments for health are based on survival rates and patient survey results. Quality adjustments for education are based on GCSE results.

**Service areas** – classification used in **Public services productivity** based on different levels of the **COFOG** classification. Includes healthcare, education, adult social care, child social care, social security administration, public order and safety, police, defence and other services.

**Standard Industrial Classifications (SIC07)** – taxonomy used in the national accounts to classify **GVA** by industry. Includes **government services (OPQ)**.

## Annex 2: National Accounts relationships

Table 1 on the following page shows the relationship between the production and expenditure representations of the National Accounts. Figures in red are taken from the Supply-Use tables, with other estimates calculated within the table. The left-hand columns are taken from the supply matrix and show output of products (in rows) by industries (columns). This matrix shows the product composition of each industry's (gross) output. The table shows that most of the gross output of industries OPQ is comprised of the product of the same description, and that production of these products outside industries OPQ is negligible. At the bottom of the left-hand columns the table shows the relationship between gross output and GVA, namely intermediate consumption (IC) by industry - that is, products used up in each industry's production processes. IC is also shown by product in the far right-hand column, where it is arithmetically the difference between gross supply and final demand for products, both measured at purchaser prices. GVA for output of industries OPQ is (before deflation to CVM terms) the numerator for labour productivity and MFP estimates. The sum of GVA for all industries plus the basic price adjustment (which converts from basic prices to purchaser prices) is equal to GDP(P) which is equal to GDP(E) – total final demand less imports.

The right-hand panel of the table summarises final demand by products. General government final consumption (GGFC) is (before deflation to CVM terms) the numerator for total public service productivity estimates. This was £343.9bn in 2012. Most of GGFC is attributed to the main products of the OPQ industries, with just £14bn attributed to other products. Overall GGFC is lower than gross output for the combined OPQ industries (£489.9bn), reflecting production destined for other final demand and IC. This outweighs the element of GGFC that is attributed to products produced outside OPQ. But GGFC is greater than GVA for OPQ (£281.8bn) both in levels and as a share of GDP. This is because GVA is net of IC by industry while GGFC is scored by products before IC is netted off. For example, there was £123.9bn of general government final consumption expenditure on 'public administration etc' products in 2012, compared with £144.1bn of gross output of this product (all in industry O). But as shown in the first column, almost half (£67.0bn) of gross output of industry O (£146.5bn) reflected other products used up in the production process, so GVA was only £79.5bn.

Table 1: Extract from 2012 Supply-Use Tables

2012 £bn	GDP(P) Output by Industry at Basic Prices								GDP(E) Purchaser Prices					
Products	Public administration and defence services; compulsory social security services (O)	Education services (P)	Human health services, Residential care services, Social services (Q)	TOTAL OPQ	Other Industries	TOTAL OUTPUT AT BASIC PRICES	Basic Price Adjustment	TOTAL OUTPUT AT PURCHASER PRICES (GDP(P))	General Government Final Consumption	Other Final Expenditure	TOTAL FINAL EXPENDITURE	Imports of Goods & Services	TOTAL GDP(E)	Memo: Intermediate Consumption by Product
Public administration and defence services; compulsory social security services	144.1	0.0	0.0	144.1	0.0	144.1	0.0	144.1	123.9	8.5	132.4	0.0	132.4	11.7
Education services	0.0	121.4	0.0	121.4	1.3	122.7	0.6	123.3	57.6	43.3	100.9	-0.6	100.3	23.0
Human health services, Residential care services, Social services	0.0	0.0	213.9	213.9	0.0	213.9	2.2	216.1	148.5	32.2	180.7	-1.9	178.8	37.3
Other Products	2.4	7.1	1.0	10.5	2436.9	2447.5	176.6	2624.1	14.0	1762.6	1776.6	-532.7	1243.9	1380.2
Gross Output	146.5	128.5	214.9	489.9	2438.2	2928.1	179.4	3107.6	343.9	1846.7	2190.6	-535.2	1655.4	1452.2
of/which: Intermediate Use by industry	67.0	29.8	111.3	208.1	1244.1	1452.2		1452.2						
Gross Value Added (GVA)	79.5	98.7	103.6	281.8	1194.1	1475.9	179.4	1655.4						
% of total	5.4%	6.7%	7.0%	19.1%	80.9%	100.0%			20.8%	111.6%	132.3%	-32.3%	100.0%	

Numerator (before deflation) for Total Public Service productivity

Numerator (before deflation) for Labour Productivity and MFP