

Understanding government output and productivity

Alwyn Pritchard
National Expenditure and Income Division
Office for National Statistics
Room D3/04
1 Drummond Gate
London SW1V 2QQ
Tel: 020 7533 5517
E-mail: alwyn.pritchard@ons.gov.uk

Executive Summary

Government output is measured by the volume of goods and services provided by government to individuals or the population at large, either free of charge or at a nominal cost. It is an important component of the gross domestic product. This article presents some figures and commentary showing how government activities are portrayed in the national accounts, both in aggregate and for a number of different government functions. The estimates of aggregate government output in GDP are now well established as National Statistics, though development work is in hand to extend and refine measures of quality change. The remaining analysis in the article – on inputs and productivity – is experimental. Table 2 contains a first experimental estimate of overall government productivity.

Even though the gross domestic product is a closely followed indicator, measuring government's contribution to GDP – its outputs – is not the only possible way to measure the benefits flowing from government activity. Government is also striving to achieve stated *outcomes* – which may be achieved in part through its *output*. For example, government might establish a goal of curtailing the number of fires and making them less destructive. This could be achieved in one or more ways including: better fire fighting; fire inspections and other prevention activities; recommending the use of smoke alarms; and improving building standards. Only the first two of these are related to the *output* of the fire service; but all contribute to the *outcome* of less fire damage. Similarly, improved exam results is an outcome which might result from better teaching, the existence of the internet, better public libraries or more support from parents; only the first of these is related to the *output* of education.

Another way in which government chooses to assess its own efficiency is through performance measures. These have played

a significant role in providing publicly available measures of what government produces in a form readily associated with recognisable services and activities, and in a way which contrasts with traditional input cost measures.

Nevertheless, efficient use of resources is central to good economic management: comparing the outputs with the inputs which produced them yields a productivity measure. But this is an approach best suited for use as background information rather than directly as a management tool for those running 'government industries'.

Using government's contribution to GDP, output growth lagged behind the increase in inputs used during the period 1995 to 2001, implying, on the new experimental measure, a fall in productivity. This suggests that, over time, resources were being used less efficiently. However, there are other possible explanations for this development:

- the increases in spending may have been used on things which will increase the capacity to produce more output in the future;
- the spending may have been on things which improve outcomes but do not contribute to output as measured for national accounts;
- the output measures used may not have monitored all the outputs being produced;
- the output measures may have failed to reflect all the quality improvements made in the outputs as a result of rising consumer expectations and the more demanding standards set for service delivery.

It is not, at present, possible to disentangle the separate effects of these various explanations. However, ONS is continuing to work to measure the possible impact of the last two.

I Introduction

This article provides a detailed update on the work in progress at the Office for National Statistics to measure government output and productivity. Earlier reports on this work are described in brief at the end of the article. As the work is not yet complete, the results shown here are illustrative. The purpose of the article is:

- to provide an update on the progress made since last year's report on measuring government output and productivity;
- to extend the analysis into some new areas, taking on the latest data and adding information for 2001;
- to identify remaining shortcomings in the methods and data sources used; and
- to explain the work which needs to be carried out to further improve the accuracy and usefulness of the results.

II Government output – what is it?

Government output is a component of gross domestic product. An estimate of aggregate government output is published regularly as part of the national income and expenditure accounts: there, it is labelled as general government final consumption expenditure at constant prices. The published aggregate series represents reality acceptably well – and better than any alternative approach that is open to us. It meets the criteria for designation as a National Statistic. All National Statistics are produced to the high professional standards set out in the National Statistics Code of Practice. They undergo regular quality assurance reviews to ensure that they meet customer needs.

Government output is the volume of goods and services provided by government to individuals or to the population at large, either free of charge or at a price which is not intended to cover the cost of production. An increase in this output results from more of the goods and services becoming available or from an improvement in their quality. Services such as the provision of healthcare treatments, schooling and defence are easily recognisable as government outputs. But it also includes the running of prisons, courts and many other functions. An important output is the administration of the social security system – but not the cash payments paid out: when government makes cash payments (or transfers) to individuals who are then free to spend the money as they wish, the national accounts record this resulting expenditure as part of the consumption expenditure of households rather than as government output. In the UK, government output currently accounts for around 19 per cent of the gross domestic product as measured by final expenditure.

The approach used to measure government output is based on identifying what is consumed – which in turn identifies what is produced. Implicit in the approach is the idea that increasing the quality of the output itself represents more output – and hence more consumption. In the market situation, people spending their own money equate more cinema tickets, more holidays, better quality food, etc with more welfare – and they bring pressure on producers to operate as efficiently as possible by exercising consumer choice. Government output creates welfare just as market output does: the fact that the consumer pays no price for it – or just a nominal price – does not alter that. More or better education generates more welfare. And so do more healthcare treatments so long as there are patients in need of them. But the work of the courts, prisons and the police service are a different matter: we regard that as output not because individuals want more of it but because society as a whole deems it necessary.

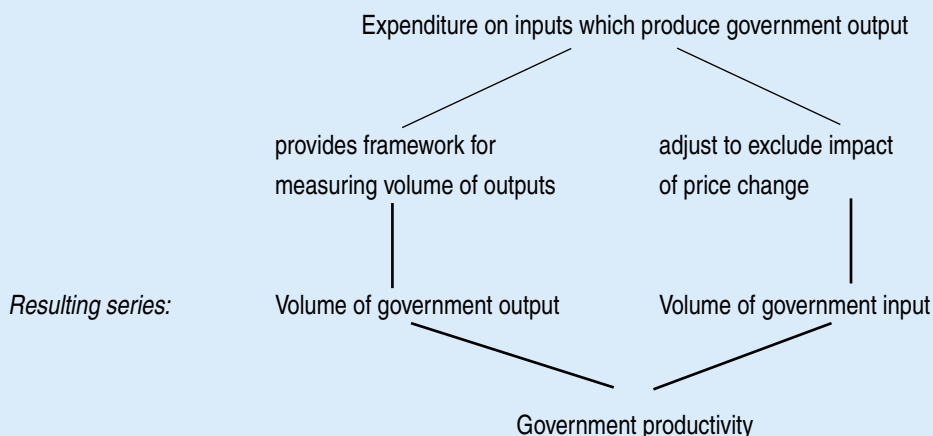
There is an important distinction to be drawn between *outputs* and *outcomes*. It is outputs which are measured in the national accounts. *Outcomes* may not be directly connected with *outputs*. For example a trend towards fewer and less destructive fires may arise in a number of ways including: better fire fighting; fire inspections and other prevention activities; more money on advertisements about smoke alarms etc; and improved building standards. Only the first two of these are related to the *output* of the fire service; but all contribute to the *outcome* of less fire damage. This outcome is the goal sought by government and by individuals. Similarly improved exam results is an outcome which might result from better teaching, use of the internet, better public libraries or more support from parents; only the first of these is related to the *output* of education.

Measuring government productivity is linked to the measurement of government output. Physical productivity, the concept illustrated in this article, relates a volume measure – government output produced in a given period – to the inputs used to produce them. To take an example, an increase in the amount of outputs produced while keeping the level of physical inputs constant generates, by definition, an improvement in the level of physical productivity. Note that this is a broad measure of productivity, taking account of the effectiveness of the use of all inputs, and is not restricted to the productivity of labour as in ONS's *Labour Market Statistics* First Release.

This article will explain how both government output and productivity are measured. If the beginning of the chain is seen as government spending and the end of the chain as a productivity measure, the order of events – and the intermediate series which have to be created – are as follows:

Figure 1

Expenditure on inputs which produce government output



III Estimating aggregate government output and productivity

Volume of government output, expenditure on government output

The expenditure on the production of goods and services which constitute government output is a component of the gross domestic product as measured by the expenditure approach. It is part of the component ‘final consumption expenditure’ which currently accounts for around 86 per cent of GDP. What is final consumption expenditure?

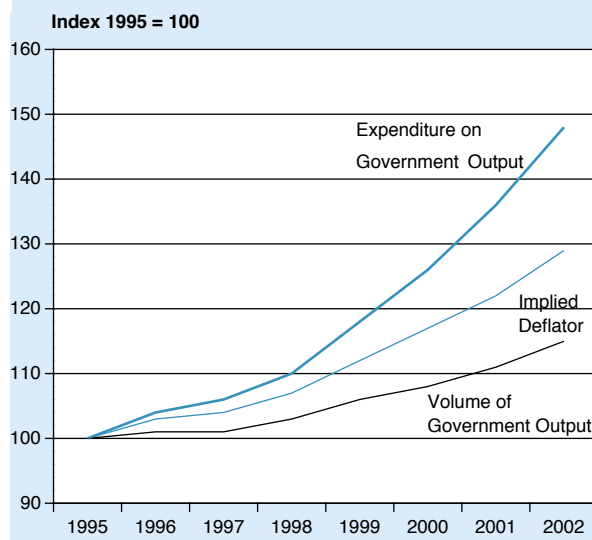
- It represents the value of the goods and services which meet individual or communal needs.
- It is made up almost entirely of expenditure by households and government.
- The expenditure by households goes to buy goods and services from businesses, e.g. retailers and suppliers of services in the market sector. This meets about 77 per cent of the needs of households.
- Their other needs – 23 per cent of them – are met through government output. These can be consumed collectively by everyone (as with defence) or by individuals (as with education and healthcare).

Figure 2 brings together two key National Statistics series:

- Expenditure on the inputs purchased by government to produce its outputs; this is usually referred to in ONS publications as general government final consumption expenditure **at current prices**.
- Government output, which represents the volume of goods and services produced by government and consumed either by individuals in households or collectively. This includes items

Figure 2

General Government: Expenditure on Government Output, Volume of Government Output, Implied Deflator 1995–2002



procured by government on behalf of individuals. This is usually referred to in ONS publications as general government final consumption expenditure **at constant 1995 prices**.

To distinguish clearly between the concepts used here, we will refer to these two series as ‘expenditure on government output’ and ‘volume of government output’ in the remainder of this note. The national accounting term ‘general government’ is used to denote all levels of government taken together.

An increase in expenditure between any two years could be the result of one of the following scenarios:

- more inputs were bought (e.g. more staff);
- the prices of the inputs bought went up (e.g. the pay rates of staff went up or better, more expensive staff were employed).

But more likely it will be some combination of these, that is:

- a change in the amount of inputs bought, together with a change in their price.

The volume of government output need not move hand in hand with the expenditure on it. They are different concepts. The expenditure has paid for the inputs; the output is what was created as a result of bringing these inputs together. The volume of output is a volume concept and is measured independently of the expenditure: it is measured in terms of what is produced for a consumer. To take some examples:

- the volume of output of health treatments can be measured in terms of the number of treatments provided to patients;
- and the volume of output of education can be measured by the number of lessons provided to students.

These examples make it easier to understand how the volume of output does not necessarily track the expenditure on producing it. A simple illustration is the arrival of an extra pupil in a class of 10: this does not add 10 per cent to expenditure but it will add 10 per cent to the output produced so long as the quality of the education provided remains the same.

A list of the main government outputs appears in the Annex. It is not an exhaustive list: in the construction of any economic aggregate, the usual practice is to measure a range of variables which, together, are believed to move in line with the whole. Government outputs cannot easily be reduced to the common denominator of money, as they usually have no selling price. If they need to be added together, this can be done by using weights derived from information on the relative costs of producing each type of output.

In some cases, particularly for collective services like defence, it may not be possible to develop volume of output measures at all. In these cases we have to make the artificial assumption that the output of these services is identical to the volume of inputs. We are trying to minimise the use of this assumption, because it carries with it the implicit assumption that productivity cannot change. Independent output indicators have now been developed for almost 70 per cent of government output and are included, in an aggregate form, in the national accounts.

If the volume of output produced by government does not vary precisely with expenditure, its unit cost of production would not remain constant but go up or down. Hence, the ratio of expenditure on government output to the volume of government output is of interest. This ratio is often referred to as the 'implied deflator': it measures the cost per unit of output. It is akin to a price index and is sometimes interpreted as a measure of public sector inflation. However, it differs from price indices such as the retail prices index in one important respect – it is not a measure of market prices and cannot be observed or measured directly.

Analysis

Table 1 shows that, between 1995 and 2002, expenditure on government output increased by 48 per cent. Growth was modest in the early years – in the region of 2 per cent to 4 per cent year on year. Most of the growth in spending came after 1998: in this period, annual growth was in the 6 per cent to 9 per cent range, reaching a high point of 9.1 per cent by 2002.

Table 1 General Government: expenditure on/ volume of government output and implied deflator

	1995	1996	1997	1998	1999	2000	2001	2002	% change 1995–2002
£ million									
All functions									
Expenditure on government output *	141,031	146,779	149,147	154,881	166,614	177,801	191,506	208,936	48
Annual change (per cent)		4	2	4	8	7	8	9	
Volume of government output at 1995 prices *	141,031	142,702	142,779	144,991	149,419	152,524	156,361	162,251	15
Annual change (per cent)		1	0	2	3	2	3	4	
Implied deflator*	100.0	102.9	104.5	106.8	111.5	116.6	122.5	128.8	

* These series are National Statistics.

Over the period, the volume of government output rose by 15 per cent. Immediately after 1995, there was very little growth. In 1999, growth began to accelerate reaching a high point of just under 4 per cent in 2002. It is interesting to note that this acceleration began one year later than the acceleration in the growth in expenditure on government output.

The implied deflator increased by 29 per cent. In effect, the cost of producing a unit of government output has gone up by 29 per cent, the rate of increase being higher after 1998 than before. That says nothing about how efficiently resources are being transformed into output. And it says nothing about whether unit costs are going up faster than they are in other sectors. Over the same period, the GDP deflator rose by 21 per cent.

The component parts of output and expenditure are examined in detail in Section IV.

Government productivity

We argued above that the cost per unit of output is not an ideal measure of efficiency nor of success or good practice.

- As it is expressed in money terms, it will reflect changes in the prices of inputs as well as changes in the efficiency with which they are converted into outputs.
- It is perfectly possible that, even when costs per unit of output are rising, resources can be used more efficiently year by year – and vice versa.
- Efficiency in the use of physical resources can only be isolated if we measure inputs excluding the effect of price changes.

We need a measure which relates outputs to the inputs that created them. Productivity measurement is one solution, as is illustrated in the following example:

- An increase in the volume of government output between any two years can result from any of the following scenarios:
 - x per cent more output is produced using x per cent more inputs; or
 - x per cent more output is produced using less than x per cent more inputs; or
 - x per cent more output is produced using more than x per cent more inputs.

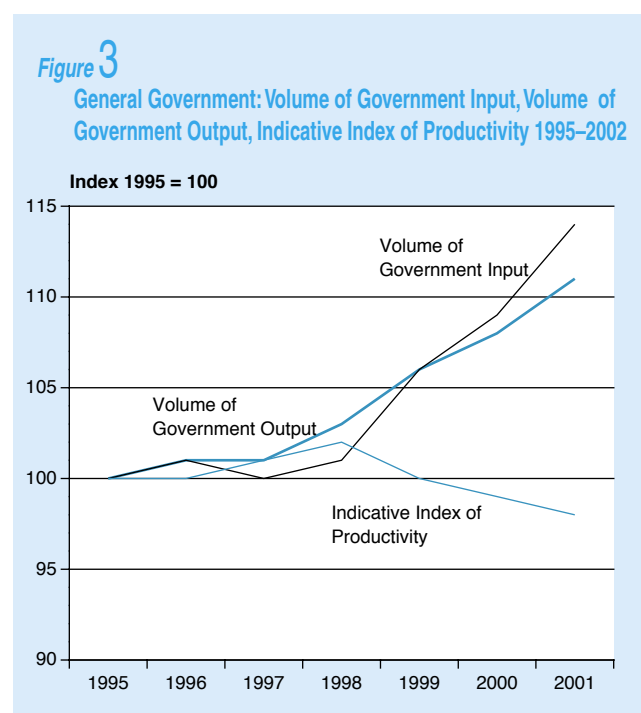


Table 2 General Government: volume of government output, volume of government input and annual productivity change indicative estimate

	£ million							
	1995	1996	1997	1998	1999	2000	2001	% change 1995–2001
All functions								
Volume of government output at 1995 prices*	141,031	142,702	142,779	144,991	149,419	152,524	156,361	11
Annual change (per cent)		1	0	2	3	2	3	
Volume of government input at 1995 prices*	141,031	142,388	141,371	142,785	149,441	153,877	160,320	14
Annual change (per cent)		1	-1	1	5	3	4	
Annual productivity change: indicative estimate (per cent) *		0	1	1	-2	-1	-2	

* This series is a National Statistic.

+ These are experimental series.

In the first of these cases, there is no change in productivity, in the second there is an increase and in the third a fall. To measure productivity, we therefore need to know two things: output (which we have already examined) and inputs. Table 2 and Figure 3 show these series, and derive a productivity index by taking the ratio between them:

- General government final consumption expenditure **at constant 1995 prices**. This represents the volume of goods and services which are produced by government and consumed either by individuals in households or collectively. It is also known as government output. This is one of the series already encountered in Table 1.
- The volume of inputs purchased by government to produce those outputs, measured as general government final consumption expenditure with the effect of price change taken out. This is not a component of the national accounts as such but it is derived from a component – general government final consumption expenditure **at current prices** – by adjusting it to exclude the effect of price changes. It does not yet meet all the criteria to be a National Statistic.
- The productivity index is the ratio of outputs to inputs at constant 1995 prices.

To simplify the terminology, the remainder of this article will refer to the first two of these series as ‘volume of government output’ and ‘volume of government inputs’. The third series is an approximation to total factor productivity: it is a broad measure which shows up changes in productivity, whether their source is a change in efficiency in the use of labour or intermediate inputs or capital.

Analysis

In Table 2, the analysis covers only the period 1995 to 2001; complete data for 2002 are not yet available.

- The volume of government output went up by 11 per cent between 1995 and 2001. Immediately after 1995, there was little growth. In 1999, growth began to accelerate reaching 2½ per cent in 2001 (and then, as we saw earlier, reaching just under 4 per cent in 2002).
- The volume of inputs grew very slowly or not at all in the early part of the period. In 1999, they began to move sharply upwards; from then, the annual rate of growth remained in the 4 per cent to 5 per cent range.
- It is the ratio of the volume of outputs to the volume of inputs which measures productivity. Since 1999, the volume of output has been lagging the volume of inputs, indicating a fall in productivity.

The data are not yet robust enough to report the productivity calculations for individual government functions but the determinants of productivity change are discussed in Sections IV and V.

IV A more detailed look at government input

This section examines the next stages in measuring government output and government productivity; namely:

- measuring expenditure on government output, and
- measuring the volume of government input.

At this stage, we will examine the series in more detail:

- by type of input;
- by function.

The types of input are labour, purchases of goods and services and capital consumption.

The functions examined in detail are health, education, social security, personal social services, police, courts, prisons and fire. These eight functions together account for approaching 70 per cent of the total relevant expenditure across all functions. For some functions – such as defence – it has not been possible yet to devise an output measure. The main output of defence – at least when units are not on active service – is to provide deterrence: no way has yet been found to measure this in volume terms. Other services such as housing are excluded as social housing in the UK is provided by units which are classified as market producers rather than to government: provision of housing by local authorities and by housing associations appears in the non-financial corporations sector.

Expenditure on government output

In Table 3, health is the largest single component of expenditure on government output; it accounts for 40 per cent of the total. The other major functions, in spending terms, are: education 29 per cent and personal social services 12 per cent. Below them come police 9 per cent, courts 3 per cent, social security 3 per cent, prisons 2 per cent and fire 2 per cent.

All functions show higher expenditure in 2001 than in 1995. For many functions, there was slow growth between 1995 and 1997 and an increase after that. The largest increases over the whole period were in personal social services and health (both up by 53 per cent), education (+39 per cent), police (+38 per cent), fire (+26 per cent) and prisons (+25 per cent). Social security expenditure fell after the transfer of some responsibilities to Inland Revenue. For personal social services, with increased demand from an ageing population, the increase was spread across the whole period; health on the other

Table 3 General Government: expenditure on government output, price indices and volume of government input, by function and economic category

£ million

	1995	1996	1997	1998	1999	2000	2001	% change 1995–2001
Education								
Expenditure on government output								
Labour	17,834	18,223	18,938	19,837	20,928	22,663	25,183	41
Goods and services	6,391	6,464	6,616	6,981	7,607	7,943	8,603	35
Capital consumption	1,066	1,111	1,138	1,142	1,157	1,187	1,264	19
Total	25,291	25,798	26,692	27,960	29,692	31,793	35,050	39
Price indices (1995=100)								
Labour	100.0	102.9	106.0	109.5	113.9	117.1	121.3	
Goods and services	100.0	101.2	102.6	103.9	103.1	104.7	106.6	
Capital consumption	100.0	102.4	104.7	108.9	113.3	117.9	122.1	
Volume of government input at 1995 prices								
Labour	17,834	17,711	17,872	18,123	18,370	19,347	20,753	16
Goods and services	6,391	6,391	6,448	6,721	7,377	7,585	8,071	26
Capital consumption	1,066	1,085	1,087	1,049	1,021	1,007	1,036	-3
All inputs	25,291	25,187	25,407	25,893	26,768	27,939	29,860	18
All inputs index	100	100	101	102	106	111	118	
Health								
Expenditure on government output								
Labour	3,419	2,841	2,680	2,676	2,865	2,799	3,074	-10
Goods and services	35,470	38,539	39,895	42,632	47,134	50,927	56,352	59
Capital consumption	92	86	82	83	109	117	120	30
Total	38,981	41,466	42,657	45,391	50,108	53,843	59,546	53
Price indices (1995=100)								
Labour	100.0	103.6	106.4	110.9	118.0	126.4	134.3	
Goods and services	100.0	102.9	105.1	108.6	114.1	119.7	124.8	
Capital consumption	100.0	105.7	104.8	107.4	109.3	112.9	117.1	
Volume of government input at 1995 prices								
Labour	3,419	2,743	2,519	2,412	2,427	2,214	2,289	-33
Goods and services	35,470	37,443	37,948	39,239	41,297	42,548	45,159	27
Capital consumption	92	81	78	77	100	104	102	11
All inputs	38,981	40,267	40,545	41,728	43,824	44,866	47,550	22
All inputs index	100	103	104	107	112	115	122	
Social Security								
Expenditure on government output								
Labour	1,816	1,834	1,899	1,965	1,915	1,882	1,721	-5
Goods and services	2,511	2,436	2,420	2,352	2,616	2,809	2,313	-8
Capital consumption	94	85	96	101	98	97	95	1
Total	4,421	4,355	4,415	4,418	4,629	4,788	4,129	-7
Price indices (1995=100)								
Labour	100.0	98.3	100.7	109.7	112.4	110.9	101.5	
Goods and services	100.0	101.8	103.7	106.5	108.1	110.0	112.1	
Capital consumption	100.0	105.1	109.4	111.6	109.6	112.1	115.1	
Volume of government input at 1995 prices								
Labour	1,816	1,866	1,886	1,791	1,704	1,697	1,696	-7
Goods and services	2,511	2,393	2,333	2,209	2,420	2,554	2,064	-18
Capital consumption	94	81	88	90	89	87	83	-12
All inputs	4,421	4,340	4,307	4,090	4,213	4,338	3,843	-13
All inputs index	100	98	97	93	95	98	87	

Table 3 - continued

	1995	1996	1997	1998	1999	2000	2001	£ million % change 1995-2001
Prisons								
Expenditure on government output								
Labour	1,090	1,124	1,131	1,093	1,191	1,244	1,241	14
Goods and services	516	520	593	660	715	641	754	46
Capital consumption	94	94	102	105	127	136	133	42
Total	1,700	1,738	1,826	1,858	2,033	2,021	2,128	25
Price indices (1995=100)								
Labour	100.0	105.1	104.4	96.9	103.8	105.6	103.8	
Goods and services	100.0	102.4	104.4	107.0	108.6	110.7	112.1	
Capital consumption	100.0	105.1	109.7	111.8	109.8	112.3	114.6	
Volume of government input at 1995 prices								
Labour	1,090	1,069	1,084	1,128	1,147	1,179	1,195	10
Goods and services	516	508	568	617	658	579	673	30
Capital consumption	94	89	93	94	116	121	116	23
All inputs	1,700	1,666	1,745	1,839	1,921	1,879	1,984	17
All inputs index	100	98	103	108	113	111	117	
Police								
Expenditure on government output								
Labour	6,705	6,942	7,244	7,625	7,729	8,041	8,415	26
Goods and services	925	1,059	1,081	1,114	1,204	1,456	2,119	129
Capital consumption	97	102	110	116	141	146	152	57
Total	7,727	8,103	8,435	8,855	9,074	9,643	10,686	38
Price indices (1995=100)								
Labour	100.0	103.7	107.6	112.1	115.7	121.7	128.5	
Goods and services	100.0	102.6	104.5	107.6	108.9	110.6	111.9	
Capital consumption	100.0	105.1	107.1	109.1	108.6	111.2	118.7	
Volume of government input at 1995 prices								
Labour	6,705	6,696	6,733	6,803	6,678	6,606	6,549	-2
Goods and services	925	1,032	1,034	1,035	1,106	1,317	1,893	105
Capital consumption	97	97	103	106	130	131	128	32
All inputs	7,727	7,825	7,870	7,944	7,914	8,054	8,570	11
All inputs index	100	101	102	103	102	104	111	
Fire								
Expenditure on government output								
Labour	1,345	1,395	1,453	1,522	1,600	1,636	1,661	24
Goods and services	132	114	129	136	149	186	188	42
Capital consumption	38	39	43	47	50	53	55	45
Total	1,515	1,548	1,625	1,705	1,799	1,875	1,904	26
Price indices (1995=100)								
Labour	100.0	103.5	108.6	113.4	115.5	118.5	119.3	
Goods and services	100.0	87.8	93.5	101.9	108.3	110.0	113.7	
Capital consumption	100.0	105.1	109.7	111.8	109.8	112.3	114.5	
Volume of government input at 1995 prices								
Labour	1,345	1,348	1,338	1,342	1,385	1,381	1,392	4
Goods and services	132	130	138	134	138	169	165	25
Capital consumption	38	37	39	42	46	47	48	26
All inputs	1,515	1,515	1,515	1,518	1,569	1,597	1,605	6
All inputs index	100	100	100	100	104	105	106	

Table 3 - continued

£ million

	1995	1996	1997	1998	1999	2000	2001	% change 1995–2001
Courts								
Expenditure on government output								
Labour	1,218	1,206	1,243	1,260	1,299	1,398	1,431	18
Goods and services	1,851	2,019	1,988	1,957	1,794	1,722	2,292	24
Capital consumption	40	40	44	46	50	55	53	33
Total	3,109	3,265	3,275	3,263	3,143	3,175	3,776	22
Price indices (1995=100)								
Labour	100.0	102.2	106.2	108.7	111.1	117.5	120.5	
Goods and services	100.0	102.0	103.8	106.6	107.6	109.4	110.9	
Capital consumption	100.0	105.1	108.7	110.9	109.4	112.0	115.4	
Volume of government input at 1995 prices								
Labour	1,218	1,180	1,170	1,159	1,169	1,190	1,188	-3
Goods and services	1,851	1,980	1,915	1,836	1,668	1,574	2,067	12
Capital consumption	40	38	40	41	46	49	46	15
All inputs	3,109	3,198	3,125	3,036	2,883	2,813	3,301	6
All inputs index	100	103	101	98	93	91	106	
Personal Social Services								
Expenditure on government output								
Labour	4,958	5,169	5,352	5,584	5,767	5,857	6,155	24
Goods and services	4,216	4,946	5,288	5,372	6,541	7,305	7,786	85
Capital consumption	54	61	58	60	199	213	222	311
Total	9,228	10,176	10,698	11,016	12,507	13,375	14,163	54
Price indices (1995=100)								
Labour	100.0	105.4	110.5	118.6	124.6	127.8	137.0	
Goods and services	100.0	100.6	102.5	104.2	105.2	106.5	106.7	
Capital consumption	100.0	105.2	104.9	106.9	107.5	110.3	122.4	
Volume of government input at 1995 prices								
Labour	4,958	4,905	4,843	4,710	4,629	4,581	4,492	-9
Goods and services	4,216	4,917	5,159	5,157	6,221	6,857	7,296	73
Capital consumption	54	58	55	56	185	193	181	235
All inputs	9,228	9,880	10,057	9,923	11,035	11,631	11,969	30
All inputs index	100	107	109	108	120	126	130	
All above functions								
Expenditure on government output								
Labour	38,385	38,734	39,940	41,562	43,294	45,520	48,881	27
Goods and services	52,012	56,097	58,010	61,204	67,760	72,989	80,407	55
Capital consumption	1,575	1,618	1,673	1,700	1,931	2,004	2,094	33
Total	91,972	96,449	99,623	104,466	112,985	120,513	131,382	43
Volume of government input at 1995 prices								
Labour	38,385	37,518	37,445	37,468	37,509	38,195	39,554	3
Goods and services	52,012	54,794	55,543	56,948	60,885	63,183	67,388	30
Capital consumption	1,575	1,566	1,583	1,555	1,733	1,739	1,740	11
All inputs	91,972	93,878	94,571	95,971	100,127	103,117	108,682	
All inputs index	100	102	103	104	109	112	118	
Overall implied deflator								
Labour	100.0	103.2	106.7	110.9	115.4	119.2	123.6	
Goods and services	100.0	102.4	104.4	107.5	111.3	115.5	119.3	
Capital consumption	100.0	103.3	105.7	109.3	111.4	115.2	120.3	
All other functions								
Expenditure on government output	49,059	50,330	49,524	50,415	53,629	57,288	60,124	23
Price index (1995=100)	100.0	103.8	105.8	107.7	108.8	112.9	116.4	
Volume of government input at 1995 prices	49,059	48,510	46,800	46,814	49,314	50,760	51,638	5
All functions								
Expenditure on government output	141,031	146,779	149,147	154,881	166,614	177,801	191,506	36
Volume of government input at 1995 prices	141,031	142,388	141,371	142,785	149,441	153,877	160,320	14
Implied deflator	100.0	103.1	105.5	108.5	111.5	115.5	119.5	

hand was fairly stable in the early years before growing strongly after 1998. But health is several times as large as personal social services and hence its recent growth has had an important influence on the growth of the total.

For most functions, the largest part of expenditure – in value terms goes on labour. For fire, labour accounts for nearly 90 per cent of expenditure, for police around 80 per cent and for education around 70 per cent. For social security, courts and personal social services, the share spent on labour is below 50 per cent. These percentages have not varied significantly over the period: there are suggestions of a slight fall in the labour share in some areas as expenditure on the purchases of goods and services has increased faster than that on labour. This is particularly the case in personal social services and, to a lesser extent, in prisons and police.

For health, the picture is very different. Here, purchases of goods and services are over 90 per cent of all expenditure. This arises because most health treatments paid for by government are not produced by government. Primary care trusts (which are a part of government) commission these services from hospital trusts and other healthcare providers: in the national accounts, these providers are classified as either public corporations or private producers. In summary, the central government buys healthcare treatments (goods and services) on behalf of patients but does not employ the staff who produce them.

Volume of government input

The volume series are obtained in one of two ways, depending on the suitability of the data available for the purpose:

- by direct measurement of the resources used (e.g. the number of employees), or
- by dividing the current price expenditure by an index which measures price change in the items bought.

These calculations are carried out at the most disaggregated level practicable, e.g. for each combination of function and economic category. These volume of inputs series are not components of the national accounts as such and they do not yet meet all the criteria to be National Statistics.

Looking at the price indices, the price of labour went up faster in most functions than that of the goods and services bought. The amount of the increase in the unit labour costs varies by function. It is 37 per cent for personal social services, 29 per cent for police, 21 per cent for education and courts, 19 per cent for the fire service and 4 per cent for prisons. As explained before, health is a different case. In expressing these health inputs at constant prices, account has

been taken of the composition of the expenditure incurred by the producers, notably that expenditure on labour accounts for a large share of hospitals' expenditure.

For two functions – personal social services and education – labour inputs were significantly lower in 2001 than they were in 1995. One influence on this is likely to be the increasing incidence of contracting out services, including the use of private finance initiative contracts: this means that government is buying goods and services rather than labour. Given this development, a more coherent picture is obtained by observing all the inputs together: it is this, rather than the rapidly changing component series which is relevant to measuring output and productivity.

All functions except social security show a higher volume of inputs used in 2001 than in 1995. For many functions, there was relative stability (or a slight fall) between 1995 and 1997 and an increase after that. The largest increases over the whole period were in personal social services (up by 30 per cent), prisons (+17 per cent), police (+11 per cent), health (+22 per cent). The increase in personal social services was spread across the whole period; health on the other hand was fairly stable in the early years before growing strongly after 1998. But health is several times as large as personal social services and hence its recent growth has had an important influence on the total. The social security series fell sharply in 2001 after the transfer of some functions to the Inland Revenue (which is not included in these tables).

V A more detailed look at government output

This section introduces the next stage: measuring the volume of output and the rate of productivity change. These are the concepts which are most meaningful from an economic point of view. However the data are not yet robust enough to present the calculations of productivity for the individual functions of government. Nevertheless, this section illustrates the process.

Volume of government output

Section II has already introduced the concept of government outputs. When we pay for goods and services, the output we buy can easily be identified as what we receive in exchange for parting with our money. When goods and services are provided free of charge by government, we are not always aware of receiving them. We therefore need to think a little harder to identify the outputs. Some of the principles were listed in the article "Measuring Productivity Change in the Production of Public Services" in *Economic Trends*, May 2002; the annex lists a number of common government outputs. This section illustrates how individual outputs are identified and measured.

The average annual prison population rose steadily from 57,000 in 1995 to just under 72,000 in 2001 (see Table 4). If the quality of prison care remained constant, this would be a strong indication of growth in output over this period. In reality, there is anecdotal evidence that the quality of service provided has declined as prisons have become overcrowded. But at present, no means has been devised to bring the effect of that into the output measure.

Table 4 Measuring the output of prisons: prison population

Great Britain	Thousands
Average prison population	
1995	56.7
1996	61.1
1997	67.2
1998	71.3
1999	70.8
2000	70.5
2001	71.9

The fire service's main unit of output is responding to emergency events such as fires; hence the downward trend in the number of secondary fires since 1995 (see Table 5) indicates a fall in output followed by a sharp increase in 2001. Numerous other fire service outputs – such as attending road accidents – are also included in the overall measure of government output. We have no reason to believe that quality change in the fire service is significant on a year to year basis.

Table 5 Measuring the output of fire services: major components and total

	Index numbers, 1995=100		
	Primary fires	Secondary fires	Total output
Weights (per cent)	49.3	12.6	100
1995	100.0	100.0	100.0
1996	104.6	78.8	100.0
1997	102.0	65.2	95.1
1998	101.7	50.5	90.0
1999	111.1	61.9	94.6
2000	111.6	63.8	98.2
2001	116.0	79.9	105.1

In education, the unit of output is a pupil year of teaching. So output is mainly a function of the numbers in education. During this period, these pupil numbers grew at a rate of about 0.7 per cent per year. Unsurprisingly, education output – when measured in this way – changes very little over the period (see Table 6). However, there is evidence that the quality of education has improved in recent years and research is in progress to quantify this so it can be reflected appropriately in the overall measure of government output.

A large part of police work consists of investigating crimes committed. But not all crimes are the same: on average, a violent crime has much more time and resources spent on it than do other types. Investigating resource-intensive crime must be regarded as creating more output than the investigation of a crime which takes up less resources. It follows that police output is influenced by changes in the composition of crimes. Table 7 shows that there was a sharp increase in violent crime over the period and sharp falls in several types of crime which are less expensive (such as thefts from vehicles and burglaries). Weighting each type of crime according to the cost of investigating it yields an increase in police output over the period. To produce an overall measure of police output, this 'raw' measure needs to be adjusted to take account of the success of the police in solving crimes and to add in other police outputs such as time spent on patrol and attending road accidents.

In health, where each specific type of treatment is usually a different output, the changing composition of the aggregate output is an important determinant of the overall trend. Some treatments are expensive while others are not; some treatments are performed frequently, others not. The cost and the incidence of each treatment are taken into account by the Department of Health in compiling an output index. Table 8 contains this index together with the ONS measure which has wider coverage. Quality change does not yet feature in this measure. But there are areas where noticeable quality change might be suspected: an increase in success rates of treatments and survival rates after treatments perhaps being the most significant. These are not yet reflected in the overall output measure.

Table 6 Measuring education output: numbers of pupils being taught, by school type

	Index numbers, 1995=100				
	Nursery	Primary	Secondary	Special	Total
1995	100.0	100.0	100.0	100.0	100.0
1996	101.6	101.2	101.0	100.6	101.1
1997	102.3	102.0	102.2	101.6	102.1
1998	101.4	102.5	103.6	101.8	102.9
1999	105.1	102.2	105.7	101.7	103.8
2000	109.5	101.6	107.7	101.7	104.5
2001	107.1	101.5	108.1	101.7	104.6

Table 7 Measuring police output: recorded crimes

England and Wales		Thousands						
	Weights *	1995	1996	1997	1998	1999	2000	2001
Violence against the person	30	473.9	517.6	551.2	516.6	561.5	596.0	637.8
Sexual offences	3	31.3	31.9	34.6	36.0	37.4	37.4	40.4
Robbery	5	68.7	72.5	65.7	65.9	79.9	92.4	114.8
Burglary – dwelling	8	644.3	596.1	521.7	480.4	450.3	412.9	423.5
Burglary – commercial & other	4	590.8	557.7	501.4	481.6	467.9	440.7	444.4
Theft of motor vehicle	6	517.7	479.7	418.1	394.2	379.0	347.8	330.8
Theft from vehicle	3	825.7	793.8	721.4	689.6	673.4	639.5	648.8
Theft – other	14	1,204.1	1,153.7	1,115.3	1,112.1	1,163.2	1185.7	1,268.6
All other notifiable crime	13	263.5	268.9	275.3	326.5	386.1	387.0	382.7
Criminal damage	5	977.1	988.0	928.8	886.8	929.2	956.5	1,038.4
Drug offences	10	134.2	142.9	147.8	139.2	125.4	115.6	119.4
Total	100	5,731.3	5,603.0	5,281.2	5,129.0	5,253.2	5,211.5	5,449.6
Weighted Index		100	100	98	95	100	102	107

* Relative cost of investigating each type of crime.

Table 8 Measuring health services output

Index numbers, 1995=100		
	Hospital & Community Health Services (DoH index)	All Health
1995	100.0	100.0
1996	102.5	102.8
1997	104.9	105.2
1998	107.6	108.0
1999	109.4	110.4
2000	109.6	113.3
2001		116.6

Table 9 Measuring social security output: indicators of claims made / payments processed

Index numbers, 1995=100							
	1995	1996	1997	1998	1999	2000	2001
Retirement pension	100.0	102.1	104.5	91.0	93.8	76.3	83.9
Widows benefit	100.0	95.0	92.5	77.5	90.0	82.5	130.0
Job seekers' allowance	100.0	93.6	90.7	85.0	84.6	78.9	75.2
Sickness benefits	100.0	100.2	93.9	81.5	80.1	78.8	69.5
Income support	100.0	96.5	94.0	97.9	97.4	98.5	100.3
Family credit	100.0	110.2	117.7	119.7	91.5	0.0	0.0
Social fund	100.0	100.5	101.9	102.8	103.2	103.2	103.2
Child & lone parent benefits	100.0	94.1	117.4	117.4	105.4	119.6	120.5
Housing benefit	100.0	100.2	97.2	93.8	89.9	84.2	81.4

In social security, the units of output are mainly claims but in some cases payments. There are many separate benefits: their incidence is shown in Table 9. For each type, the numbers of claims or payments must be weighted in proportion to the processing cost. Taken together, these results paint a picture of declining output for social security during the late 1990s, partly reflecting the period's economic prosperity but also the reorientation of the social security system. However, this decline might be an overestimate, as it does not yet take account of other output activities such as giving advice.

Government productivity

Table 2 gave an indicative measure of productivity change for government as a whole. It was calculated as the ratio of the change in the volume of outputs to the change in the volume of inputs, taking all government activities together. It is planned to make this analysis available at function level as soon as the quality of the data warrant it.

Conclusions

This article has compared the output produced by government over a year with the resources which have been used to produce it. These resources comprise a wide range of items, only some of which can be directly linked to producing a specific output. At one extreme, disposable items used in a hospital operation are, by definition, linked to that particular output. At the other extreme, activities such as training or recruitment do not produce output at the time they are carried out; their *raison d'être* is that they facilitate production in the future. In a number of cases government output is demand led (e.g. the number of fires or the number of old people) making it difficult to manage short-term fluctuations. In other cases, the decision to generate more government output may be one of policy. All these factors together suggest that we would not expect close relationships year by year between expenditure and output. A part of the increase in inputs in the past few years will go towards building an infrastructure which delivers more output – or better quality output – in future years.

This brings us to the question of whether a meaningful picture is presented by the approach used in this article. Much of the information is already included in the computation of gross domestic product and already meets the National Statistics quality criteria. For instance, the expenditure on government output is obtained from outturn reports on spending by central and local government. The output measures have been built up from information on each function and are included in GDP. The article also has a role in setting out the framework for measuring productivity change in government: future work will be consistent with this framework.

Output growth has lagged behind the increase in inputs during the period 1995 to 2001, implying, on the new experimental measure, a fall in productivity. This suggests that, over time, resources were being used less efficiently. However, there are other possible explanations for this development:

- the increases in spending may have been used on things which will increase the capacity to produce more output in the future;
- the spending may have been on things which improve outcomes but do not contribute to output as measured for national accounts;
- the output measures used may not have monitored all the outputs being produced;
- the output measures used may have failed to reflect all the quality improvements made in the outputs as a result of rising consumer expectations and the more demanding standards set for service delivery.

These factors may also affect the implied deflator (cost per unit of output). But it is not, at present, possible to disentangle the separate effects of these various explanations. However, ONS is continuing to work to measure the possible impact of the last two. We have some indication of what is missing from our figures and are working to include them. Examples include the trend to using more effective drugs, higher observed patient survival rates (both of which point to an improvement in the quality of output) and treating patients in private sector hospitals (an activity which is not yet covered by these figures). ONS will continue this work with a view to publishing estimates of productivity for each government function. To achieve this, we will improve coverage of the series included here and work to incorporate quality change into the output measures. Regular progress reports will be published.

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- OECD Productivity Manual: A guide to the measurement of industry level and aggregate productivity growth (2001), OECD, Paris; available at www.oecd.org/pdf/M00018000/M00018189.pdf
- Pritchard A (2002) Measuring productivity in the provision of public services, *Economic Trends*, No. 582, pp 20–32.
Presents the concepts and some of the data relevant to measuring government productivity.

Annex

Examples of some government outputs

Fire: tackling fires, attending accidents, preventing fires.

Courts: holding court cases, giving support to individuals on probation.

Police: solving crimes, attending accidents, patrolling.

Prisons: looking after prisoners.

Health: provision of treatments of various kinds in hospitals; provision of services by family doctors, opticians, pharmacists and dentists.

Education: educating pupils, delivering better quality education.

Social security: processing claims for different types of benefit; providing services of various types to the elderly, children, etc.

Personal social services: providing residential care for adults, foster placements for children, community home places for children, home help services and adoption services.