

## Towards a more productive state

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## **Reform**

*Reform* is an independent, non-party think tank whose mission is to set out a better way to deliver public services and economic prosperity. Our aim is to produce research of outstanding quality on the core issues of the economy, health, education, welfare, and criminal justice, and on the right balance between government and the individual. We are determinedly independent and strictly non-party in our approach.

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## Executive summary

Improving productivity is the biggest challenge facing the public sector. This Parliament will be one of unprecedented spending restraint, yet demand in core public service areas will continue to rise. Only by becoming more productive will the public sector be able to deliver the same, if not a better, service to citizens.

This should be a priority for the new Government. Official estimates suggest UK public sector productivity has increased by a mere average of 0.2 per cent a year since records began in 1997.<sup>1</sup> Over the same period, real terms public spending has risen by an average of 3.1 per cent a year<sup>2</sup> – almost 16 times faster than productivity. Based on these figures, the public sector now receives substantially larger sums than it did at the end of the last century, without getting much better at using them.

In reality, however, we know very little about public sector productivity growth. Most official estimates do not include a measure of service quality, and the availability and reliability of data is variable across different sectors. Officials and statisticians are nevertheless working to address these issues, and the UK's methods for measuring public sector productivity remain relatively advanced when compared to those in other developed countries.<sup>3</sup>

However, public sector productivity requires immediate attention, and there are several conceptual and methodological challenges that need to be addressed before the Government can even begin to understand how to improve it. The biggest of these is to recognise that productivity improvements, while necessary, will not on their own deliver higher quality, lower cost public services. Only an approach that embraces value for money and incorporates information on both costs and outcomes will be able to achieve this. To this end, the report recommends the following to better understand, and thereby, improve public sector productivity:

**Focus on organisational productivity:** At the root of the problem is an undeveloped understanding of productivity at an organisational level, such as across our schools, hospitals and prisons. Too often, reform programmes have been driven centrally across government departments, without the requisite analysis of how organisations in different contexts, under different management structures, in the public or private sectors, compare with one another. We consider the limitations of analysing productivity across different public sectors in Chapter 1.

**Adherence to a value for money framework:** The second important change must be at a conceptual level. The temptation to equate greater productivity with cost-cutting is not a helpful approach, and neither is considering public sector outcomes without regard to the cost of government intervention. Only by using a framework that examines each stage of decision-making, linking cost to outcomes (rather than outputs), will policymakers be able to assess the effectiveness of government spending and the public able to hold the state to account. Our suggested framework is outlined in Chapter 2.

**Improved methods and data collection:** Analysis at any level is limited by the availability, reliability and validity of data, and appropriateness of the methods used to evaluate productivity. Chapter 3 sets out the main conceptual and methodological issues with measuring productivity in the public sector.

The forthcoming Spending Review is an opportune moment to put public sector productivity and value for money under the spotlight. It is not enough for the Government to call for improvements; they must understand how to achieve these. Public services may well be able to deliver against the budget cuts they are expected to receive, yet

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1 Office for National Statistics, *Public Service Productivity Estimates: Total Public Services, 2012, 2015, Reform calculations*.

2 HM Treasury, *Public Expenditure Statistical Analyses 2015, 2015, Chapter 4*.

3 Heinz Handler et al., *The Size and Performance of Public Sector Activities in Europe* (Social Science Research Network, 2005).

without a more sophisticated framework and better measurement techniques, the opportunities for large or small productivity gains may be lost – and with it the potential to improve or sustain people’s wellbeing in generations to come.

This report is not intended to provide definitive answers to the problem, but rather to change how politicians, officials and public service leaders approach public sector reform, and provide a framework for future research.

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# 1

## The challenge of our time

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Improving productivity is critical to the wellbeing of this and future generations. This Parliament will be a period of unprecedented budgetary restraint: the Office for Budget Responsibility has forecast public spending to fall by 1.5 per cent a year in real terms – a total fall of 4.4 per cent of GDP by 2019-20.<sup>4</sup> At the same time, an ageing population, growing demand and rising expectations will put further pressure on government budgets. Only by becoming more productive will the public sector be able to deliver the same, if not a better, service to citizens.

The Government recognises this challenge. Its framework for the forthcoming Spending Review committed to “increase productivity and efficiency to ensure that every extra pound is put to the very best use.”<sup>5</sup> In preparation, the Government Economic Service has been undertaking a major review of productivity in different government departments.

Improving public sector productivity is not, however, a new ambition for government. Over a decade ago, the then Labour Government established a Public Services Productivity Panel of private and public sector experts to drive productivity gains across government departments.<sup>6</sup> Since then, the Office for National Statistics (ONS) and the former UK Centre for the Measurement of Government Activity (UKCeMGA) have developed new ways to measure government activity.

The recent drive to learn more about public sector productivity followed the Atkinson Review in 2005 whose remit was to assess the measurement of government output. International comparisons are scarce due to a lack of data harmonisation.<sup>7</sup> However, the UK has been at the forefront of research initiatives to better understand productivity.<sup>8</sup>

Despite the attention given to this subject, few levers have been identified that could improve productivity in public sector organisations. The Government’s *Productivity Plan*, which focussed almost exclusively on productivity of the whole economy, cited service redesign, organisation and workforce, and technology and data as three potential sources of increased productivity in the public sector.<sup>9</sup> What should be done at an organisational level was not identified.

This lack of focus on comparing productivity between organisations has hindered the discovery of mechanisms that could improve performance. Reports by the National Audit Office (NAO), whose remit is to evaluate value for money in public spending, have compared performance across different organisations, such as across different police forces. However, much of central government’s work has been across sectors. The Cabinet Office’s Efficiency Reform Group, for example, is examining central government efficiency, government procurement and major project management across government departments “to deliver efficiencies, savings and reforms on behalf of UK taxpayers.”<sup>10</sup>

A more sophisticated analysis is needed to bring public sector productivity into full view. Understanding productivity differences at an organisational level, in addition to a macro sector level, will help identify where, and eventually how, productivity can be improved. By demonstrating where resources are being used most effectively, policy can be better crafted to ensure the public sector is producing the goods and services that citizens need in the most efficient way.

4 Office for Budget Responsibility, *Economic and Fiscal Outlook: July 2015*, 2015, Table 4.12.

5 HM Treasury, *A Country That Lives within Its Means: Spending Review 2015*, 2015, 13.

6 HM Treasury, *Making a Difference: Motivating People to Improve Performance*, 2002.

7 Handler et al., *The Size and Performance of Public Sector Activities in Europe*.

8 Faridah Djellal and Faïz Gallouj, “Les Services Publics à L’épreuve de La Productivité et La Productivité à L’épreuve Des Services Publics,” *Revue D’économie Industrielle* 3e, no. 119 (September 15, 2007).

9 HM Treasury, *Fixing the Foundations: Creating a More Prosperous Nation*, 2015.

10 Cabinet Office, “Efficiency and Reform Group,” Webpage, 2015.



## 1.1 More than inputs and outputs

Productivity is crucial for examining public sector performance, but it is not the whole picture. The productivity of a sector or organisation is a calculation of the total volume of output produced for each unit of input, adjusted for the quality.<sup>11</sup> Inputs include the amount of labour and physical resources used to produce an output. The output is the service delivered, such as a hospital operation or a school lesson. The relationship between input and output may be affected by a combination of management decisions and environmental factors – a topic discussed more in Chapter 2.

Value for money in public services is a much broader concept than productivity (see Figure 1). An analysis of value for money needs to capture more than a ratio of inputs to outputs: it should also measure how well organisations achieve intended outcomes, and at what cost. This poses significant difficulties in the public sector. Whereas businesses have mostly clear, quantifiable metrics for their success or failure – such as return on investment, profit and turnover – outcomes are often less tangible or easily quantifiable in the public sector.

**Figure 1: Definitions**

<b>Inputs</b>	The resources, such as labour and capital, used to produce activities, outputs and outcomes.
<b>Outputs</b>	The goods or services produced by the inputs. In the public sector services are the main output.
<b>Outcomes</b>	The ultimate goals or objectives sought by government on behalf of citizens.
<b>Economy</b>	The extent to which the cost of goods and services are minimised.
<b>Efficiency</b>	The relationship between the output from a good or service and the resources used to produce them.
<b>Effectiveness</b>	The extent to which desirable outcomes have been achieved.
<b>Productivity</b>	The ratio of outputs produced to inputs used.
<b>Value for money</b>	The economy, efficiency and effectiveness with which public organisations have used their resources to achieve policy goals.
<b>Environmental factors</b>	Factors that are beyond the control of the sector or organisation being evaluated.

Service quality, prevention of hidden or future costs and wider social outcomes are all key factors to consider in value for money judgements, largely without easily identifiable benchmarks such as price and level of demand. For example, the police may respond to a high number of incidents, but crime in the area may still rise. Examining value for money in the police service on the narrow measure of number of responses alone would not tell us how well it delivers the outcomes society needs.

Similarly, the purchasing of inputs, such as goods and services, is an important aspect of value for money excluded from productivity analysis. Given that the workforce accounts for around half of departmental expenditure, intelligent staff management will be crucial to achieving value for money.<sup>12</sup> Hiring one teacher instead of two to deliver the same number of lessons to the same number of pupils would improve productivity as defined above. Yet if that teacher delivers the same quality of lesson but is twice as expensive, there is no clear case for the hiring decision. Clearly, the quality of the teacher (input) and lesson (output) are vital in making this judgement, as will be discussed in Chapter 3.

<sup>11</sup> Office for National Statistics, *Productivity Handbook* (Palgrave Macmillan, 2007); OECD, *OECD Compendium of Productivity Indicators 2015* (OECD Publishing, 2015).

<sup>12</sup> Jonathan Cribb and Luke Sibieta, *Mobility of Public and Private Sector Workers* (Institute for Fiscal Studies, 2015).

Ministers and policymakers must therefore focus their attention beyond productivity and embrace a value for money approach to evaluating the public sector. It is only through this more holistic framework that an understanding of best practice can be reached.

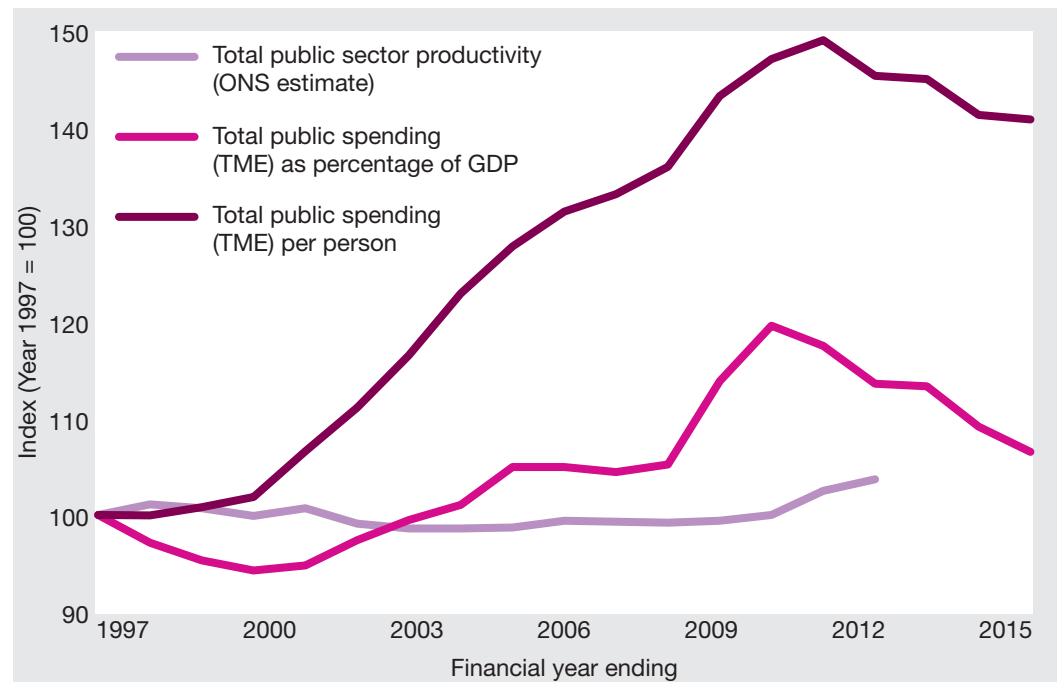
## 1.2 Productivity and public spending

While productivity is not in itself sufficient to improve value for money, it is still a critical component. Understanding the drivers of greater productivity is therefore key to improved public sector performance. Despite little being known about these drivers, there is much conjecture. This is particularly true about the relationship between productivity and public spending.

The Coalition Government saw cost reduction as a key driver of productivity in public services. It argued that spending restraint concentrates minds and leads to improved productivity through innovation. For example, it has been argued that cuts to the policing budget and subsequent reductions to the workforce have resulted in police forces exploring the use of mobile technology for administrative tasks to keep officers out on the front line for longer.<sup>13</sup> The corollary to this argument is that rapid spending growth harms productivity, as additional funds are not used effectively.<sup>14</sup>

The ONS's productivity estimates for the public sector provide a benchmark with which we can evaluate these claims. The estimates show a trend of general productivity decline between 1997 and 2010, during which period public spending rose considerably (Figure 2). By 2010, productivity returned to the level it was in 1997, but total public spending per person had increased by half and, as a proportion of GDP, by one fifth. Notably, the sharpest increase in estimated productivity growth was between 2010 and 2012, which also saw the sharpest decline in real-term spending per person.

**Figure 2: Public sector spending and productivity since 1997**



Source: Office for National Statistics, *Public service productivity estimates*, 2015; HM Treasury, *Publish Expenditure Statistical Analyses*, 2015; Reform calculations.

<sup>13</sup> Theresa May, "Lessons of Police Reform", Speech to *Reform*, 3 September 2014.

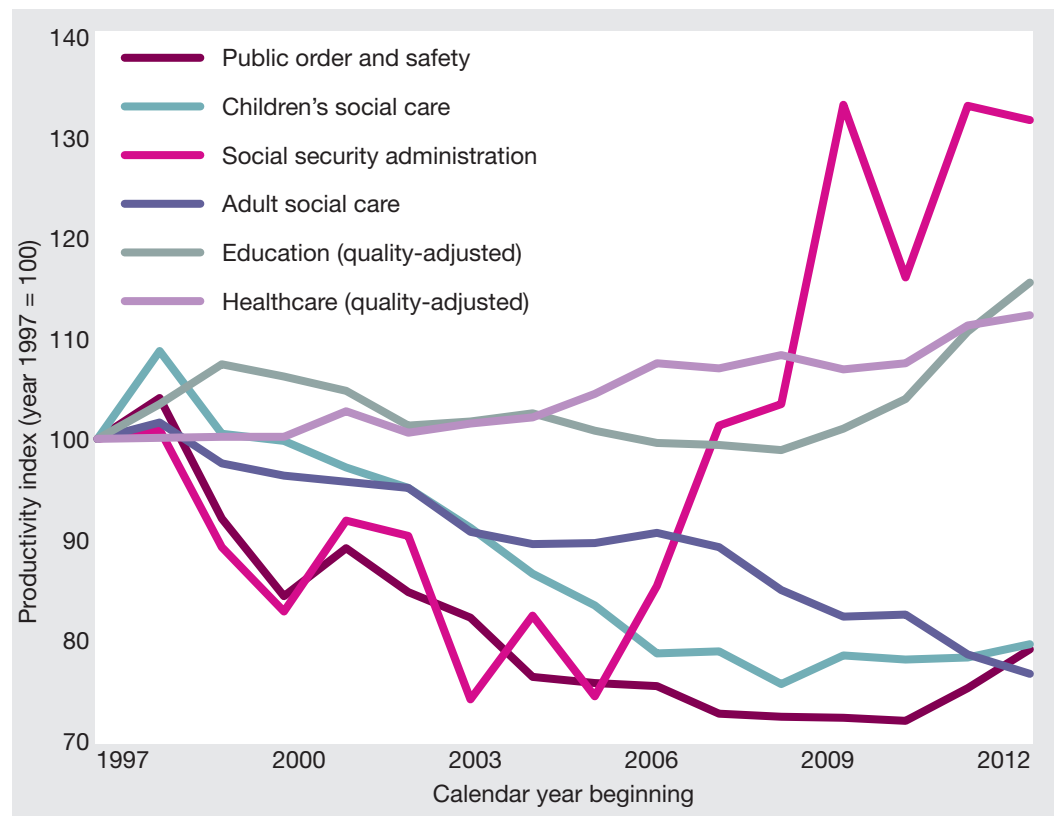
<sup>14</sup> Martin Beckford, "Labour's Extra Billions in Public Spending Led to Worse Value for Money," *The Telegraph*, July 28, 2010.

The inverse association between spending and productivity shown in Figure 2 is driven by a falling volume of inputs, including workforce numbers – which is one result of spending less. As the ONS state, the rise in productivity in 2011 and 2012 coincide with the first two falls in inputs since the series began in 1997.<sup>15</sup> This suggests that productivity at a total public sector level is related to spending restraint.

### 1.3 Quality matters

Insights about service quality and public sector outcomes can be brought into productivity measurement through quality adjustment. The ONS's headline figures for total public sector productivity show only small fluctuations, but Figure 3 shows there is wide variability in growth across different sectors. The figures show a general decline in productivity since 1997 in half of the public service areas represented (public order and safety, children's social care and adult social care), with recent increases in the health, education and social security administration estimates.

**Figure 3: ONS productivity estimates for different public service areas**



Source: Office for National Statistics, *Public service productivity estimates, 2015*.

Some of the variation in productivity growth in Figure 3 is explained by the absence or inclusion of a quality adjustment. Health and education are the only sectors in which the ONS quality adjusts the output. Education output includes the numbers attending schools and further education and is quality adjusted using pupils' GCSE results.<sup>16</sup> Healthcare output includes hospital and community health services, family health services, 'GP prescribing' and non-NHS provision. This is quality adjusted using five measures: 'health gain', short term survival, waiting times, data from the national patient survey and primary care outcomes.<sup>17</sup>

<sup>15</sup> Office for National Statistics, *Public Service Productivity Estimates: Total Public Services, 2012*.

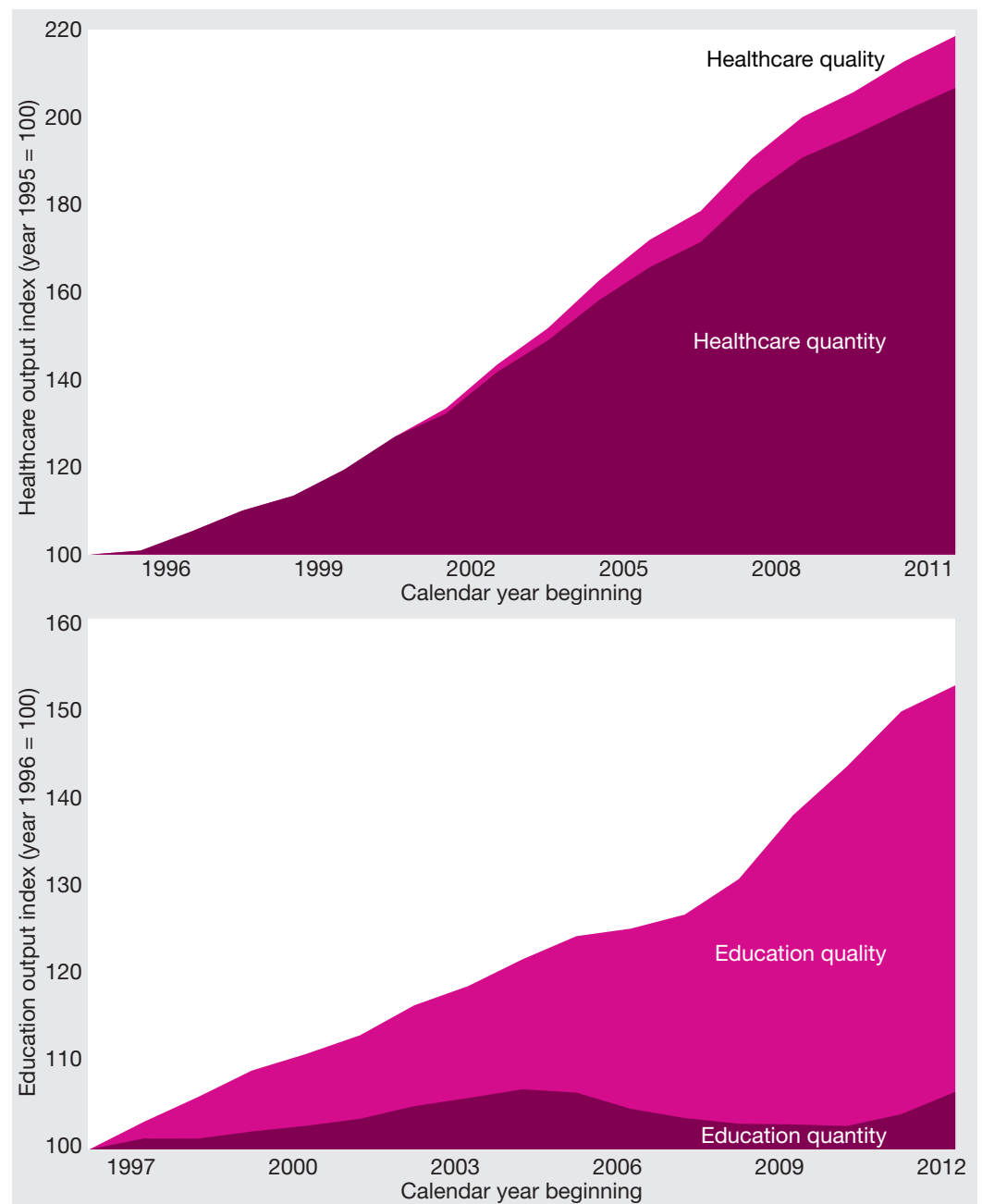
<sup>16</sup> The adjustment is an uncapped average point score at GCSE. This is calculated by multiplying the number of GCSE and GCSE-equivalent subjects each student takes by the difficulty level (higher grades score higher points).

<sup>17</sup> Office for National Statistics, *Sources and Methods, Public Service Productivity Estimates: Healthcare, 2012*.

The contribution of quality to output growth in education is large and increasing. As Figure 4 shows, quality adjustment has a much greater impact on education than quantity does, and its impact on output has been growing. This means that quantity change, such as recent declines in pupil numbers, have had a much lesser impact on overall productivity than service quality has when measured by pupils' GCSE results.

Quality adjustment also has a positive impact on healthcare output, leading to upward revisions of ONS healthcare productivity estimates. However, as Figure 4 shows, the impact of quality on output is much lower than the impact of quantity. This may be explained by the multiplicity of sources from which the ONS retrieve data on service quality, as described above.<sup>18</sup>

**Figure 4: Impact of quality adjustment on education and healthcare output**



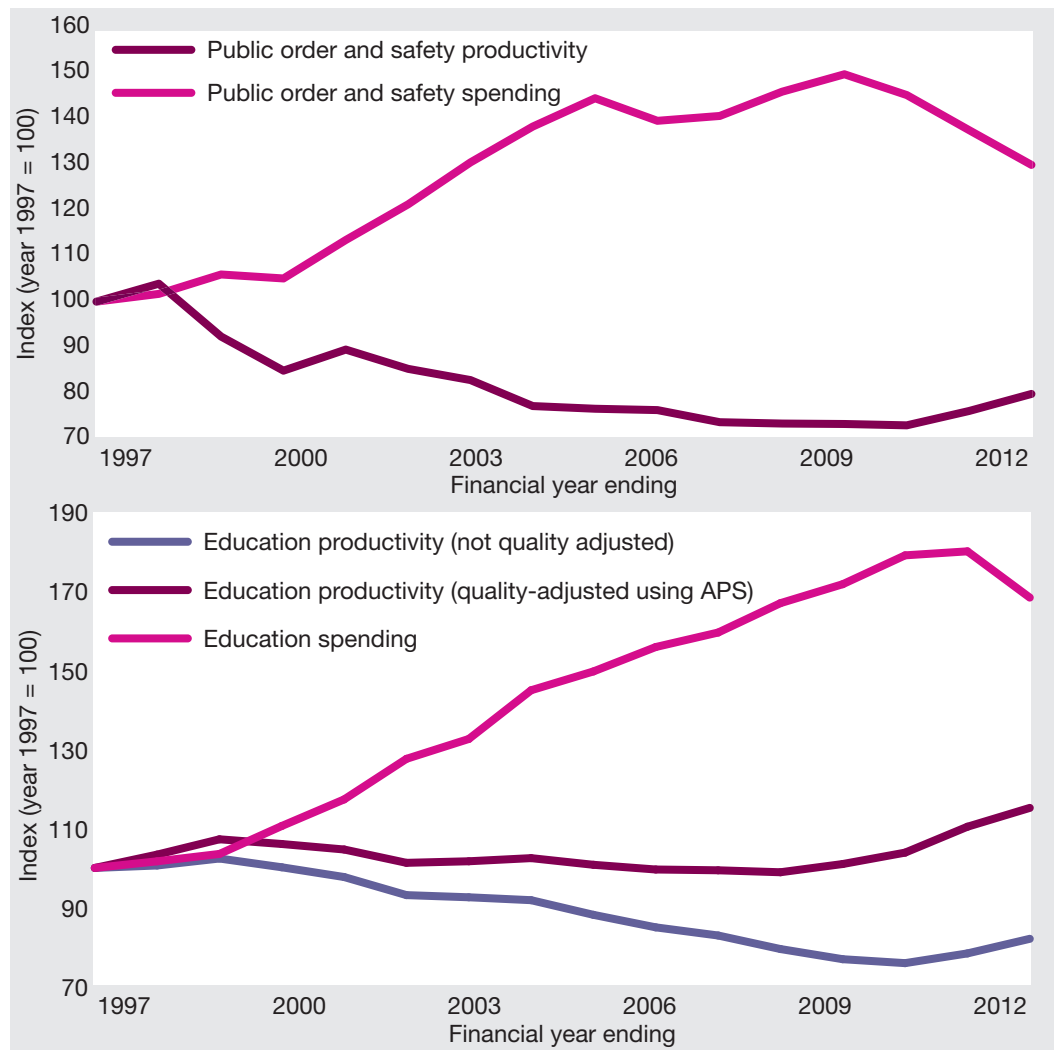
Source: Office for National Statistics, *Public service productivity estimates*, 2015.

It should be noted that there is good evidence that the quality adjustment used by the ONS for education is open to exam grade inflation.<sup>19</sup> For this reason, the ONS are undertaking a review to find a better measure for quality. Previous research by *Reform* has therefore used international assessments to quality-adjust ONS education output figures, which suggests a productivity decline rather than rise.<sup>20</sup>

Despite the positive impact of quality adjustment on the ONS's productivity estimates, there is still an inverse association between productivity and spending. Examining two contrasting productivity trends suggests that – with or without quality adjustment – spending is inversely associated with productivity at a sector level, as Figure 5 shows.

Figure 5 contrasts productivity and spending indexes for education, and public order and safety. Education productivity has seen the second largest productivity growth since 1997 and public order and safety the second lowest productivity growth, according to productivity estimates by sector (Figure 3). As noted, education productivity includes input and output measures for schools and further education. Public order and safety includes input and output measures for prisons, courts and the probation service (but excludes the police).

**Figure 5: Association between spending and ONS productivity estimates**



Source: Office for National Statistics, *Public service productivity estimates, 2015*; HM Treasury, *Publish Expenditure Statistical Analyses, 2015*; Reform calculations.

19 See, for instance, Robert Coe, *Changes in Standards at GCSE and A-Level: Evidence from ALIS and YELLIS, 2007*.  
 20 Amy Finch and James Zuccollo, *How to Run a Country: Education* (Reform, 2015).

Figure 5 shows that, just as with the total public sector figures shown in Figure 2, productivity increases when spending falls. Set aside the converse relation between 1997 and 1998 where spending and productivity both rise, both quality-adjusted and non-quality-adjusted productivity figures are inversely associated with spending. This suggests that even including insights about service quality, which a value for money approach would endorse, spending restraint and productivity are linked.

However, merely examining how well sectors convert inputs to outputs under different funding scenarios does not tell us where and how productivity gains can be made, nor whether services deliver good value for money. Some public organisations – for example, some hospitals or courts – will be delivering better outcomes for every pound of their budget than other organisations. Without a framework that considers both cost and outcomes, and a method for comparing organisations with one another, the potential to recognise and realise these productivity gains will be wasted. This is the subject of the next chapter.

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# 2

## Value for money framework

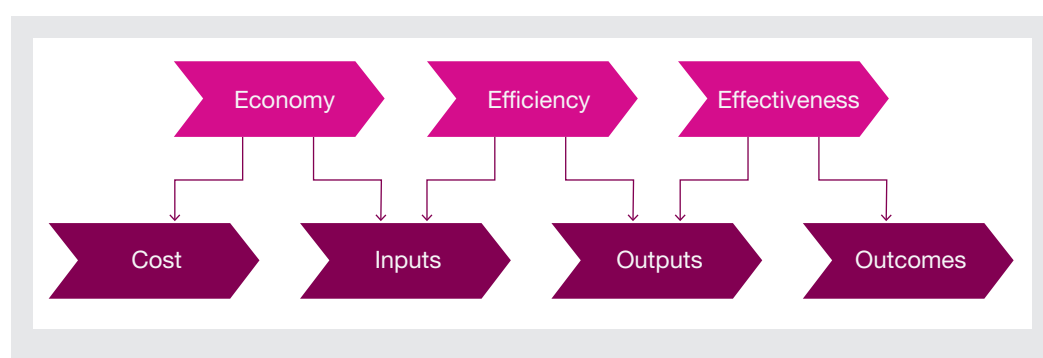
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The National Audit Office (NAO) and Public Accounts Committee use three criteria to assess the value for money of government spending: economy, efficiency and effectiveness.<sup>21</sup> The benefit of such an approach is that it enables policymakers and public sector leaders to consider performance at each and every stage of the production chain.

The framework can also be used to compare specific policy initiatives, organisations, or sectors.<sup>22</sup> It could help government departments to identify organisations that are performing poorly, or examples of best practice. Additionally, it can be used by public sector leaders to measure how sections of their workforce, or specific departments within these organisations, are performing. As argued in Chapter 1, the ability to measure and analyse productivity at an organisational level is essential, though not on its own sufficient, for increasing value for money in public services.

**Figure 6: The value for money framework**



	<b>Economy</b> Spending less	<b>Efficiency</b> Spending well	<b>Effectiveness</b> Spending wisely
<b>Definition</b>	The extent to which the cost of goods and services are minimised	The relationship between the output from a good or service and the resources used to produce them	The extent to which objectives have been achieved
<b>Aim</b>	Supplies are purchased at the best price possible.	The workforce is utilised to provide services in the best way possible.	The service provided delivers the best outcomes possible.

**Source: National Audit Office, *Assessing value for money*, 2014.**

While the ‘three E’s’ of economy, efficiency and effectiveness are commonplace indicators for assessing value for money in business, their application to public organisations has been patchy. For the most part this is because government currently fails to collect, collate and share performance data in an effective way. Few studies therefore have had the luxury of adequate information for evaluating performance across every indicator.

The availability of the data will also dictate which quantitative method can be used and which part or parts of the production chain can be measured. In the public sector this has meant in most cases that research has focussed on cost-reduction (economy) and improving outcomes (effectiveness) with little consideration given to efficiency. However, as demonstrated below, effectively assessing value for money in the public sector requires an understanding of all three elements.

It should be noted that there is ongoing concern about the quality of public data. The Government recently launched an independent review led by the UK Statistics Authority and Professor Sir Charles Bean to address challenges in the measurement and

<sup>21</sup> National Audit Office, “Assessing Value for Money,” Webpage, 2014.

<sup>22</sup> Penny Jackson, *Value for Money and International Development: Deconstructing Myths to Promote a More Constructive Discussion* (OECD, 2012).



production of economic statistics, including national accounts.<sup>23</sup> Improving the availability and quality of data is the first step towards being able to understand value for money in public organisations. The decision to begin a review in this area is therefore encouraging.

## 2.1 Economy

Economy measures can be used to evaluate how cheaply organisations purchase their capital and labour, such as equipment and the workforce. An evaluation of public organisations against this measure will consider the relationship between their funding and inputs.

### 2.1.1 Spending wisely

The majority of research on financial decision-making considers the relationship between funding and outputs, rather than inputs. For example, research has analysed expenditure on teachers (funding) per pupil (output) across different schools, finding that even once known contextual factors such as pupil characteristics are taken into account, 30 per cent of variation in spending remains unexplained.<sup>24</sup> Research by the Audit Commission has evaluated school economy by clustering similar schools together and examining the variation of schools' spending on key areas such as learning resources, catering, and energy.<sup>25</sup>

Understanding how well organisations purchase their capital and labour (i.e. their inputs) is an area worthy of investigation in itself. Unfortunately, relatively few studies have been able to examine this. In some cases, this may be because the measures of input are inadequate. As highlighted later in Chapter 3, ensuring that inputs are correctly quality adjusted is a challenging research task. Alternatively, procurement mechanisms may be centrally controlled, leaving no variation to explore in terms of costs (such as in prisons, the courts and, now, hospitals).

It is much easier therefore for researchers to examine the economy of decision-making where central procurement has not been introduced. For example, the NAO examined NHS trust and foundation trust spending decisions in 2013, finding that there were 5,201 products for which the variation in spending across hospitals was greater than 50 per cent.<sup>26</sup>

Similarly, a review of policing procurement found wide variation in spending on basic equipment. The price paid by forces on standard police boots ranged from £25 to £114 and for high visibility jackets from £20 to £100.<sup>27</sup> While the quality differences of these products was not measured, this information gives a broad picture of the potential scope for public organisations to achieve cost reductions when purchasing their capital and labour inputs.

#### Prison unit cost programme

In 2012 the Ministry of Justice (MoJ) introduced a benchmarking programme to cut the unit costs per prisoner across public sector prisons. In 2013-14, £84 million of savings were delivered as part of this programme.

#### The Knight review

The 2013 Knight review examined per capita expenditure on the fire services in each fire and rescue authority (FRAs). It highlighted savings of £196 million a year if all FRAs were to spend as much per capita as the average FRA on key areas of spending.

#### Schools financial benchmarking

The Department for Education (DfE) has a database of school spending data which allows schools to compare spending decisions with schools that are similar in terms of size, school type and pupil characteristics.

<sup>23</sup> HM Treasury, "Independent Review of UK Economic Statistics: Terms of Reference," October 6, 2015.

<sup>24</sup> Rebecca Allen et al., *Understanding School Financial Decisions* (Department for Education, 2012).

<sup>25</sup> Audit Commission, *Valuable Lessons*, 2012.

<sup>26</sup> National Audit Office, "The Procurement of Consumables by NHS Acute and Foundation Trusts," 2011.

<sup>27</sup> National Audit Office, *Police Procurement*, 2013.

**School efficiency review**

The DfE has examined the relative efficiency of schools using data envelopment analysis. While the results were not published, the study highlighted seven areas of best practice relating to workforce deployment, financial benchmarking, school clusters and the expertise and role of the governing body.

**Crown courts efficiency tool**

The MoJ has an efficiency tool which allows officials to compare the outputs of courts with similar peers. The tool examines the relationship between inputs, such as sitting days used for a case, and outputs, such as disposal rates.

**Carter review of hospital productivity**

The Carter review is investigating NHS hospital productivity. Its interim report sets out a framework for measuring productivity with an Adjusted Treatment Index (ATI). The method will provide a ratio of a hospital's actual costs for patient treatment to the national average costs for that particularly mix of patients.

## 2.2 Efficiency

Efficiency focuses on the organisational characteristics, such as workforce arrangements and management. It considers how well management and operational decisions transform resources into the outputs produced. In other words, efficiency requires us to examine how resources, capital and labour are deployed. For example, a police force may take the decision to reallocate resources from neighbourhood policing to specialist units, such as those dealing with cybercrime. Evidence suggests that redeploying officers in this way improves the ability of police forces to combat criminality.<sup>28</sup> Being at the centre of the value for money chain, efficiency is also key to ensuring that public spending is transformed into better outcomes.

### 2.2.1 Workforce deployment

Ensuring that public sector employees are deployed well is fundamental to efficiency. The way in which teachers, police officers, or nurses are utilised can have a great effect on the outputs delivered by public services and, ultimately, the outcomes. For example, a hospital may purchase high quality surgeons at a low cost (thus being highly economical), but if those surgeons spend only a small portion of their time using their skills then labour efficiency in the hospital would be questionable.

Consideration should also be given to the extent to which timetables and job descriptions exploit the skills of the workforce. This would ensure that organisations make the most of the human capital they have. In addition, pay ratios, workforce mix and roles and responsibilities may impact how well employees work together to produce higher levels of output with the same, or even less, resources and effort.

### 2.2.2 Capital management

While understanding the impact of capital expenditure on public service outcomes is a difficult task, it is important to recognise the impact of capital input on output. Capital such as building design, equipment, technology and software, may have a large impact on how staff can be deployed and managed. For example, the use of technology to deliver lessons will likely affect the amount and type of teaching required in the classroom, and therefore, the efficiency of a school.

Building infrastructure and design may also affect how efficiently staff are able to function. For example, the layout of older Victorian prisons can reduce visibility for prison officers who are tasked with monitoring inmate behaviour. As a result not only is inmate safety reduced in older institutions due to higher levels of prisoner misconduct,<sup>29</sup> but more staff are needed to supervise the same number of prisoners.

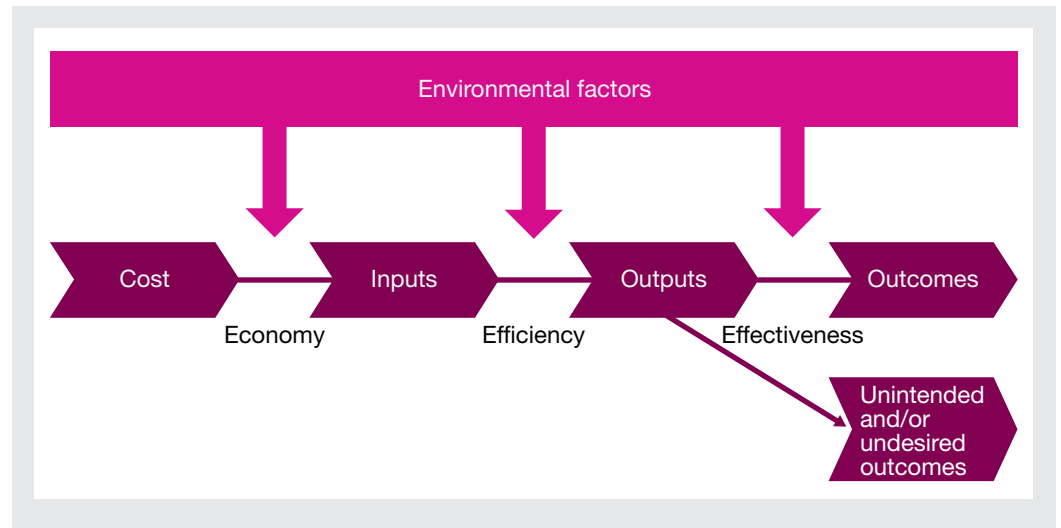
28 Abie Longstaff et al., "Neighbourhood Policing: Past, Present and Future: A Review of the Literature" (The Police Foundation, 2015).

29 Robert G. Morris and John L. Worrall, "Prison Architecture and Inmate Misconduct A Multilevel Assessment," *Crime & Delinquency* 60, no. 7 (October 1, 2014).

## 2.3 Effectiveness

Evaluating effectiveness is essential to value for money judgements, as it measures the extent to which individual or social outcomes have been achieved through public spending.<sup>30</sup> There are multiple outcomes that the public sector seeks to address but, in doing so, may produce unintended or negative outcomes (Figure 7).<sup>31</sup> All these should be accounted for in any effectiveness measure.

**Figure 7: How environmental factors affect effectiveness**



A narrow view of productivity which fails to encompass the measurement of effectiveness risks misunderstanding whether public services are actually delivering value to citizens. For example, an effective fire service may respond to lower numbers of incidents due to the implementation of better prevention measures. In this case an exclusive focus on outputs (i.e. incident responses) would suggest productivity had declined when arguably the converse is true.<sup>32</sup>

Similarly, concentrating solely on outputs could incorrectly identify high levels of productivity. A hospital may deliver a high number of outputs in terms of the operations it delivers, but this could be because it has to readmit and retreat more patients. In this case, rather than signifying increased productivity, higher outputs (i.e. operations) are a result of poorer quality of care initially being received by patients. This again underlines the importance of considering the entire chain in the value for money framework (see Figure 6).

Work by the OECD suggests a greater focus on increasing effectiveness in the public sector can help foster a more prosperous society. Improvements to educational outcomes, such as higher school achievement, creates better skilled citizens who are subsequently more employable. In turn, higher levels of employment and lower levels of reliance on the welfare state can lead to increased economic growth and social prosperity.<sup>33</sup>

### The What Works Centre for Crime Reduction Toolkit

Led by the College of Policing, the centre provides effectiveness ratings for a number of criminal justice interventions to help police forces make evidence-based interventions. The interventions include technology, such as CCTV and electronic monitoring, as well as correctional boot camps and 'scared straight' programmes.

<sup>30</sup> Patrick Dunleavy and Leandro Carrera, *Growing the Productivity of Government Services* (Edward Elgar Publishing, 2013).

<sup>31</sup> National Audit Office, "Assessing Value for Money".

<sup>32</sup> Dunleavy and Carrera, *Growing the Productivity of Government Services*, Ibid.

<sup>33</sup> OECD, *Government at a Glance 2013* (OECD Publishing, 2013).

### 2.3.1 Measuring outcomes

Public sector outcomes have often been categorised as individual or collective depending on whether it is an individual or society that predominantly benefits from them.<sup>34</sup> Healthcare treatments, for example, would on the whole be considered as delivering individual outcomes, whereas defence would be classed as delivering collective outcomes. This simple distinction, however, fails to capture the areas of significant overlap between individual and societal outcomes across a number of other policy areas. Understanding effectiveness requires a consideration of both forms.

#### Individual returns to public services

The individual returns to public services give an indication of public service outcomes, both intended and unintended. In the education sector, attention is given most to the individual returns in terms of progression into further education or employment, and future or lifetime earnings. For example, research by the Institute for Fiscal Studies has found a 27 per cent increase in average lifetime earnings from completing some form of higher education.<sup>35</sup>

In the healthcare sector, the evaluation of individual outcomes focuses on the benefits of improved quality of life for service users, for example using Quality Adjusted Life Years (QALYs). In the criminal justice sector, measures evaluate whether rehabilitative interventions can increase the life chances of prisoners. For example, drug treatment programmes can prevent offenders from being punished further due to being involved in anti-social behaviour whilst incarcerated and following release.<sup>36</sup> Abstaining from drug use also improves prisoners' health which is an additional individual return.

#### Social returns to public services

Despite the complexity of measuring the social returns to public services, it is generally thought that increasing individual outcomes can provide societal benefits. For example, higher levels of education and improved health can contribute to higher employment and other human and social capital 'externalities', such as reduced poverty.<sup>37</sup>

Similarly, whilst reducing reoffending is beneficial to the offender, as it enables them to avoid further punishment and reintegrate into society, it will also positively impact crime levels and thus the number of victims. Research by the ONS has found that victimisation is associated with lower levels of personal wellbeing, sometimes for a sustained period of time.<sup>38</sup>

Additionally, research has found that reduced reoffending rates through the provision of education and job programmes can improve the state of the economy, which impacts on society as a whole.<sup>39</sup> The NAO have estimated that reoffending cost the economy between £9.5 billion and £13 billion in 2007-08. Therefore, expanding successful programmes has the potential to deliver additional collective value through reduced government spending.<sup>40</sup>

#### Quality-adjusted life years (QALY)

QALYs consider the state of a person's health following a healthcare intervention, such as medical treatment. QALYs are calculated by estimating the years of life remaining for a patient, weighting each year with a quality-of-life 'score'. One QALY is equal to one year of life in perfect health. Quality of life is often assessed by a person's ability to perform basic daily activities, absence from pain and good mental health.

34 Office for National Statistics, *Productivity Handbook*, ed. Dawn Camus (Palgrave Macmillan, 2008).

35 This is when compared to individuals who leave school at 16 with no qualifications. Richard Blundell, Lorraine Dearden, and Barbara Sianesi, *Evaluating the Impact of Education on Earnings in the UK: Models, Methods and Results from the NCDS* (Institute for Fiscal Studies, 2004).

36 Gary A. Zarkin et al., "Benefits and Costs of Substance Abuse Treatment Programs for State Prison Inmates: Results from a Lifetime Simulation Model," *Health Economics*, 21, no. 6 (June 2012).

37 Daron Acemoglu and Joshua Angrist, *How Large Are the Social Returns to Education? Evidence from Compulsory Schooling Laws* (National Bureau of Economic Research, 1999).

38 Office for National Statistics, "Crime Statistics, Focus on Public Perceptions of Crime and the Police, and the Personal Well-Being of Victims 2013-2014," Press release, (March 26, 2015).

39 Norman H. Sedgley et al., "Prison's Dilemma: Do Education and Jobs Programmes Affect Recidivism?," *Economica* 77, no. 307 (July 1, 2010).

40 National Audit Office, *Managing Offenders on Short Custodial Sentences*, 2010.

### Teaching and Learning Toolkit

The Education and Endowment Foundation has developed a toolkit that allows practitioners to compare the relative cost-effectiveness of different school interventions. The toolkit is a meta-analysis of randomised control trials conducted in schools in England. It considers the average months of progress a pupil has been found to make, the strength of evidence for this finding and the relative cost.

### 2.3.2 Effectiveness and environmental factors

Measuring and improving effectiveness is, however, hugely challenging. It is at this stage of the value for money chain that attribution is the most problematic.<sup>41</sup> For example spending on education could be wasted on the so-called ‘sheep-skin effect’ whereby education simply acts as a signal to employers about a person’s prior ability rather than the skills they have gained through education.<sup>42</sup> If this is the case, improved employment prospects are not attributable to the quality of education received, but merely represent an individual’s pre-held abilities.

Similarly, if one of the desired policy outcomes for the NHS is to increase levels of public health, it is important to distinguish between the impact of NHS improvements, such as reduced waiting times and new medicines, and the impact of wider changes to the population, such as a reduction in the numbers of smokers. Demographic shifts may also have a much more significant impact on health outcomes than any reform to health policy and practice. The impact of an ageing society on overall public health levels is a key example.<sup>43</sup> Attributing public service outcomes, in this case health improvements, specifically to health service policy is therefore a difficult task.

It is clear that evaluating the performance of the public sector through productivity measurement alone is not sufficient. Performance measures should instead consider the whole value for money chain, from spending decisions through to outcomes. However, whilst a wider value for money framework has a number of advantages it also poses significant conceptual and methodological challenges. The next chapter will explore potential quantitative methods for addressing these issues.

41 Diana Mihaiu, Alin Opreana, and Marian Cristescu, “Efficiency, Effectiveness and Performance of the Public Sector,” *Romanian Journal of Economic Forecasting*, 2010.

42 Steffen Habermalz, *An Examination of Sheepskin Effects over Time*, 2003.

43 Carl Emmerson, Paul Johnson, and Robert Joyce, eds., *The IFS Green Budget* (Institute for Fiscal Studies, 2015).

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# 3

## Evaluating public sector organisations

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Evaluating economy, efficiency and effectiveness is crucial if policymakers are to give a holistic appraisal of value for money in public services. However, the intrinsic nature of public sector inputs, outputs and outcomes makes measurement difficult. While there is an established body of literature on measuring organisational efficiency, no technique is devoid of criticism. The appropriate choice will depend on a range of contextual factors relating to the availability, validity and reliability of data, and the research and policy objective.

### 3.1 Measuring quality

In competitive markets, prices provide an indication of consumers' relative valuation of goods and services. While not a perfect measure, these can be used to evaluate the quality of market inputs and outputs. For example, when looking at the prices of flights leaving from and going to the same destination, the variation in prices can be interpreted as a reflection of a difference in the quality of service delivered.

The absence of competitive market prices in the public sector makes measuring value for money less straightforward. Most public sector outputs, such as hospital treatments or schooling, are free at the point of use. Where services are not free, such as prescriptions or access to the courts, they are nonetheless heavily subsidised or regulated. Prices for public sector outputs are thus an imperfect measure of service quality.

A similar argument can be made for public service inputs. While information on the cost of inputs is available, these often do not derive from competitive markets. For example, pay bands could be used to weight the number of NHS nurses by their level of skill.<sup>44</sup> Yet high levels of unionisation and a near government monopsony in the labour market for nurses could distort wages,<sup>45</sup> leading to the conclusion that the cost of public sector inputs is an inappropriate measure of input quality.

Market prices could be used to measure the quality of a service provided in the public sector. For example, the cost of an operation in a private clinic may give an indication of how much patients value the procedure in the public sector. However, this method of quality adjustment should be used with caution. Individuals purchasing goods and services in the private sector may be intrinsically different from those unable or unwilling to pay. Measuring the quality of public services this way could encourage governments to provide services for a phantom service user.

Hedonic pricing can be used to produce a monetary valuation of public sector inputs, outputs or outcomes. This technique isolates the value of a single characteristic by holding constant other factors that influence the price of a good or service. For example, by controlling for factors such as floor space, aesthetics and proximity to schools, hedonic pricing can produce a monetary value that consumers place on crime levels. In theory this estimate could be used to proxy the value of 'public safety' as a desirable public sector outcome.

Other types of weights can be used as an alternative to prices and costs. Researchers have developed techniques such as contingent valuation surveys, which ask people how they value different goods and services.<sup>46</sup> This method is most common in understanding people's valuation of or willingness to pay for medical treatment.<sup>47</sup> It has not been used in productivity comparisons, but is nonetheless used in the private sector to understand the quality of different goods and services. Although the technique might provide more

44 See for example Office for National Statistics, *Productivity Handbook*, ed. Dawn Camus (Palgrave Macmillan, 2008).

45 Jonathan Cribb, Carl Emmerson, and Luke Sibieta, *Public Sector Pay in the UK* (Institute for Fiscal Studies, 2014).

46 Peter A. Diamond and Jerry A. Hausman, "Contingent Valuation: Is Some Number Better than No Number?," *The Journal of Economic Perspectives* 8, no. 4 (October 1, 1994).; Paulo Nunes and Peter Nijkamp, "Economic Valuation, Values And Contingent Method: An Overview," *Regional Science Inquiry* III, no. 1 (2011).; Richard T. Carson and Nicholas A. Flores, "Contingent Valuation: Controversies and Evidence," *Economics Working Paper Series, University of California*, 2000.

47 Jose Luis Pinto-Prades, Veronica Farreras, and Jaime Fernández de Bobadilla, *Willingness to Pay for a Reduction in the Mortality Risk after a Myocardial Infarction: An Application of the Contingent Valuation Method to the Case of Eplerenone* (Universidad Pablo de Olavide, Department of Economics, 2006).

accurate information than cost weights or prices, it risks exhibiting the same issues related to survey responses, such as response bias.<sup>48</sup> In addition, surveys can be costly.

A review of the evidence can provide useful information on the variables to select in order to quality adjust public sector input or output. For example, the literature on the determinants of teacher quality could offer insight into the potential variables that could be used to quality adjust the number of hours taught (i.e. output). Triangulating various sources of information on the quality adjustment of inputs and outputs proves to be an effective and low-cost method of obtaining useful information.

### 3.2 Capturing everything that matters

As in the private sector, the public sector provides multiple goods and services using multiple resources. For example, a hospital provides diagnostic and treatment services in addition to catering and accommodation (the outputs). These services are carried out by different people and different equipment (the inputs).

The multiplicity of inputs and outputs raises challenging issues for efficiency measurement, such as how to aggregate and respectively value them. For example, when measuring the efficiency of a prison as a whole, the researcher must decide whether the number of prison riots is a more important output than the number of prisoner escapes. Evaluating the relative importance of these incidents to create an overall productivity index (see Box 1) is a difficult task.

It is, however, possible to avoid evaluating different inputs and outputs by using advanced mathematical techniques, such as data envelopment analysis (see Box 3). This has been a successful method for measuring efficiency with small sample sizes.<sup>49</sup> It has been widely used to compare hospital efficiency,<sup>50</sup> in the regulation of privatised utilities,<sup>51</sup> and to evaluate different police forces and prisons.<sup>52</sup>

Analysing the relationship between just one input and output, such as through partial efficiency measures (see Box 2), also circumvents the issue of weights. One could evaluate hospital efficiency by examining both how many surgeons are needed to perform a certain number of operations and how many catering staff are needed to deliver a certain number of meals. While this does not produce an overall efficiency measure, it could be helpful in understanding the drivers of efficiency at the organisation level.

It is difficult, however, to evaluate overall efficiency between different organisations using partial efficiency measures.<sup>53</sup> Any levers identified to improve efficiency will depend on the choice of inputs and outputs. However, those inputs and outputs may be more significant to some organisations than others. For example, comparing the efficiency of a community hospital with an acute hospital by examining how well surgeons spend their time may not be helpful, as community hospitals employ very few.<sup>54</sup>

Some of the literature on value for money in schools, including work by the Audit Commission, uses partial efficiency measures, such as pupil-teacher ratio and the ratio of teachers to education support staff, to identify areas for improving productivity.<sup>55</sup> To

48 Carson and Flores, "Contingent Valuation: Controversies and Evidence.", *Ibid.*

49 Pinto-Prades, Farreras, and Bobadilla, *Willingness to Pay for a Reduction in the Mortality Risk after a Myocardial Infarction: An Application of the Contingent Valuation Method to the Case of Eplerenone.*

50 *Ibid.*; Sverre A. C. Kittelsen and Jon Magnussen, "Economies of Scope in Norwegian Hospital Production – A DEA Analysis," 2009.

51 Emmanuel Thanassoulis, "DEA and Its Use in the Regulation of Water Companies," *European Journal of Operational Research* 127, no. 1 (November 16, 2000): 1–13; Aoife Brophy Haney and Michael G. Pollitt, "International Benchmarking of Electricity Transmission by Regulators: A Contrast between Theory and Practice?," *Energy Policy* 62, no. C (2013): 267–81.

52 Nicky Rogge et al., "An Analysis of Managerialism and Performance in English and Welsh Male Prisons," *European Journal of Operational Research* 241, no. 1 (February 16, 2015).; Emmanuel Thanassoulis, "Assessing Police Forces in England and Wales Using Data Envelopment Analysis," *European Journal of Operational Research* 87, no. 3 (1995).

53 Emmanuel Thanassoulis et al., "A Comparison of Data Envelopment Analysis and Ratio Analysis as Tools for Performance Assessment," *Omega* 24, no. 3 (1996): 229–44.

54 Papanicolas Irene and Smith Peter, *Health System Performance Comparison: An Agenda For Policy, Information And Research: An Agenda for Policy, Information and Research* (McGraw-Hill Education (UK), 2013).

55 Audit Commission, *Valuable Lessons*, *Ibid.*



understand the reason for variations in school spending, other studies have examined the proportion of hours taught by qualified subject teachers and the expenditure on senior managers per pupil.<sup>56</sup> While these studies do not aim to provide an overall assessment of efficiency differences, their analysis is able to highlight both best practice and areas for improvement.

### 3.3 Identifying the causes

It is important that efficiency comparisons recognise the influence of environmental and external factors beyond the control of the organisation being considered. For example, measuring jobcentre productivity by employment outcomes without accounting for changes in the labour market would lead to meaningless results and would not provide useful policy recommendations. Schools, hospitals and other public organisations serve different people with different needs, but efficiency must be attributable to the organisation's activity rather than the user's characteristics or other environmental factors.

There are a number of methods that allow researchers to control for the effect of environmental factors on efficiency. In situations where the environmental factors are well known, a range of methods can be used to isolate the effect of these environmental variables from other input variables (see Chapter 3.4). For example, regression analysis can be used to explore the link between teacher pay and teacher quality.<sup>57</sup>

When the environmental factors affecting efficiency are not well understood, other approaches can be used. Sensitivity analysis has been used in order to test the robustness of the results derived from a statistical or mathematical model.<sup>58</sup> It examines the extent to which uncertainty in the results can be attributed to uncertainty in the explanatory variables. When looking at how effective a school is in terms of pupil attainment from disadvantaged backgrounds, performing a sensitivity analysis could take the form of replacing the variable used in order to control for socio-economic origin, such as eligibility for free school meals based on the parents' income and seeing how that would affect the result.

However, attempting to separate environmental variables and inputs in this way is not always useful to organisations themselves. It would be hard for a school to interpret the results of an efficiency analysis in which they were compared to a handful of very different schools. Clustering techniques can help overcome this problem. Grouping organisations with their 'statistical neighbours' allows a comparison of like with like.

It is also important to acknowledge the existence of the 'dynamic effects' of inputs and outputs, such as the impact of output in one year on input the following year. For example, crime and detection rates in policing may reflect previous efforts in crime prevention.<sup>59</sup> Given the scale and complexity of public policy objectives there can also be significant time lags between the inputs and outcomes provided by public agencies. For example, expenditure on health services may not result in improved public health or recorded increases in life expectancy until some years later.<sup>60</sup> The measurement of public sector productivity without consideration of longer term outcomes can result in an over focus on reducing costs and short-termist policies.<sup>61</sup>

<sup>56</sup> Rebecca Allen et al., *Understanding School Financial Decisions*, Ibid.

<sup>57</sup> Steven Rivkin and Eric Hanushek, "Pay, Working Conditions, and Teacher Quality," *The Future of Children* 17, no. 1 (March 12, 2007).

<sup>58</sup> Don Galagedera and Param Silvapulle, "Experimental Evidence on Robustness of Data Envelopment Analysis," *The Journal of the Operational Research Society* 54, no. 6 (June 1, 2003).

<sup>59</sup> Peter Smith and Andrew Street, "Measuring the Efficiency of Public Services: The Limits of Analysis," *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 168, no. 2 (March 1, 2005).

<sup>60</sup> Institute of Public Administration, *Measuring Public Sector Productivity: Lessons from International Experience*, 2006.

<sup>61</sup> Djellal and Gallouj, "Les Services Publics à L'épreuve de La Productivité et La Productivité à L'épreuve Des Services Publics.", Ibid.

### 3.4 Summary of quantitative methods for productivity measurement

There are two main categories of quantitative techniques that can be used to measure efficiency and productivity: the non-parametric and the parametric, respectively corresponding to the mathematical and statistical approaches.<sup>62</sup> Index numbers (IN), partial efficiency measures (PEM) and data envelopment analysis (DEA)<sup>63</sup> pertain to the first category. Regression analysis and stochastic frontier analysis (SFA) pertain to the second.<sup>64</sup> There is no single superior method; each technique has its set of implications for the interpretation of the results it produces and also brings about its share of strengths and weaknesses.<sup>65</sup>

#### Box 1: Index numbers

An index number (IN) is the ratio of an index of output to an index of input.<sup>66</sup> Several techniques can be used to create the indexes, most often by deflating and aggregating individual measures. The ONS measures productivity at a sector level using IN.

Pros	Cons
<ul style="list-style-type: none"> <li>&gt; Gives a broader picture of productivity trends</li> <li>&gt; Easy for comparing different organisations</li> </ul>	<ul style="list-style-type: none"> <li>&gt; Requires value judgments on the importance of different inputs and outputs</li> <li>&gt; Masks the drivers of productivity</li> <li>&gt; Not easy to obtain weights necessary to compute IN</li> <li>&gt; No modelling of the production process</li> </ul>

#### Box 2: Partial efficiency measures

Partial efficiency measures (PEMs), also known as partial indicators, capture an organisation's productivity in terms of delivering individual outputs or services.<sup>67</sup> The measures can capture any part of the production process.

Pros	Cons
<ul style="list-style-type: none"> <li>&gt; Easy to interpret</li> <li>&gt; Easy to calculate</li> <li>&gt; Can be quality adjusted</li> </ul>	<ul style="list-style-type: none"> <li>&gt; No global vision of overall productivity</li> <li>&gt; Difficult to compare organisations in terms of overall productivity</li> </ul>

62 The techniques reviewed in this section will be limited to ones applied to cross-sectional datasets. Techniques applied to longitudinal datasets are more complex and out of the scope of this publication. For a clear history of the methods used to measure productivity see Daraio Cinzia and Simar Léopold, "The Measurement of Efficiency," in *Advanced Robust and Nonparametric Methods in Efficiency Analysis*, vol. 4, Studies in Productivity and Efficiency (Boston, MA: Springer US, 2007).

63 For a more detailed exposition of DEA please see Emmanuel Thanassoulis, *Introduction to the Theory and Application of Data Envelopment Analysis* (Boston, MA: Springer US, 2001).

64 For a more detailed yet brief introduction to SFA see Vasilis Sarafidis, *An Assessment of Comparative Efficiency Measurement Techniques* (Europe Economics, 2002). For an extended explanation of SFA please see Subal C. Kumbhakar, Hung-Jen Wang, and Alan P. Horncastle, *A Practitioner's Guide to Stochastic Frontier Analysis Using Stata* (Cambridge University Press, 2015) or William H. Greene, "The Econometric Approach to Efficiency Analysis," in *The Measurement of Productive Efficiency and Productivity Change*, ed. Harold O. Fried, C. A. Knox Lovell, and Shelton S. Schmidt (Oxford University Press, 2008), 92–250.

65 Mark Andor and Frederik Hesse, *A Monte Carlo Simulation Comparing DEA, SFA and Two Simple Approaches to Combine Efficiency Estimates* (Center of Applied Economic Research Münster (CAWM), University of Münster, 2011).

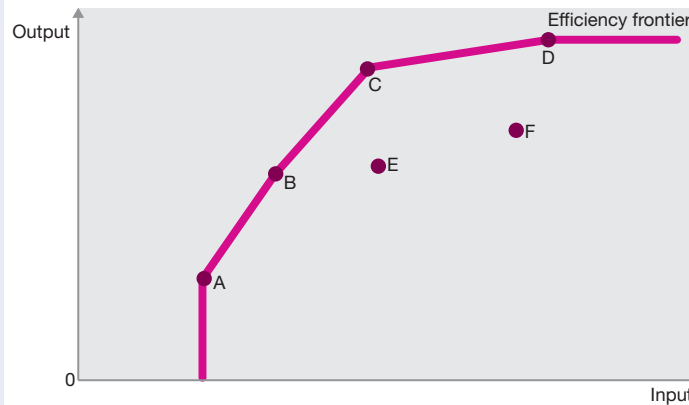
66 These input and output indexes are built thanks to a Laspeyres output quantity index and a Laspeyres input quantity index or other indices like Paasche, Fisher, Malmquist and Törnqvist. For further explanation on the construction of these indices see Office for National Statistics, "Index Numbers," Methods Explained, Economic & Labour Market Review (Office for National Statistics, March 2007) or Douglas W. Caves, Laurits R. Christensen, and W. Erwin Diewert, "The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity," *Econometrica* 50, no. 6 (November 1, 1982).

67 Helen Simpson, *Productivity in Public Services* (The Centre for Market and Public Organisation, 2006).

**Box 3: Data envelopment analysis**

Data envelopment analysis (DEA) is a mathematical technique that converts the inputs and outputs of the most efficient organisations into a frontier. It applies weights that maximise the efficiency score of organisations, joining all extreme levels of production<sup>68</sup> to create an 'outer envelope' (points A, B, C and D in Figure B below).

**Figure A: Data envelopment analysis<sup>69</sup>**



Units on the frontier are deemed 100 per cent efficient. The distance of the rest of the units from the frontier reflects their level of inefficiency and thereby their potential for improvement.

**Pros**

- > Can be used on small samples<sup>70</sup>
- > Makes no assumption about the exact relationship between inputs and outputs
- > No need for inputs and outputs to be weighted in terms of their importance
- > Can use multiple inputs and outputs
- > More robust than SFA for datasets with less than fifty organisations<sup>71</sup>

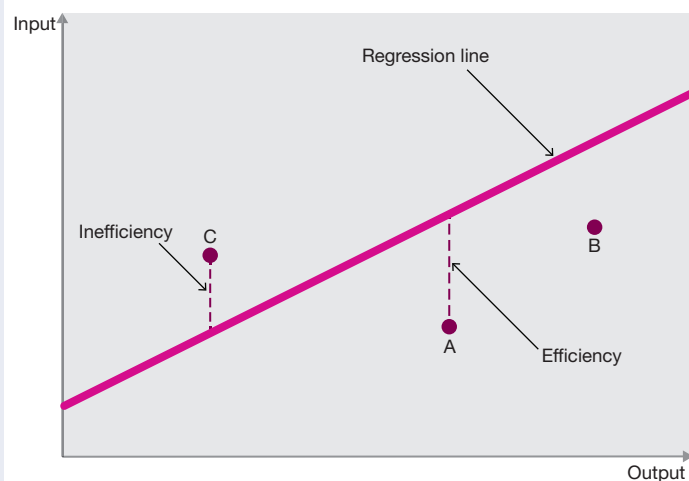
**Cons**

- > Too many firms may appear to be efficient
- > Efficiency score is solely contingent upon the organisations included in the analysis
- > Harder to compute than IN, PEMS or regression analysis

**Box 4: Regression analysis**

Regression analysis is a technique that estimates the extent to which inputs explain the variance of outputs that different organisations produce. It yields a measure of productivity captured by the error term (i.e. unexplained factors) of the regression equation.

**Figure B: Regression analysis (ordinary least squares)**



The distance between organisations below the regression line (A or B) and the line is a measure of efficiency; the distance between organisations above the regression line (C) and the line is a measure of inefficiency.

68 By piece-wise linear segments.

69 Smith and Street, "Measuring the Efficiency of Public Services: The Limits of Analysis."

70 Rajiv D. Banker, Vandana M. Gadh, and Wilpen L. Gorr, "A Monte Carlo Comparison of Two Production Frontier Estimation Methods: Corrected Ordinary Least Squares and Data Envelopment Analysis," *European Journal of Operational Research* 67, no. 3 (June 25, 1993): 332-43.

71 Ibid.

**Box 4: Regression analysis (continued)****Pros**

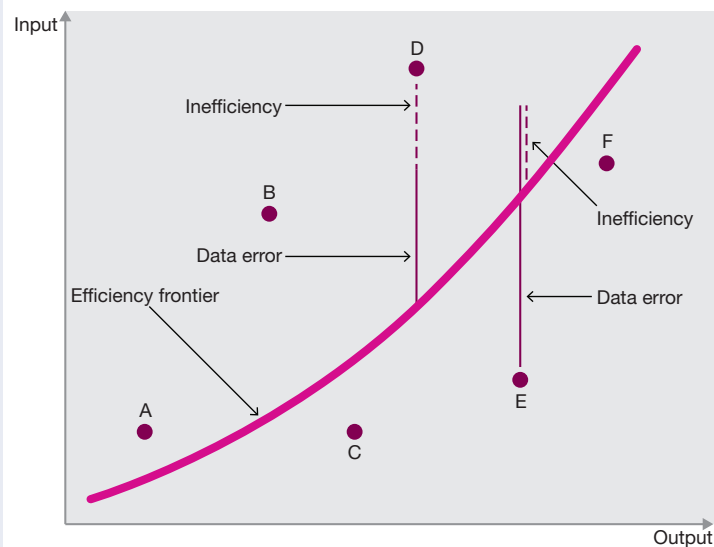
- > Easy to interpret
- > Easy to compute
- > Allows to control for influence of external factors

**Cons**

- > Allows to control for influence of external factors
- > The efficiency or inefficiency measures capture statistical noise, such as the impact of unobservable environmental factors
- > Sensitive to over or under explanation when there are too many or too few variables relative to the number of units (observations)

**Box 5: Stochastic frontier analysis**

Stochastic frontier analysis (SFA) is a regression-based approach to productivity. In contrast to regression analysis, it divides the error term into two components: one corresponding to statistical noise and another corresponding to a measure of inefficiency. It uses the available data in order to estimate the cost function of a relatively efficient organisation.<sup>72</sup> This cost function is known as the frontier.<sup>73</sup>

**Figure C: Stochastic frontier analysis<sup>74</sup>****Pros**

- > More robust than DEA for datasets with more than fifty organisations<sup>75</sup>
- > Can deal with multiple inputs and outputs
- > Provides information about an ideal level of efficiency
- > Can control for external factors

**Cons**

- > Outliers will affect the efficiency score
- > In contrast to DEA, SFA assumes that inputs and outputs are related in a discrete way<sup>76</sup>
- > Sensitive to over or under explanation when there are too many or too few variables relative to the number of units (observations)
- > Harder to compute than IN, PEMS or regression analysis

<sup>72</sup> Ibid.

<sup>73</sup> SFA estimates the cost function through the use of 'maximum likelihood' estimation techniques.

<sup>74</sup> Vasilis Sarafidis, *An Assessment of Comparative Efficiency Measurement Techniques*.

<sup>75</sup> Banker, Gadh, and Gorr, "A Monte Carlo Comparison of Two Production Frontier Estimation Methods."

<sup>76</sup> By this we mean the algebraic relationship between inputs and outputs, otherwise known as the functional form of the production function.

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# 4

## Implementing the value for money framework

The Government is right to highlight productivity as a key priority for this Parliament. Within a tough financial climate, the public sector will simply fail to maintain service levels for citizens, never mind improve them, without significant productivity gains.

However, productivity on its own is not sufficient for improving the nation's wellbeing. To do this, the Government must look beyond inputs and outputs to understand what it is trying to achieve and at what cost. As others have stated, "outcomes are the 'so what' of politics";<sup>77</sup> without a value for money approach that considers the chain of decision-making from spending to outcomes, the Government cannot hope to live up to the public's needs and expectations.

The Government must also overcome significant barriers before it can start to measure productivity well. It must look at organisational productivity, in addition to sector level, to find the levers for improving performance. This will require better data and improved methods for analysing productivity. Above all, the Government must adopt a consistent and holistic framework within which to assess the relative value for money provided by different organisations, as put forward in this report.

The Spending Review is a moment to look ahead at the big challenges facing the country. With demand for public services expected to rise, and limited funds available, productivity is the only route to better public services. It should be a core focus for this Government's spending programme and it will be a core focus for *Reform* in the months to come.

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<sup>77</sup> Longstaff et al., "Neighbourhood Policing: Past, Present and Future A Review of the Literature," 1.

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