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# The distributional impact of public spending in the UK

IFS Working Paper W12/06

Cormac O'Dea  
Ian Preston

# The Distributional Impact of Public Spending in the UK\*

Cormac O’Dea<sup>†</sup>     Ian Preston<sup>‡</sup>

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Public spending in the UK in 2008/9 amounted to over £10,000 per person or about 43% of national income (Crawford, Emmerson and Tetlow 2009) while net receipts from tax and social security contributions exceeded £8,000 per person or about 35% of national income. These transfers of resources between individuals and the state, either as cash payments or as supply of goods, affect individual standards of living and do so in ways that differ markedly between different households. Assessing the impact of government activity on the distribution of household living standards is essential to the evaluation of public service provision but raises challenging conceptual issues that we discuss in this report.

The diversity of ways in which governments spend raises complex issues for assessment. In particular the distinction between straight cash transfers and provision of benefits in kind, and, within the provision of benefits in kind between provision of private and of public goods, may call for a variety of approaches in evaluation of the associated benefits. While cash transfers are often regarded (though even here there are issues) as straightforwardly allocable to well-identified recipients, some goods such as health or education services can be associated with specific recipients but at a valuation which may be difficult to determine and other goods, such as services consumed in common like defence or environmental protection, may be regarded as raising issues too forbidding to allow any safe allocation to be made at all. Exercises which attempt to evaluate the redistributive effect of government (for example, Dodge 1975, Evandrou, Falkingham, Hills and Le Grand 1993, Gemmill 1985, Gillespie 1965, Menchik 1991, O'Higgins and Ruggles 1981, Piggott and Whalley 1987, Ruggles and O'Higgins 1981, Sefton 2002, Van't Eind, Van Fulpen, Pommer and Ruitenberg 1986) therefore vary considerably in the comprehensiveness with which they cover the public budget and typically stop short of allocating the whole of government spending.

The Office of National Statistics has published for many years an annual evaluation of the effects of taxes and benefits on household income (see Barnard 2009 for the latest example). In this study, most direct and indirect tax payments, all cash benefits and a substantial proportion of private benefits in kind are allocated to households on the basis of clearly explained assumptions. Sefton (2002) pushes the allocation a little further for the early years of the past decade. A recent report for the 2020 Public Services Trust by Volterra Consulting (2009) seeks to extend

the analysis even further by allocating remaining items of the public budget. While these exercises are illuminating it is acknowledged that “the criteria used both to allocate taxes and to value and apportion benefits to individual households could be regarded as too simplistic (Barnard, 2009, p.A25).” Our aim in this paper is not to develop alternative figures but rather to explore in greater depth what is and is not known about the distributional impact of public sector activity.

## 1 Cash Transfers

### 1.1 Valuing Cash Transfers

Transfers in cash are easiest to understand and provide a benchmark against which to develop a treatment of other forms of spending. Suppose the state takes resources from some individuals and gives the sums raised to others, and suppose we can regard neither type of transfer as conditional in any way on economic behaviour that the individual can alter. The analyses of the ONS and others in the same spirit proceed on this sort of basis.

There are, of course, serious issues about assuming that tax payments and benefit receipts, even of this kind, accurately reflect the costs and gains to the households to which they are being attributed. This is well recognised in the ONS study itself: “For example, the lack of data forces us to assume that the incidence of direct taxes falls on the individual from whose income the tax is deducted (p.A25)” and “In allocating indirect taxes we assume that the part of the tax falling on consumers’ expenditure is borne by the households which buy the item or the service taxed (p.A26).” Taxes and benefits, by their very nature, render choices that would have been made in their absence unaffordable and therefore must alter demand for goods or supply of labour. It is only under unrealistic assumptions about the other side of the relevant markets that prices and wages will not be affected and the incidence therefore falls entirely on households in the way assumed. If commodity taxes, by reducing demand, lead to lower prices of the goods consumed then their burden on the consumer is less than assumed. If income taxes, by reducing supply of labour, raise pretax wages then their incidence on the taxed is correspondingly less. The burden in these cases does not, of course, disappear but is passed on to those with

an interest in sales of the good or purchases of labour. At the same time, taxes which are not formally incident on households, such as employer National Insurance contributions, will have an effect on households (of arguably similar magnitude) despite being typically neglected in such studies. Moreover all of these effects are likely to ramify beyond the particular markets for goods bearing the respective taxes.

The assumption that behaviour is unaltered is also problematic and, if relaxed, raises issues to do with substitution within individual budgets associated with taxes and benefits. The assumption that the taxes and benefits under discussion are lump-sum, unconditional on behaviour, is plainly at variance with reality. Benefits paid only to the unemployed may induce some individuals who might otherwise have worked for low earnings to give up doing so so as to acquire entitlement. Such individuals lose some pretax income and gain some leisure time but, since in the absence of the benefit they would have chosen to work, the loss must exceed the gain and the gain from receipt of the benefit is therefore less than its value. Similarly, taxes on income make working less attractive and may induce some people to lower their hours of work. Again there is a loss of earnings and gain in leisure but they do not balance out in their impact on household welfare and the burden of the tax is greater than measured by the tax paid. These are examples of what economists call *excess burden* or *deadweight loss* and should properly form part of the assessment of the redistributive impact of the tax and benefit system. Evaluating this component of the burden would require discussing the extensive literature on the empirical modelling of behavioural responses and we set these issues aside in the discussion that follows.

We illustrate points about cash transfers with the figures for taxes and cash benefits in 2007/8 in Barnard (2009)<sup>1</sup>.

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<sup>1</sup>Direct taxes here include income tax, National Insurance contributions and council tax payments. Indirect taxes include Value Added Tax, alcohol, tobacco, fuel and vehicle duties as well as taxes on betting and television licences. Cash benefits include state retirement pensions and other contributory and non-contributory cash benefits. Original incomes include "income from employment, occupational pensions, investments and from other non-government sources" as well as imputations for fringe benefits. Statistics are based on information about incomes and expenditures in the Expenditure and Food Survey, reweighted and grossed to reflect population totals. The unit of analysis is the household and, where adjustments are made for differences in household size and composition, McClements equivalence scales are used. Fuller details are provided in Barnard (2009).

## 1.2 Redistributive effect

Consider then a single transfer and assume that it goes from a richer to a poorer person (and assume that the characteristics of the two people and the prices which they face are similar<sup>2</sup>). The gap between their incomes falls and inequality between the two is correspondingly reduced, whether measured in terms of the absolute gap or as a proportion of either's income. Can this rather simple observation about isolated transfers between individuals be extended to give a basis for assessment of the redistributive effects of transfers taking place across the whole distribution? It turns out that it can. If net transfer as a proportion of original income is rising all of the way up the income distribution - which is to say that taxes and benefits are *progressive* considered together - then the proportional gaps between incomes are reduced, concertina-fashion, between individuals at all points in the distribution (see Jakobsson 1976, Lambert 2002, Preston 2007, for example).

Let us take the ONS data and order households by equivalised income after receipt of cash benefits and payment of direct (but not indirect) taxes<sup>3</sup>. Households can be grouped into decile groups, each constituting one tenth of the distribution, and taxes and benefits compared across groups as a proportion of original income<sup>4</sup>. As is evident from Figure 1, net transfers as a proportion of original income rise between the first and second decile groups but decline from there on. As a consequence, as seen in Figure 2, the net effect of taxes and benefits is to raise the ratio between incomes of those in the second and first deciles but to depress inequality everywhere else in the distribution. The overall effect is therefore broadly progressive excepting its effect at the very bottom of the distribution.

Breaking this down into the effects of taxes and benefits, we see, again from Figure 1, that benefits are highly concentrated on the lower deciles in a consistently progressive way. Taxes on the other hand are far less clearly progressive in effect.

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<sup>2</sup>We can allow for differing characteristics by working with equivalised incomes - see Blackorby and Donaldson (1994) - and for differences in prices by working with equivalent incomes - see Donaldson (1992)

<sup>3</sup>The fact that the ordering by income so defined may depart from that according to original income means that theoretical observations on effects of taxes and benefits may need some qualification. We are following here, however, the manner in which statistics are presented in Barnard (2009).

<sup>4</sup>The taxes, benefits and incomes used in calculations here are unequivalised.

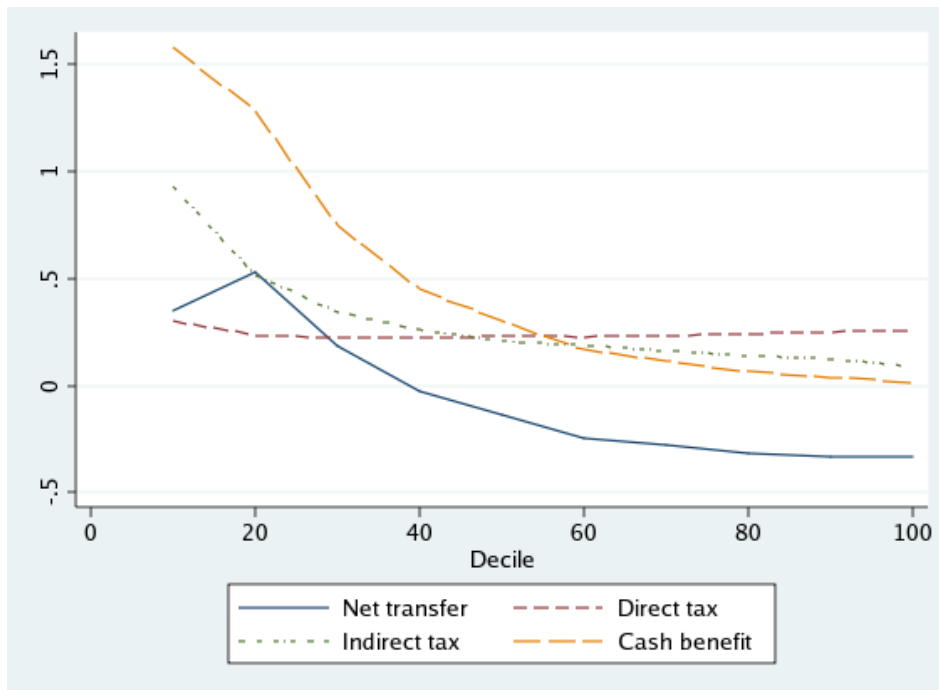


Figure 1: Taxes, benefits and net transfers as a proportion of original income

Direct taxes do increase very gradually as a proportion of original income, except between the first two deciles, but indirect taxes decrease systematically and the two together are regressive in effect. The positive redistributive impact of cash transfers is therefore overwhelmingly attributable to the role of cash benefits.

A somewhat weaker criterion for inequality comparison than the uniform closing up of relative income gaps is to compare cumulative shares of original and final income as one moves up the income distribution. If we plot, for each decile group, the total income of that and all poorer deciles as a fraction of the total income in the economy then we construct a representation of the distribution known as the *Lorenz curve*. If one income distribution has a Lorenz curve lying everywhere above another then that means that, at whatever point we cut the population, the poorer fraction of the population have a greater share of total income in the former distribution than in the latter. This is still a strong sense, referred to as Lorenz dominance, in which we might say that one distribution is less unequal than another (and one that is consistent with comparison of relative income gaps as used above). In this sense, the distribution of final incomes is unambiguously more equal than that of original



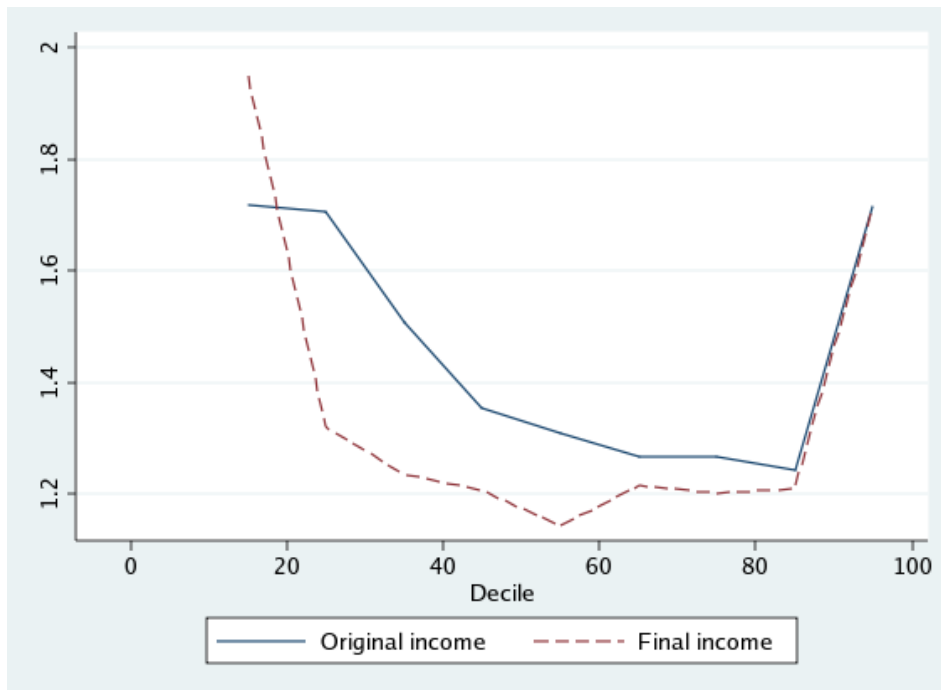


Figure 2: Ratios between incomes at successive deciles

incomes, as seen in Figure 3.

It is also possible to plot cumulative shares of tax and benefit totals against the same income ranking in a way that is informative about their redistributive effect. It is possible to show (see, for example, Lambert 2002 or Morris and Preston 1986 for an application) that the effect, say, of a particular tax or benefit on the Lorenz curve of income depends on two things - the deviation of the curve showing cumulative shares of that tax or benefit<sup>5</sup> from the Lorenz curve for income beforehand (interpretable as the *departure from proportionality* in application of the tax or benefit) and the *average rate* of the tax or benefit. Looking at Figure 3, where such curves are plotted, we see reemphasised the point that benefits are far more important than either direct or indirect taxes. Indirect taxes are in fact regressive, as already noted. While direct taxes are mildly progressive - the curve showing the distribution of direct taxes lies, on the whole, slightly outside the Lorenz curve for original income - the departure from proportionality is so small that any redistributive impact is

<sup>5</sup>We cannot call this the Lorenz curve unless the relevant tax or benefit payments necessarily increase with income.

swamped by that of cash benefits.

### 1.3 Social welfare

Analysis of inequality of the sort outlined above gains interest from the way in which it can be linked to arguments regarding social welfare. Return again to consideration of a single net transfer from a richer to a poorer person. If income in the hands of a less well-off person is regarded as socially more desirable than income in the hands of someone better-off then the transfer of resources not only reduces inequality but also raises social welfare, an argument appreciated since at least Dalton (1920) and often regarded as compellingly linking comparisons of inequality and social welfare. We can also extend this observation to evaluation of a system of transfers across the whole distribution.

If we are prepared to specify the way in which incomes of individual households contribute to social welfare then we can evaluate the effect of transfers at household level and add up the effects of the transfers on social welfare across the whole distribution. For small enough transfers this comes down to application of 'welfare weights' to the effects of the transfers on individual households (as in cost benefit analysis - see, for instance, Drèze and Stern 1987). That is to say, the transfers can be added up across the distribution, weighting them by factors reflecting the social desirability of providing resources at the point in the income distribution occupied by the recipient. If social preferences are averse to inequality then the weights will be higher at the lower end of the distribution and transfers which move resources towards poorer households will result in gains in social welfare. To be exact, if the cumulative sum of net transfers remains always positive as we move along the income ranking from poorest to richest then, under the assumption that income gains are always judged better for poorer than for richer households, it must be that social welfare in the final income distribution will be higher than in the original distribution<sup>6</sup>.

Such curves are constructed and compared in Figure 4. The cumulative sum

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<sup>6</sup>It is assumed here that net transfers do not fall so rapidly along the income distribution as to cause reversals in the ranking of richer and poorer individuals. The result follows from the result of Shorrocks (1983) relating social welfare comparisons between income distributions to comparisons of cumulative totals.

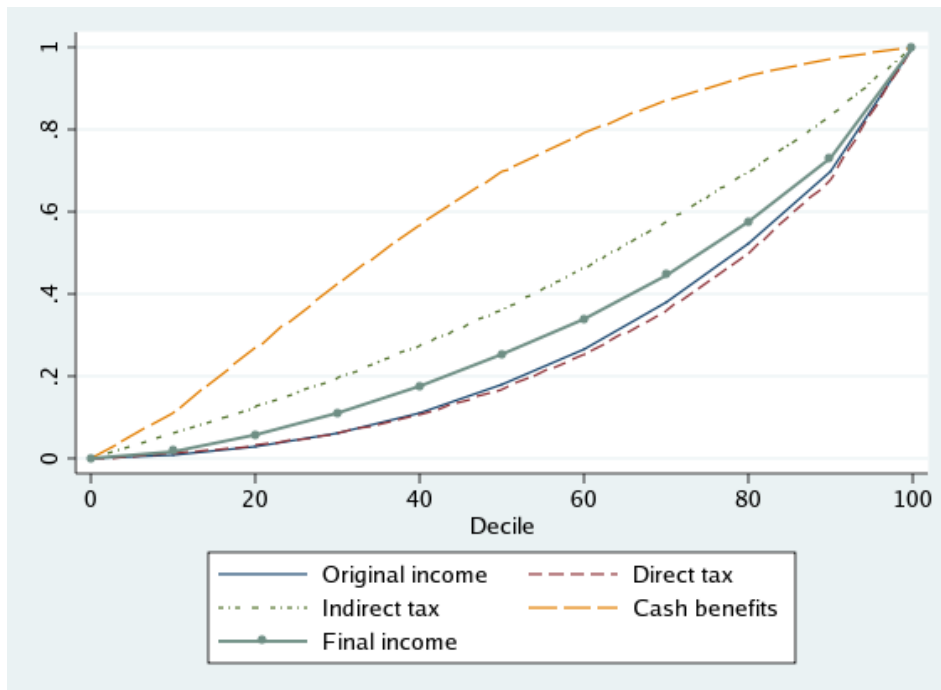


Figure 3: Cumulative shares

of net transfers cannot remain everywhere positive because the total of the taxes allocated in this exercise is more than the total sum of benefits. The sum is positive however over the lower half of the distribution suggesting that cash transfers do at least unambiguously raise the social welfare of the poorer half of the population.

This raises an obvious issue though. The total of the taxes allocated exceeds the total of the benefits because only a fraction of public spending has been covered by the exercise. Any sensible and comprehensive analysis of the distributional and welfare effects of the public sector needs to take account of the welfare effects of other forms of public spending. That is the main topic of the current paper which we now take up.

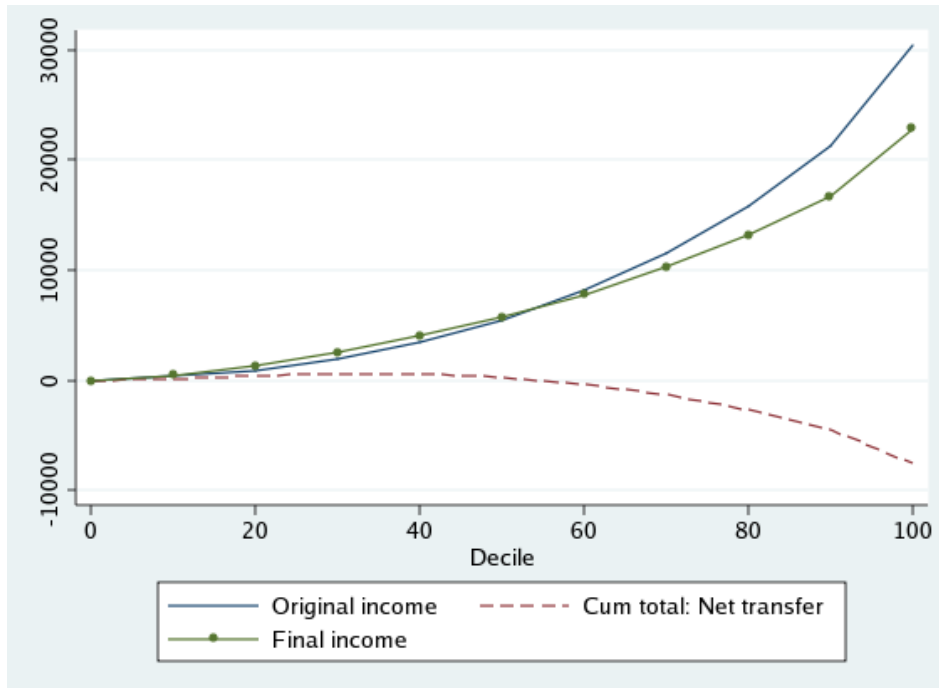


Figure 4: Cumulative totals

## 2 The distributional effect of publicly provided goods: conceptual issues

The cash benefits allocated in the ONS study considered above constitute only just over a quarter of government expenditure. Most government spending is in fact made for the purchase of goods and services provided to citizens. Incorporating the benefits from this spending into assessment of the distributional effect requires some way of valuing the gains to households and we will argue that there is no way to get the valuation of benefits right without careful consideration of preferences and demand for the goods and services provided.

The ONS study does also make an attempt to allocate certain benefits in kind. In particular a large part of the exchequer cost of health, education, housing and transport subsidies is allocated across households on the basis of evidence on use of the corresponding services. The existence of serious issues in the way that these benefits are included is however acknowledged: “We know only an estimate of the total financial cost of providing benefits such as education, and so we have to treat

that cost as if it measured the benefit which accrues to recipients of the service. In fact, the value that recipients themselves place on the service may be very different to the cost of providing it (p.A26).”

At this point it is important to draw attention again to the distinction between different types of publicly provided goods.

- At one extreme we can think of services which are provided in ways that are clearly allocable to specific households and consumed separately by those households in ways that exclude consumption by other households of the same quantities. These are goods essentially similar in kind to those typically provided through market mechanisms and referred to as *private goods*. The archetypal example here would be food, though this is rarely provided publicly. It is clear that at least large parts of, say, education or health services have this property.
- At the other extreme are goods consumed collectively in ways that are not rivalrous between households, in the sense that consumption by one household does not diminish the scope for consumption of the same services by other households. To the extent that it is impossible or prohibitively costly to exclude individuals from benefitting then it may be infeasible also to fund supply of such goods through market arrangements. These are goods, referred to as *public goods*, which it is well recognised that competitive markets are ill-suited to provide and include public budget items like defence or environmental protection.

Of course many publicly provided goods are neither pure private goods nor pure public goods. As we discuss below, the provision of education involves elements that benefit the recipient and components that benefit society in a manner such that the benefits are non-excludable. While in our discussion below we consider separately the valuation of publicly provided private goods and publicly provided public goods and don't explicitly deal with goods that involve benefits of both kinds, the framework can be applied to these hybrid goods. In particular, we can think of the decomposition of the benefits of any public provision into components that are private (i.e. they accrue to particular individuals and others can be excluded from benefitting) and those components that are public (those benefit from which

it is not possible to exclude anyone) and value each of these components using the relevant framework.

For reasons which we will return to later, publicly provided private goods raise less difficult issues than public goods and we discuss the former first.

Government provision of private goods can be motivated by many reasons including the overcoming of various forms of market failure or paternalistic concerns. Nonetheless, the reduction of inequality has at times been an explicit motivation for social reformers. Le Grand (1982), for example, quotes Tawney (1964) to the effect that by “the pooling of . . . resources by means of taxation, and the use of funds thus obtained to make accessible to all, irrespective of their income, occupation, or social position, the conditions of civilization which, in the absence of such measures, can be enjoyed only by the rich . . . It is possible for society . . . thus . . . to abolish, if it pleases, the most crushing of the disabilities, and the most odious of the privileges which drive a chasm across it.” Thoughts such as these have undoubtedly played a historic role in the development of the UK public sector. Furthermore, the possibility for those at the higher end of the income distribution to opt out of public provision, while continuing to pay through taxes to cover its cost, may arguably enhance redistributive effect even further (see Besley and Coate 1991) at the same time as maintaining a public consensus in favour of state provision.

To evaluate the redistributive impact of public provision of such goods calls for consideration of the counterfactual possibility - in other words, to consider what would have happened if the goods were not provided publicly. In the case of private goods it may make sense to assume that a private market would exist. Nonetheless provision, decided differently, might be at a different level and the difference in demand would probably lead to a difference in price (which, in turn, would have effects on other markets<sup>7</sup>). Furthermore, public provision may be motivated by correction of some market failure. For example, public provision of health insurance may be prompted by problems associated with asymmetries of information in markets for private health insurance and absence of public provision would mean that levels of

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<sup>7</sup>In particular, public services may make intensive use of particular labour types whose wages may be bid up as a consequence. For example, military service or academic research are activities which tend, because of the public nature of the benefits to be provided, to be provided publicly and each may be suited to particular worker types whose services would be less in demand if public spending were reduced.

provision would be affected by those market failures.

Where the goods provided are public in nature, public provision is necessitated by collective action problems associated with the nonrival and nonexcludable character of the benefits and absence of public provision might lead to no provision at all. In fact, an economy without certain publicly provided services, such as judicial arrangements that protect personal security and support the integrity of private trading arrangements for other goods, would be so far removed from the actual economy that it makes little sense to consider evaluating the distribution of benefits relative to such a state.

To make such comparisons is clearly too ambitious but it may remain a sensible exercise to attempt to make comparison, based on consumer welfare in the two situations, with well-defined hypothetical alternatives involving private provision at specified prices, recognising that while this is only to describe part of the redistributive effect it is nonetheless to offer something more than an accounting exercise dividing up costs of provision<sup>8</sup>.

## 2.1 Valuing benefits for publicly provided private goods

### 2.1.1 Measuring benefits

Assessing the distributional effect can be seen as requiring that two questions be addressed. How much do different households receive? How much do different households value what they receive? Neither of these ought to be avoided. In particular, the evaluation of benefits received is a crucial part of assessing the distributional impact of public spending. If it is the distribution of household welfare that interests us then it is the valuation of the benefits from the good provided that matters and not the cost of providing them. Some simple examples make the point.

- To take a trivial case, suppose that resources raised through taxes are wasted on spending that households regard as valueless or worse. In such a case it

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<sup>8</sup>An alternative exercise might be to consider the distributional impact not of total spending but only of marginal spending. While this may be interesting and in some respects less ambitious it would raise many further questions concerning the distinction between marginal and average incidence (see Lanjouw and Ravallion 1999, for example) and it is not what we have in mind in the discussion that follows.

seems plain that no benefit should be attributed to households whatever the cost.

- To take another example, suppose that individuals consume some private good, that the government decides to tax them an amount exactly equal for each household to spending on that good and then to provide to them exactly the same quantity of the good itself. In this case it seems evident that households will cease to spend their private incomes on the private good and that the benefit to the household is exactly equal to the amount spent on the good. In this case attributing to each household the cost of providing the quantity that it uses seems to get the allocation just right.
- Now suppose instead that taxes are raised in the same way but the private good is provided to all households at an identical level. Somewhere in the income distribution will be a household that would have chosen this level if choosing privately and it seems sensible to continue to evaluate the benefit to that household similarly. However other households are now constrained to consume amounts differing from what would be their private choices and, even though they are provided with equal amounts at similar cost, it cannot be maintained that they benefit equally.

How then should the consumption benefits of publicly provided goods be valued? The issue has been discussed in several papers<sup>9</sup>. We base the following discussion on an approach close to that of Cornes (1995), which is to value the benefits according to an equivalent cash transfer. That is to say, we value the provision according to the lump sum cash transfer which, if made in the absence of public spending on the good concerned but with the publicly provided good available to the household at a suitable price, would leave the household at the same standard of living as with the

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<sup>9</sup>The proposal of Aaron and McGuire (1970), advanced in the specific context of valuing public goods, has been particularly influential. (See also Maital 1973, 1975 for elaboration of the idea and Brennan 1976 for a critique.) Their suggestion is to take the price at which a household, given its circumstances, would be happy to purchase the quantity provided (sometimes called the *virtual price* of the publicly provided good) and to value the quantity at that price (in other words to take the product of the virtual price and the quantity). We see several compelling reasons not to use this technique in the current context.



actual provision. We view this approach as conceptually ideal while appreciating the practical difficulties in implementation.

This method provides a monetary valuation comparable to the cash transfers discussed in the previous section. It requires a choice of the suitable price at which to suppose the publicly provided good is offered when calculating the equivalent transfer and it is important that the price be the same for all households if there is to be no comparability problem across households<sup>10</sup>. For private goods the appropriate and obvious price would be the common cost of provision. The idea is explored diagrammatically in Box 1.

There are several attractive things about this way of valuing public provision of private goods.

- Firstly, it is evident that increasing the quantity provided, because it increases consumer welfare, increases the measured benefit. This is a minimally desirable feature in contexts in which quantities provided can vary across households<sup>11</sup>.
- Secondly, when two households receive the same quantity but differ in economic circumstances it is the one which is willing to pay more for the benefits that is measured as having the higher benefit.
- Thirdly, pricing the publicly provided good to reflect cost of provision when evaluating the equivalent transfer retains the link between cost of provision and monetary benefit accruing to individuals.

Some commentators suggest that it is an undesirable feature of cost-based evaluation that productivity gains in provision reduce measured benefits even when the quantity provided is unchanged. On the contrary, we would argue that while the utility benefits are unchanged, it seems not absurd to suggest that the *monetary value* of benefits does indeed fall in such cases.<sup>12</sup>

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<sup>10</sup>The Aaron-McGuire method described above also provides a monetary valuation but it is the fact that the good is being evaluated at a different virtual price for different households that arguably raises issues in the comparability of monetary amounts across households.

<sup>11</sup>The fact that it is not a property of the Aaron-McGuire technique seems a compelling reason not to use that approach.

<sup>12</sup>Indeed, it would be absurd, say, to value the benefits of streetlighting as if street lights were still gas or oil fuelled and lit by hand even if the light provided is unchanged.

**Box 1 Valuing publicly provided goods**

Figure 5 illustrates the idea. An individual provided with quantity  $Q$  of a publicly provided private good has (after tax) income of  $y$  which is spent on a privately purchased good. The curve  $AA$  connects all combinations of quantities spent on the two goods which give the household the same standard of living as the actual provision  $(Q, y)$ . The straight line  $BB$  has a slope equal to the price of the publicly provided good  $P$  and at the point  $X$  the consumer has the same living standard as at  $(Q, y)$  and is prepared to give up the private for the public good at a rate exactly equal to  $P$ . If given an income of  $Y$  and allowed to purchase the publicly provided good at price  $P$  the consumer would therefore choose to consume at  $X$  and be exactly as well off as they are with the existing public provision. The equivalent transfer valuing the public provision is therefore the distance  $Yy$ .

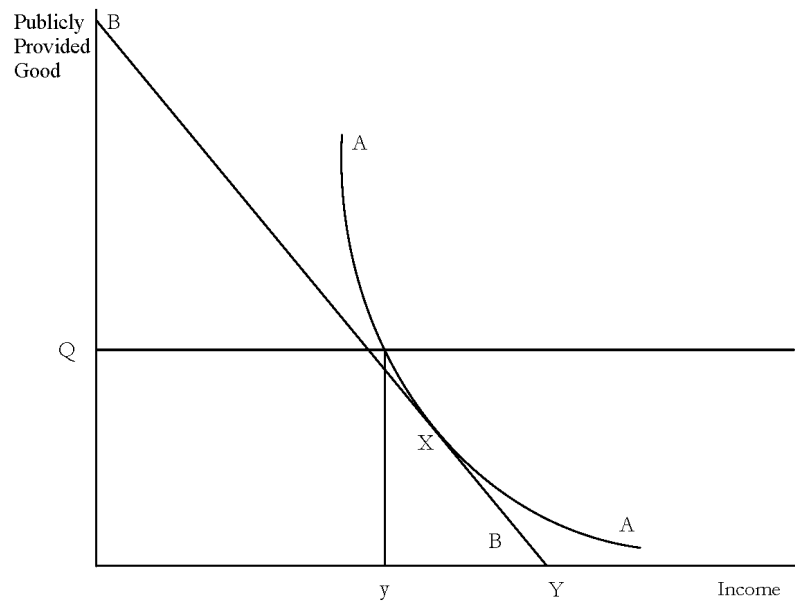


Figure 5: Valuing a publicly provided private good

### 2.1.2 Valuations and income

In the context of a distributional study as defined here it is the variation of benefits with income that is of most interest. How do benefits vary with income? Answering this question is crucial to determining how the distributional effect varies from what might be indicated by a simple study based on use and cost.

Let us suppose that the household has no choice but to consume the quantity provided for it by the government. There will be some income at which a household is content with that actual provision. At this income the rate at which the household would give up private income for the publicly provided good (the *virtual price*) exactly equals its actual price and such a household would be measured, under the proposed method, as valuing the benefit at exactly the quantity multiplied by that price<sup>13</sup>.

This household values the benefit most highly, according to the method proposed, among all households. For households at lower incomes, assuming that demand for the good rises with income, the household is being forced to consume more of the publicly provided good than it would choose to do given its disposable income and it seems unexceptionable to regard it as valuing the benefit less. On the other hand, households at higher incomes would choose to consume more and, although they may be expected to value the good at a higher price<sup>14</sup>, they are also being required to overconsume the private good which they value correspondingly less; overall they are worse off than if left to make the choice for themselves and they, therefore, also benefit less. Eventually, at high enough income, the amount provided publicly and what would be chosen privately may deviate to such an extent that the household would happily forgo public provision altogether (even without return of tax costs) and purchase the good privately for itself - for such a household the benefit from public provision is negative. Box 2 illustrates these points using the sort of diagram introduced in Box 1.

Benefits of a fixed provision therefore vary with income as in Figure 7, first rising to a peak and then falling. This would be the pattern for a household compulsorily

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<sup>13</sup>This, incidentally, is the one case in which the proposed method values the benefit exactly as would Aaron and McGuire (1970) as the quantity provided multiplied by the virtual price.

<sup>14</sup>Methods such as that of Aaron and McGuire would suggest that the benefit of provision should therefore be regarded as greater.

**Box 2 Valuation and income**

Let  $y^*$  denote the income at which a household would be content with public provision at the actual cost of provision  $P$ . Such a household is illustrated in Figure 6 as the household consuming at  $(Q, y^*)$  and the value to it of public provision is  $y^*Y^*$ . Such a household has the highest valuation of provision of any household receiving  $Q$ ; at either higher or lower incomes the value to the household is lower. At an income below  $y^*$ , such as  $y_1$  in Figure 6, the benefit is below  $y^*Y^*$  and increasing with income whereas at incomes above  $y^*$ , such as  $y_2$  in Figure 6, it is below  $y^*Y^*$  and falling with income. Generally speaking, the further is income from  $y^*$  the further is the household's desired provision from actual provision and the lower the income transfer equivalent in its effect on household welfare to the public provision. The household with income  $y_0$  in Figure 6 is just at the point where the measured benefit hits zero.

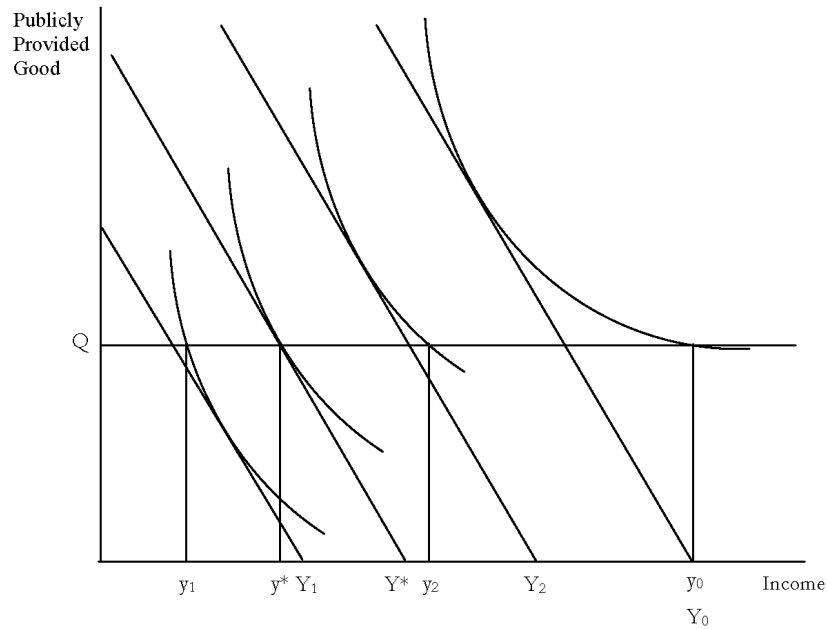


Figure 6: Valuation and income

required to consume the level publicly provided as, say, for a publicly provided private good such as education if the suggestion, sometimes canvassed, of making private education illegal were ever enacted.

In practice, for many publicly-provided private goods, supplementation or substitution by privately financed alternatives is possible. There is, for example, the possibility of opting out and consuming solely privately financed alternatives to public education or to certain forms of publicly provided elective surgery. There is, for example, also the possibility of topping up public provision of security through privately purchased security, of topping up public health provision through privately purchased “hotel benefits” in hospital or of topping up public education provision through out-of-hours private tuition. These possibilities change the picture somewhat.

Taking first the possibility of *opting out*, it is plain that the income at which this option will be exercised is exactly the income<sup>15</sup> at which the benefit of public provision, as measured here, hits zero. The effect of allowing opting out for such households is that the benefit can never become negative. The valuation of public provision for households able to opt out (but not to top up) has a humped relation with income as in the case of public provision but with a truncation of the value from below at zero.

If *private supplementation* is possible then households with incomes above the level at which public provision is as desired and benefits peak<sup>16</sup> and therefore desired levels of provision above the publicly provided level do not have to remain dissatisfied but can ensure that their demand is met by additional private purchases of their own. For households which do so, and assuming for simplicity that the price at which they can make such purchases is the same as the cost of public provision<sup>17</sup>, the value of public provision never declines from the peak, remaining from then onwards exactly equal to the expenditure saved by the individual. This is therefore one case in which the value of benefits is unambiguously (weakly) increasing in income.<sup>18</sup>

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<sup>15</sup> $y_0$  in Figure 6.

<sup>16</sup> $y^*$  in Figure 6.

<sup>17</sup>If this is not so then the income at which the right to supplement is exercised may be above  $y^*$ .

<sup>18</sup>Notice that differences in the value of benefits for different individuals in this context come from individuals with the same preferences having different incomes. The preferences themselves are considered to be the same across all individuals. The assumption of preferences that are identical

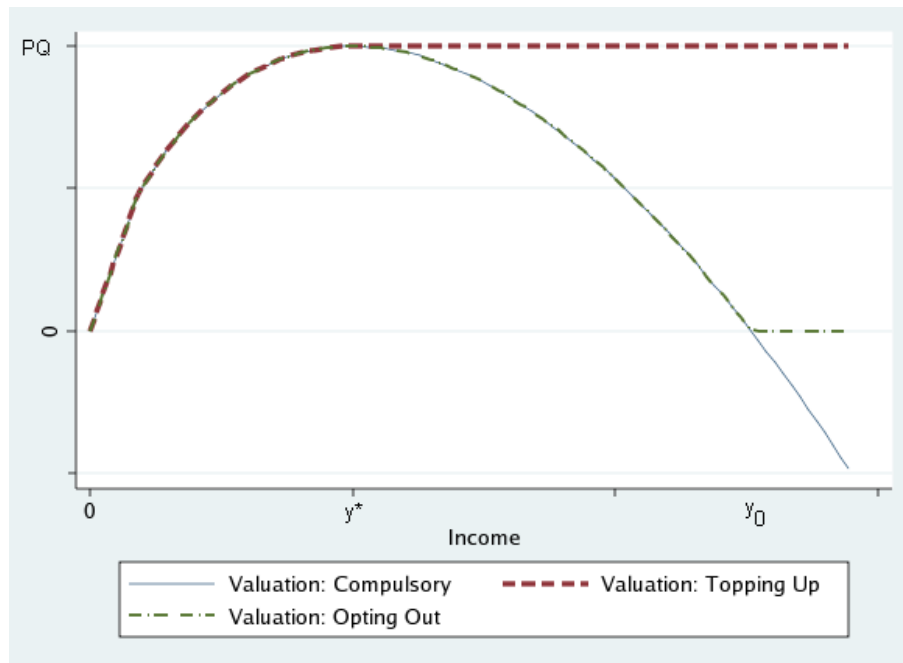


Figure 7: Valuation and income

## 2.2 Valuing benefits for public goods

Assessment of benefits from provision of public goods is more difficult<sup>19</sup>. Benefits are enjoyed in common and public provision overcomes a collective action problem. Households purchasing the good privately and individually without sharing costs would fail to recognise the benefits to others and provide an inefficiently low level. The benefit from public provision needs to be incorporated into valuation of the distributional impact and welfare comparisons cannot be drawn in the same way as with publicly provided private goods.

Suppose private provision would actually be zero. The equivalent private transfer to zero provision *at the shared cost* is negative rather than zero, as it is in the private case, and this is the appropriate comparison point. Box 3 elaborates on the point.

is maintained throughout this paper; in its absence there is very little that can be said generically.

<sup>19</sup>Recall that a public good is one which is not rival (that is, one household's consumption of the good does not preclude consumption by another household) and is not excludable (that is, it is impossible to exclude individual households from consuming the good once it is provided to some). A classic example is the protection provided by the defence forces.

Box 3 Valuing public goods

The public good  $Q$  is publicly provided to individuals at an average price  $P/n$  equal to the slope of the line  $BB$ . In the absence of public provision the cost of the public good is not shared and no one individual is prepared to contribute voluntarily at the collective cost  $P$ . Provision is therefore at 0. The line  $CC$  connects points at which the individual is as well off as at this point. If presented with the budgetary possibilities represented by the line  $DD$ , along which the public good is offered at the shared cost  $P/n$ , the individual would choose to consume at  $X'$  and be as well off as if consuming  $y$  of the private good and none of the public good. The equivalent transfer valuing the public provision is therefore the distance  $Yy'$  rather than  $Yy$ .

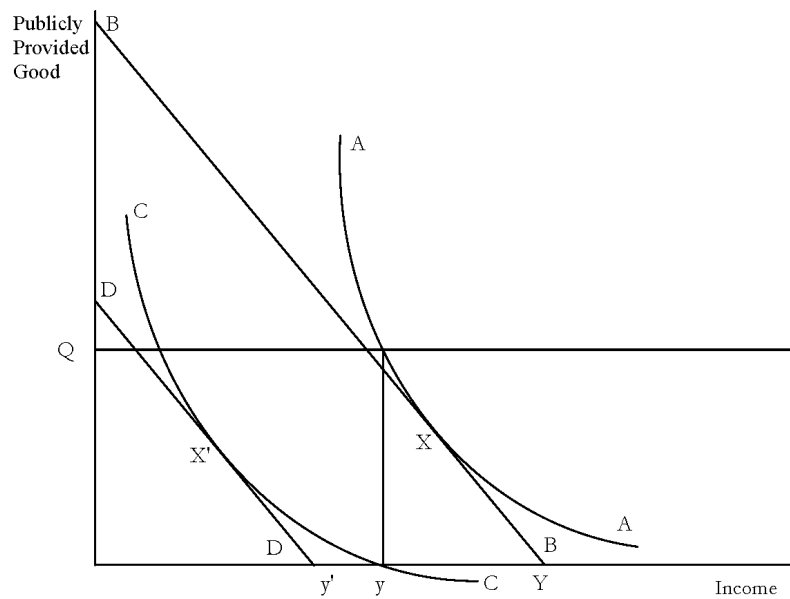


Figure 8: Valuing a publicly provided public good

## 2.3 Distribution of quantities

The discussion so far suggests that the distributional impact of public spending is determined by

- the way in which willingness to pay for services provided varies across the income distribution
- the way in which quantities or qualities of service offered or provided vary across the income distribution.

The former of these was the subject of the section above and the latter is the subject of the current section. We can see the distribution of quantities as arising from the interplay of two things: on the one hand, political decisions on the level and allocation of public spending and, on the other, private responses.

To begin with, consider a publicly provided good which is required to be provided at a homogeneous level across the population. In democratic conditions one would expect the level of spending to be set with a view to gaining majority support for the policies of the government. Preferred levels of spending on the good will vary within the population both because household resources differ but also because public funding arrangements may mean the costs of provision fall more heavily on some households than others. The simplest case to consider is that where spending is voted on in isolation from other issues and preferences are *single peaked* in the sense that each household has a preferred spending level and is increasingly dissatisfied the further spending deviates from that preferred level. It is well known that a majority voting equilibrium exists in such a world and that it will correspond to the desired level of the *median voter* - the voter relative to whom half of the voting population want higher spending and half want lower. If it is also true that the higher a household's income the higher is its preferred spending then we know also that the decisive voter will be the voter right in the centre of the income distribution.

Publicly provided goods provide a textbook example of a case where these assumptions are fragile. Because of the possibility of opting out, it is quite possibly untrue that preferences are single peaked. For very low quality public services, a household may choose the private sector and, given that, prefer lower to higher spending; once public spending reaches an adequate level however the household will



be content to opt in to public provision and will then prefer higher to lower spending at least until spending reaches its preferred level; for spending beyond its preferred level it will again prefer lower to higher spending. This complex pattern of preferences means existence of a voting equilibrium is much more difficult to determine (Barzel 1973, Stiglitz 1974). Furthermore, the higher tax costs falling on the rich and the higher probability of the rich opting out mean that it cannot be assumed that preferred levels of spending are higher for richer voters so it is impossible to identify median spending preference with median income level. Theoretical exploration of equilibrium in these sorts of models, and also models with topping up, show the possibility of voting outcomes in which the preferences of middle income households oppose a coalition of rich and poor households wanting low public spending for different reasons and in which the pivotal voter is located well below the middle of the distribution. (For examples of these sorts of treatments see Stiglitz 1974, Glomm and Ravikumar 1993, Epple and Romano 1996a, 1996b, Gouveia 1997.)

These models are sophisticated but still simplistic in their neglect of the complexity of political decision making, the ways in which issues of public provision get entangled with bargains over other issues and the ways in which this gives scope for other sorts of influence to be exerted. Nonetheless the observation that levels of spending will tend to match the preferences of pivotal voters near to the middle of the income distribution probably captures something close to the truth. We can of course speculate on what the preferences of these pivotal voters might be. If, as is the case in the UK as well as most developed economies, median income is less than mean income, then the median voter might be expected to have a preference for redistribution from those at the top of the income distribution to those further down. Meltzer and Richard (1981) hypothesise that such dynamics have been behind the expansion in the size of government (in many countries) over the second half of the twentieth century. With the extension of the franchise, the income of pivotal voter has tended to decrease relative to mean income, leading to a demand for more redistribution, which, in a democracy, is met.

Even where public provision is notionally uniform that does not mean that different individuals will not find ways of securing advantage in access to public provision and that this may be more beneficial to households at certain points in the distribution. Better educated, professional households may be able to secure better

services either because of better procedural understanding, greater confidence in dealing with providers or because greater social proximity makes providers more comfortable dealing with them. Evidence of this with respect to provision of health and education is discussed below.

Where provision differs across individuals, there may be scope for individuals to change behaviour so as to acquire or enhance entitlement to consumption of better quality services. The most obvious example is with households moving to locate themselves in catchment areas of high quality schools. To the extent that households expend resources to acquire entitlement to better services a market may be generated which will lead to capitalisation of the benefits gained by changing behaviour. House prices near the best schools, for example, will rise as demand from richer households drives them up (see Gibbons and Machin 2003, 2008). In equilibrium richer households will consume higher quality public services but will not be achieving any net monetary gain because of the extra housing expenses incurred in order to do so. Indeed to the extent that the chasing of better quality public services causes individuals to locate differently from how would otherwise be optimal there will be an associated deadweight loss.

## **2.4 Inequality and social welfare**

A key advantage of the method for valuing benefits of publicly provided private goods as described above is that, by construction, a household receiving public provision  $Q$  and paying tax  $T$  towards the cost is exactly as well off as it would be if it received a net cash transfer equal to the evaluated benefit less the tax paid and purchased the good privately at the cost of public provision. Its situation can therefore be compared by means of this equivalent transfer to its situation as it would have been in the absence of public provision, where it would have been left to purchase provision privately but without benefit of the transfer.

This suggests that a sensible way to approach the comparison of the inequality and social welfare associated with the distribution of welfare with and without such public provision may be by looking at these equivalent transfers just as was done with cash transfers in the previous section. In particular looking at how transfers vary as a proportion of income and looking at how cumulated totals of net transfers build

up as one moves along the income distribution may remain justifiable approaches to assessing the redistributive and welfare effects of the public spending<sup>20</sup>.

If those political economy models are correct which suggest patterns of spending that are likely to favour the preferences of households in the middle of the distribution then it is to here that we should expect the greatest redistribution, in line with Director's Law (Stigler 1970): "Public expenditures are made for the primary benefit of the middle classes, and financed with taxes which are borne in considerable part by the poor and the rich".

There is, of course, the possibility that public provision changes the cost of providing the good. Indeed this may be part of the rationale for government intervention in provision. However we can then separate the welfare effects of public provision neatly into the redistributive effect associated with the allocation of quantities across households, evaluated by means of equivalent transfers evaluated at the price after government intervention, and the price reduction effect, evaluated by comparing the effect on household welfare of the price reduction in a hypothetical regime where the good is provided privately at the lower price. This is not to say that this latter effect is distributionally neutral. Lowering the cost of a good, for example, which accounts for a particularly large part of poorer households' budgets should be considered distributionally progressive. However, this element of the distributional impact requires modelling of the effect of public provision on costs and is rarely considered in distributional evaluations of the sort we are considering.

## 2.5 Nature of benefits and beneficiaries

The discussion above has proceeded as if identifying the nature of the service provided and the identity of the beneficiary were readily apparent. In practice, this is often far from being as obvious as this might suggest.

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<sup>20</sup>Converting policy effects into monetary terms raises several technical but practically important issues. It is only under restrictive assumptions on preferences that choice of prices at which to evaluate social welfare effects is innocuous (Roberts 1980, Blackorby, Laisney and Schmachtenberg 1994). It is only under restrictive assumptions on preferences that measures of welfare incorporating equivalent transfers always respond to straight cash transfers in wholly appropriate ways (Blackorby and Donaldson 1988). Donaldson (1992) summarises the issues involved here well. A seriously comprehensive empirical treatment would need to address these issues.

### 2.5.1 Insurance benefits

For many of the publicly provided goods we are considering, the nature of the benefits is largely that of insurance against certain eventualities.

- Many of the cash benefits considered in Section 1 can be considered as insurance against various forms of income risk. Whether formally contributory or not, the nature of contingent benefit payments can be regarded as payouts from programs of social insurance against the contingency concerned<sup>21</sup>.
- Most public health spending is best seen as a form of insurance against ill health. The private good for which it substitutes and which is purchased by those choosing to opt out of elements of public provision is typically sold in the form of insurance cover rather than direct payment for treatment.
- Spending on the police and judiciary can be seen as insurance against crime. Consumption of police assistance by victims of crime are receiving conditional assistance reducing the costs to them of crime.

For such goods, *use*, in the sense of direct consumption of services is better regarded as an insurance payout rather than a measure of the value of the insurance to the individual. It is not, for example, that someone who does not fall ill does not benefit from hospital services and that the state therefore redistributes from them to someone who does, any more than it is true that purchasers of private medical insurance who do not require treatment are voluntarily redistributing to those who do.

The appropriate valuation in such cases is in terms of the *risk premium* for the contingency against which insurance is provided. Individuals benefit according to the amount that they would have been prepared to pay to avoid the risk against which and to the extent to which they have been insured. For risks that do not vary across the population it would be appropriate to think of the quantity of insurance provided being provided at a flat rate with the value of the benefit varying only insofar as individuals with differing circumstances might be differently prepared to pay to avoid risk. In fact, most of the risks mentioned do vary across households: the

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<sup>21</sup>Pushing the idea a little further, progressive taxation of income can be regarded as, in part, another form of insurance against income risk.

risk of unemployment, of disability, of ill health, of victimisation all vary systematically with observable characteristics which would be a basis for privately provided insurance to be offered to individuals at differing rates and for individuals to be differently eager to acquire that insurance.

### **2.5.2 Life cycle effects and intergenerational issues**

Use of many services also follows a highly predictable life-cycle path.

- The contingencies upon which receipt of cash benefits is conditioned show systematic variation with age. Most obviously and explicitly this is so for state retirement pensions and certain other payments to the elderly, such as winter fuel payments and free bus passes. Entitlement to benefits associated with disability also shows a clear life cycle path. Child benefit payments on the other hand are an example of a cash benefit typically paid to families in the middle years of their life.
- Again, health is a good example. Health deteriorates in predictable ways with age and a very large part of consumption of public health services occurs predictably later in life.
- Publicly provided education is provided so as to benefit individuals at very specific stages in their life cycle. There are issues discussed further below about whom it is most sensible to regard as the beneficiary of education spending but, however that question is answered, the life cycle path is clearly not flat.
- Both levels of victimisation and fear of crime are different in different age groups (Ditton and Farrall 2007) suggesting that the benefits from police spending may show an age-related pattern.

It is highly dubious to regard this as constituting redistribution from young to old or vice versa. Everyone who is old was young once and everyone who is young has an expectation of being old. To a large extent what the age patterns to receipt of benefits, asynchronous with tax payments, is achieving is an enforced pattern of saving and borrowing within individual lives. To the extent that what is of interest is more redistribution between different people rather than redistribution over time

for a particular individual, a better way to think of this would be to consider lives as a whole, to consider the whole path of receipt of publicly provided transfers and services and of tax payments across the whole life, to discount those streams back to an appropriate age and only then to compare across individuals. Spending could then be regarded as being redistributive only to the extent that it reallocates resources between the lives of different individuals. However a recognition of the fact that individuals face constraints on borrowing that prevent them smoothing lifetime resource streams and may do so differently at different points in the income distribution means that even this perspective may be too simplistic (see Holzmann 1990).

Of course, this is a difficult perspective to bring. At any one point in time the current population consists of individuals at different stages in their life cycle, some of whom will be nearing the end of life while others only have the uncertain expectation of currently unknown future benefits. Individuals living in different periods will also have faced different prices of provision of public services, making conversion into comparable monetary values difficult. Matters are further complicated by the fact that life expectancies themselves vary across individuals. Those who have higher incomes tend to have lower mortality rates than those with lower incomes. There also tends to be a negative relationship between wealth and life-expectancy (Banks, Muriel and Smith (forthcoming), Hills et al. 2010). To the extent that those in the final stages of the life-cycle tend to be net recipients of government transfers, differential mortality will induce redistribution from those with less income and wealth to those with more.

Nonetheless variation in levels of provision over time will have an intergenerational redistributive impact. At its simplest a permanent expansion of a particular public spending program with no life-cycle pattern to net benefits will affect the currently old for a shorter fraction of their life than the currently young. Where the program tends to raise funds from the comparatively young and to provide benefits towards the end of the life cycle on a pay-as-you-go basis<sup>22</sup>, as for example with public health or pensions spending, there is a transfer at the point of introduction or expansion to those in the generation which is currently elderly. By contrast, the

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<sup>22</sup>That is to say, funded on a budgetary basis which balances year-by-year rather than funding postponed benefits by investment of currently raised funds

introduction or expansion of publicly provided education provision tends to redistribute from current adults to future adults.<sup>23</sup>

### 2.5.3 Family and dependents

We believe it is the effect of public spending on the distribution of economic welfare across individuals that matters. Indeed when things are set into a life-cycle context in which it is possible for individuals to move between households it is difficult to see what other perspective could make sense. Nonetheless individual welfare is determined by the economic circumstances of the household(s) in which those individuals live and by the distribution of resources within those households so it is not possible to ignore issues regarding determination of the distribution of economic resources across and within households and families.

Public spending decisions could in principle alter the strength of individual bargaining positions within households. Public childcare provision is an obvious example to consider. If the public sector provides something like this which substitutes for a service that is traditionally provided within the household by one of the partners then that person's bargaining position is possibly affected. On the other hand if this frees that partner up to enter employment outside the household then that also affects their economic position in the household. The interplay of this different effects is potentially subtle. Decisions about who within a household receives publicly funded benefits may also be important in the way that it affects decision making and the distribution of resources within the household (see for example, Lundberg, Pollak and Wales, 1997).

A particularly difficult issue has to do with the identification of beneficiaries where services are provided for the ostensive benefit of dependents. Most obviously this is an issue in respect of education which, whether privately or publicly provided, is funded by parents but provided to children. The issue is also present though with other forms of spending benefiting children, such as health interventions in early years, and with spending for the benefit of, for example, elderly dependents. In each case the benefit appears to be for someone other than the funder. To

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<sup>23</sup>The literature on "generational accounts" tries to bring such a perspective to bear on questions of public finance, but is not without its critics (see Auerbach, Gokhale and Kotlikoff 1994, Cardarelli, Sefton and Kotlikoff 2000, Havemann 1994).

count education as a benefit for the adult seems to ignore the main beneficiary and to misrepresent the social compact whereby each generation receives education from its parents in return for providing it to its children. To count the benefit for both adult and child would be to count it twice in a way skewing the comparison between different types of spending. Counting the benefit as a benefit to the child views this as redistribution between generations which is nonetheless accepted by the donor. Where education is privately provided it does have the form of a voluntarily undertaken intergenerational transfer and that seems also to be a sensible way to see public education. Nonetheless, the effect of public provision, by relieving parents of the duty of funding their children's education, will actually impact more on parent's finances<sup>24</sup>.

Having said that, benefits of education spending are typically allocated in practice to the household of the parents. This is largely a response to practicalities. Typical empirical studies are cross-sectional, evaluating redistribution between households at a point in time rather than between individual lifetimes, as suggested above, and in this context it makes sense to locate the child in the household of its parents. The child is anyway at the beginning of a life at a future standard of living that is unknown. Nonetheless studies do differ somewhat in how they allocate higher education spending, sometimes treating the child as a separate householder and sometimes allocating the benefits to the parental household (Sefton 2002).

### **3 The distributional effect of publicly provided goods: evidence on specific services**

#### **3.1 Sources of evidence**

The discussion of the previous section points to the appropriateness of assessing the distributional effect through valuing the benefits from quantities provided along the income distribution. To evaluate this requires information on both the distribution

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<sup>24</sup>Representing as redistribution between *family dynasties* has an attraction in theoretical models but hardly captures the real complexity of family structures in a way that could be brought to data.



of quantities and the valuation placed on the associated services. We discuss possible sources of pertinent information.

Evidence on the distribution of resource use is the most common focus of empirical work. In particular, for publicly provided private goods, there are often surveys of use that can be put to this purpose. Often these are rather cruder than would be ideal - in particular, they may often indicate who uses particular services while being insensitive to intensity of resource consumption. For example, frequency of visits to doctors may be recorded but not length of consultation, frequency of victimisation may be recorded but not consumption of police resources. Nonetheless these sort of surveys remain probably the most informative source available on the question of interest and form the basis for the most constructive empirical work in the field.

What is less easy to draw conclusions about is the way that valuation of the services provided varies with income. Occasionally it may be possible to measure returns from public services in monetary form, as for example with the earnings returns from education. More often there are benefits in kind, the valuation of which can only at best be indirectly inferred from related behaviour. Wherever observable economic choices are motivated by attempts to access services of better quality, there is the potential for drawing inferences about valuation of services. For example, if purchase of houses are motivated by attempts to get nearer to good public services then spatial house price variation contains information about the capitalised value of those services. Where individuals supplement or opt out of public provision by purchase of private alternatives, the amounts paid for those alternatives and the way that those amounts vary with individual circumstances and with the quality of public services offered to the individual is again indicative of valuation of public services. This is not to say that those valuations are easily read off from data on behaviour - on the contrary, they cannot be without complex economic modelling - but rather to note that these are possible places to look for *prima facie* evidence on the issues. We discuss several instances of this sort of evidence below.

An alternative to looking at economic behaviour is to look at attitudinal data for expressed opinions on willingness to pay for public spending. There are surveys which ask regular questions on attitudes to public spending. It is important in this context to recognise the need to be careful in modelling the way in which the associated tax costs fall on respondents. Brook, Hall and Preston (1998) and Hall

and Preston (1998) describe one innovative attempt to incorporate variation in tax costs into the British Social Attitudes Survey in order to model preparedness to pay for different components of UK spending. In that instance the attempt to model tax costs was not very successful and evidence for any strong income effects in demand for public services proved difficult to find; the authors suggest that it may be difficult to read much into this when “respondents are answering questions about hypothetical situations without prior deliberation and as part of a lengthy questionnaire” and when “they may have decided opinions about which aspects of public spending deserve more funds but little idea about the size of extra finance needed to secure the sort of improvements they want.” Evidence of association with other sociodemographic characteristics does emerge. Preston and Ridge (1995) are more successful in modelling responses from the same survey on attitudes to local government spending.

One other sort of behaviour that may be indicative of valuation is the behaviour through which public spending is actually determined, which is to say political decision making. Voting differences across regions undoubtedly reflect differences in demand for public services but only among a large number of other issues with which they are entangled. Decisions for most public spending items are unfortunately mainly national, periodic and taken together with decisions on other contentious issues. Modelling the political process to extract information on valuation of public services is an interesting but ambitious possibility that lies beyond the scope of anything we discuss below.

### **3.2 ONS evidence**

The ONS study does also make an attempt to allocate certain benefits in kind. In particular a large part of the exchequer cost of health, education, housing and transport subsidies is allocated across households on the basis of evidence on use of the corresponding services. The effect is summarised in Figures 9 and 10 where lines labelled ‘ONS benefits’ or ‘ONS transfers’ include both cash benefits previously discussed and these additional benefits in kind. These benefits are notably more progressive than cash benefits alone and total net transfers, incorporating these benefits, decline as a proportion of income over the whole of the distribution

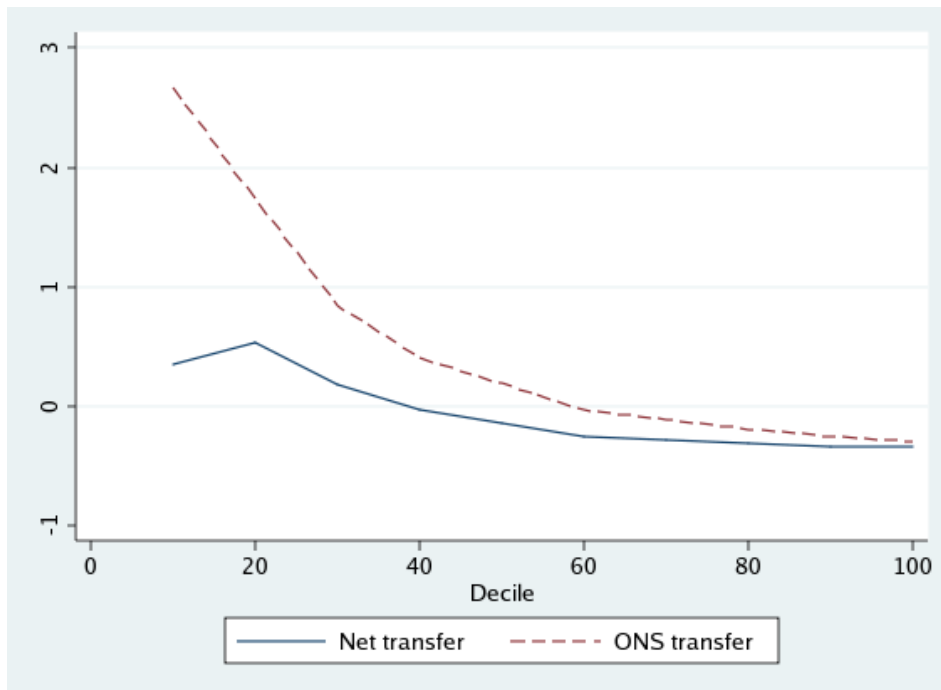


Figure 9: Net transfers as a proportion of original income

(including now the lowest deciles of the distribution).

### 3.3 Health

Spending on the National Health Service accounted for 7.8 per cent of national income in 2008/9 and represented about 18.1 per cent of total managed expenditure of the public sector (Crawford, Emmerson and Tetlow 2009). Trends in health spending over time and comparison with other countries are discussed by Propper (2003).

The distribution of health benefits reported by ONS can be seen in Figures 11 and 12. “The benefit from the health service is estimated according to the age and sex of the household members rather than their actual use of the service” and from information on cost of provision. Sefton (2002) uses actual use data from the General Household Survey and Family Resources Survey to show, for 2000/01, a pro-poor bias in the cost of health service benefits in kind that exceeds what can be explained by age and gender composition of different income groups and that appears to be

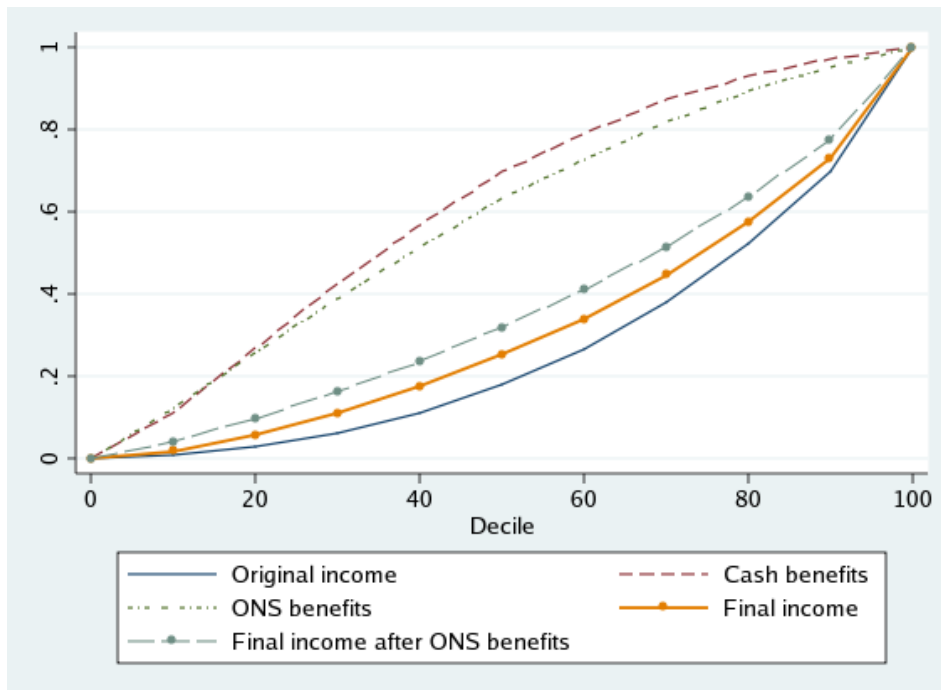


Figure 10: Cumulative shares

present in each of the different health care services distinguished (inpatient care, outpatient care, GP consultations and prescriptions).

The reasons for public intervention in health markets are summarised for example in Cutler (2002) and include externalities, information asymmetries and considerations of equity. Some of the benefits from public spending on health are undoubtedly nonrival, such as prevention of infectious disease, but the vast bulk of spending is for the purpose of treatment of individual ailments. The incidence of illness is uncertain and it seems appropriate to regard the benefits as insurance benefits accruing to the population in general rather than specifically to those who happen to fall ill and require treatment. This does not mean that the benefits should be regarded as equal. Individuals with different characteristics will have different susceptibility to different illnesses and therefore a different willingness to pay for insurance against those illnesses and would typically face different premia for such insurance under conditions of competitive private provision, at least to the extent that such characteristics are observable and admissible bases for insurance contracts. Valuing benefits according to intensity of use of public health services should capture accurately this dimension

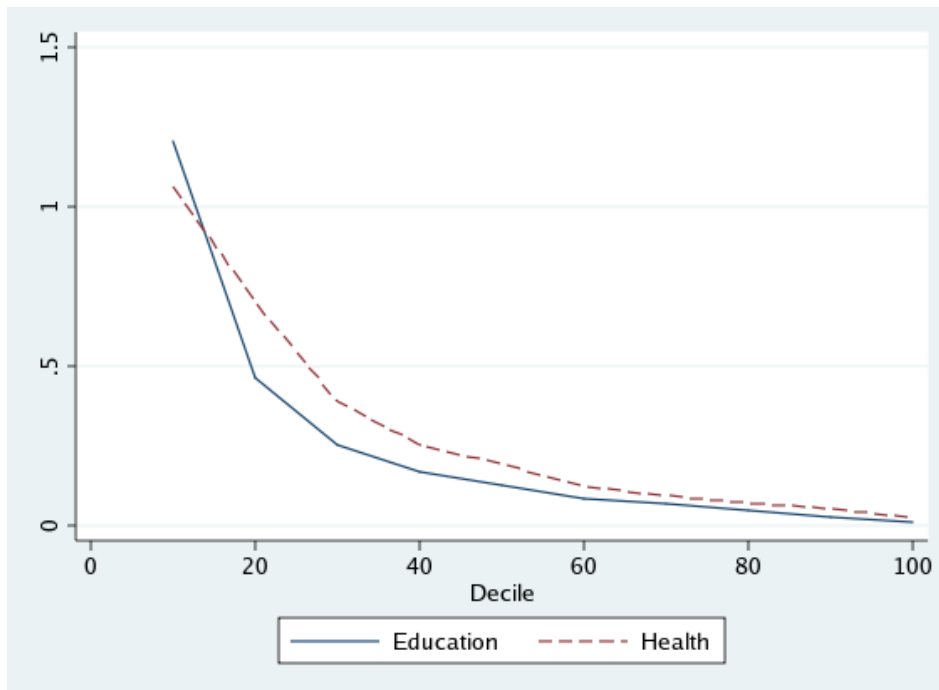


Figure 11: Net transfers as a proportion of original income

of difference across groups in the population (as argued by Sefton 2002).

Health service provision also differs in other dimensions of quality, both clinical, particularly with respect to length of waiting time for non-urgent treatments, and non-clinical, such as with regard to hospital amenities such as privacy, cleanliness and so on. For these aspects it would be reasonable to expect some variation in demand for health spending with ability to pay. The costliness of ill health, particularly in terms of forgone earnings from restricted availability for work, may also be greater for those with higher incomes.

Variation across socioeconomic groups in amounts spent on the relief of ill health can be seen as arising from two sources. Firstly there is variation across groups in need and secondly variation in the degree to which spending matches need.

Sociodemographic variation in health risks is longstanding and well documented. Two government reports, the Black and Acheson reports, have looked into inequalities in health (Department of Health and Social Security 1980, Department of Health 1998) and prompted a voluminous literature. Le Grand (1978) reports substantial variation across socioeconomic groups, defined by type of occupation, in self as-

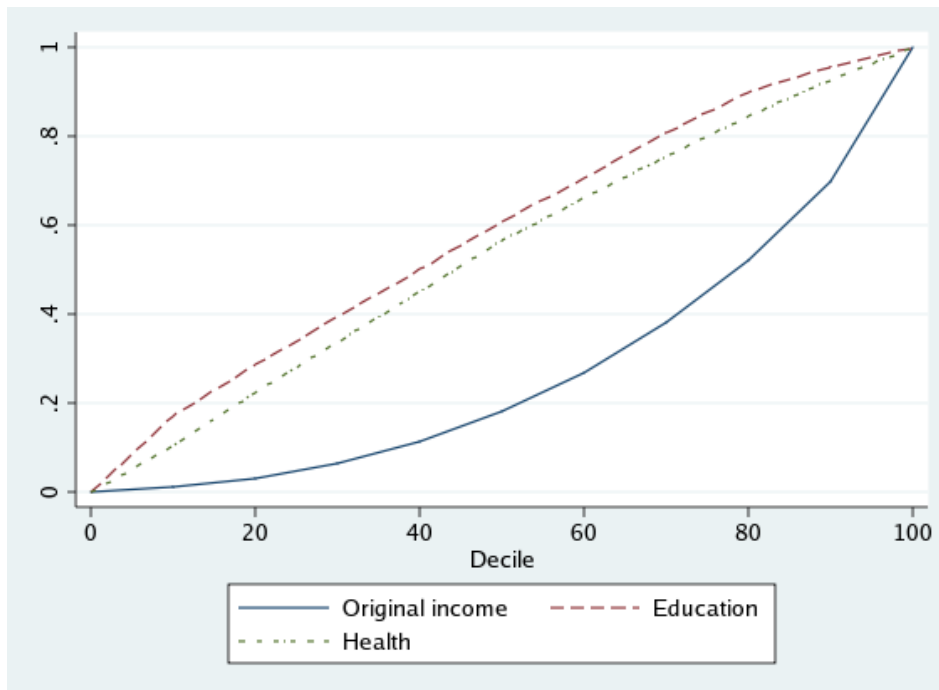


Figure 12: Cumulative shares

essed morbidity based on the General Household Survey, showing both limiting long standing illness and acute sickness to be concentrated in less skilled groups. Furthermore these inequalities remain after standardising for differing age and sex composition of the groups. Propper and Upward (1992) extend this to the 1980s classifying households by income to demonstrate that chronic limiting illness, acute illness and general poor health are all concentrated in lower income households. Van Doorslaer, Wagstaff et al (1997) (see also Wagstaff and Doorslaer 2000) place this in an international context, outlining a methodology for comparison and showing the concentration of ill health among the poor to be comparatively high in the UK. Banks, Marmot, Oldfield and Smith (2009) show pronounced socio-economic gradients in health for mature males whether measuring socioeconomic position by income, wealth or education and whether using biological measures of disease or individual self-reports. Currie, Shields and Wheatley Price (2007) and Case, Lee and Paxson (2008) discuss socio-economic gradients in health for children, the latter paper drawing particular attention to the existence of income gradients in chronic conditions.

Failure of treatment to match need is discussed in a large number of papers on inequity in health care provision. Goddard and Smith (2001) and Dixon, Le Grand, Henderson, Murray and Poteliakhoff (2003, 2007) survey much of this literature, the latter noting that “the picture overall is a confusing one”. Whereas earlier studies (Le Grand 1978) tended to point to the better off using more relative to need, later studies (Collins and Klein 1980, O'Donnell and Propper 1991, Propper and Upward 1992) suggested that within morbidity groups the poor were not inequitably treated. Subsequent work (Sefton 2000, Morris, Sutton and Gravelle 2005) tends to clarify the existence of different patterns at different stages of health care provision, with the more deprived tending to visit general practitioners if anything more often but the more affluent making greater use of specialist consultation services and a somewhat ambiguous picture emerging for inpatient visits. This pattern seems to be common to many countries (Wagstaff and van Doorslaer 2000, van Doorslaer, Wagstaff et al 2000, van Doorslaer, Masseria et al 2004, van Doorslaer, Koolman and Jones 2004, van Doorslaer, Masseria and Koolman 2006). Focussing on patterns of use of particular services in particular localities, Dixon, Le Grand, Henderson, Murray and Poteliakhoff (2003, 2007) discuss evidence from several sources of pro-rich bias, suggesting that lower socio-economic groups may also tend to present themselves later and at more advanced stages of illness, and concluding that “this may be the result of differences in the ability to communicate, to articulate needs and wants, and in self-confidence in dealing with professionals, bureaucrats and managers.”

Even given that there is no evident tendency for lower socioeconomic groups to visit GPs less often, it is not clear that the consumption of resources or the benefits of such visits are the same for all. Boulton, Tuckett, Olson and Williams (1986) and Wilson (1991) discuss evidence on differences in the nature of general practitioner consultations across socioeconomic groups. There is evidence, some now rather old, that better off patients tend, for example, to get longer consultations (Cartwright and O'Brien 1976), to receive more information (Pendleton and Bochner 1980) and to prefer more involvement in decision making (McKinstry 2000). Deveugele, Derese, van den Brink-Muinen, Bensing and De Maeseneer (2002) however fail to find any association of consultation length with social class in a cross-sectional study spanning several countries including the UK.

Any pro-rich bias in NHS provision will be mitigated by the increased propensity

of the rich to use the private sector. About 16 per cent of health care spending in the UK in 1998 was private health spending and about 80 per cent of that was covered by private health insurance (Emmerson, Frayne and Goodman 2001). While supplementary private health cover only covers certain aspects of health provision, for example non-urgent elective surgery but not long term care, primary consultations or emergency interventions, the decision of those with private insurance to use private alternatives for those options will reduce the benefit which they receive from public health spending, even though, as Sefton (2002) notes “differential use of private health care services only explains a small part of [the] differences between income groups and this effect is concentrated at the top end of the income distribution”. The proportion of the population with private health insurance varies over time but was about 12 per cent of the population in 2008 (Laing and Buisson 2008), not dissimilar to what it was in the late 1990s (Emmerson, Frayne and Goodman 2001, Foubister, Thomson, Mossialos and McGuire 2006), from a half to two thirds being employer-provided and a third to a half individually purchased (depending on the source for the information). One reliable and unsurprising conclusion from many empirical studies (Propper 1989, 1993, 2000, Besley, Hall and Preston 1999, Propper, Rees and Green 2001, King and Mossialos 2005, Wallis 2003) is the strong effect of income on probability of purchase with under five per cent of those in the lowest income decile being covered as opposed to over forty percent of the top decile (according to the information from the Expenditure and Food Survey in Emmerson, Frayne and Goodman 2001). Indeed the values in Figure 3 of that paper suggest that over a third of private insurance holders lie in the top decile of the income distribution and two thirds lie in the top three deciles. Figure 13 shows how the proportion of households spending on private insurance varies with (equivalised) income in the Expenditure and Food Survey, data being pooled from 2002 to 2007; Figure 14 uses the same data to show how annual private expenditure also rises with income<sup>25</sup>. Several, though not all, of the studies cited (Besley, Hall and Preston 1999, King and Mossialos 2005, Wallis 2003) find evidence of association between quality

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<sup>25</sup>These figures are smoothed using locally weighted regression techniques. Details are available from the authors on request.

Too much should not be read into the behaviour of these figures at very low income levels where data is sparse and there may be a strong influence of households for which low current income may give a misleading picture of economic position (see Brewer, O'Dea, Paull and Sibieta 2009).



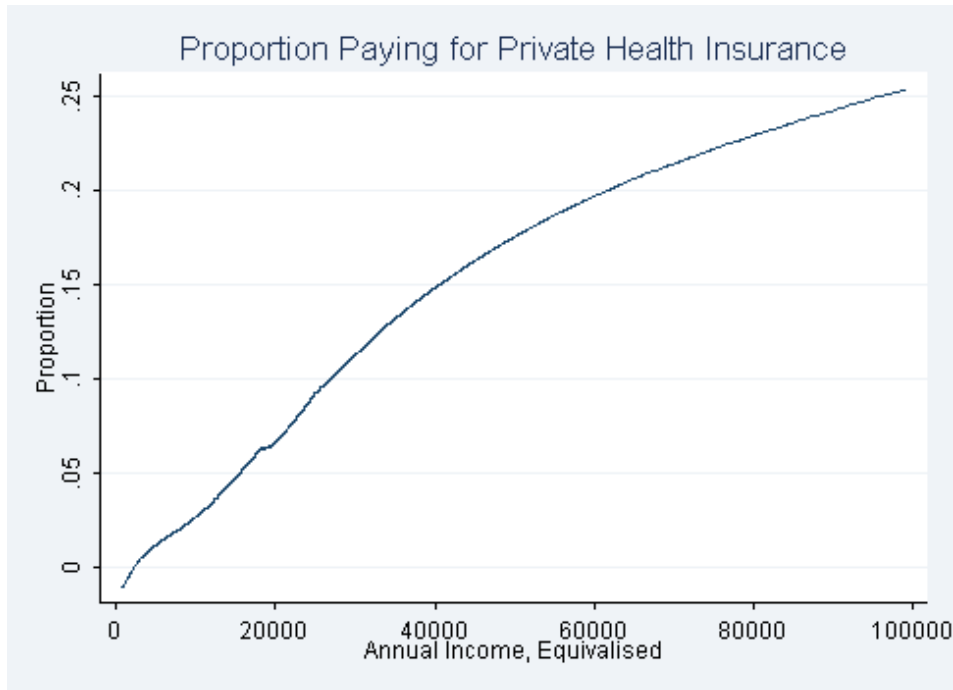


Figure 13: Purchase of health insurance

of public provision, particularly as measured by waiting times, and propensity to purchase private insurance, compatibly with these aspects of provision mattering to individuals.

### 3.4 Education

Public spending on education was 5.7 per cent of national income in 2008/9 or about 13.2 per cent of total managed expenditure of the public sector (Crawford, Emmerson and Tetlow 2009). Dutta, Sefton and Weale (2003) discuss trends and international comparisons. Spending on primary and secondary schools accounts for about half of this; spending on higher and further education accounts for another 15 and 12 per cent; the remainder is spent on provision for under fives, student support and capital spending.

Figures 11 and 12 also illustrate the ONS distribution of education benefits. In this case, the “benefit in kind from education is allocated to a household according to its members use of state education.” The concentration of benefits in the lower parts

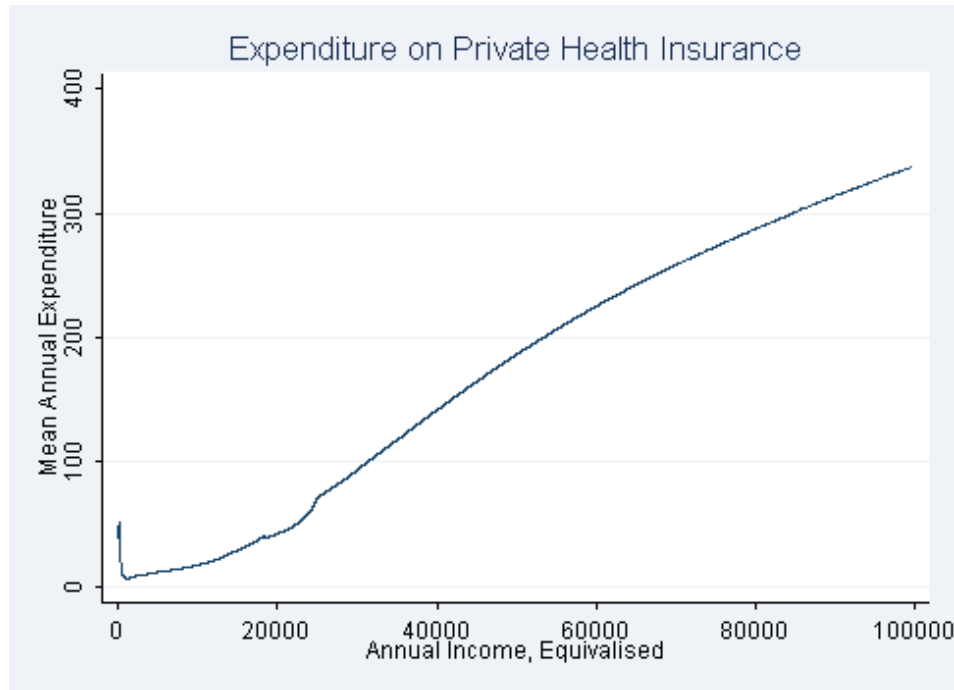


Figure 14: Expenditure on health insurance

of the distribution is mainly due to “the concentration of children in this part of the distribution”. As argued earlier, this makes the suggestion of a pro-poor bias rather misleading from a life cycle point of view. Sefton (2002) compares the distribution with what can be explained by age and gender alone and finds, for 2000/01 (though not 1996/97), a slight pro-poor bias in the sense that the lower two quintiles receive slightly more and the uppermost quintile slightly less than would be expected on the basis of demographic composition. Breaking this down into individual services, he demonstrates a “strongly pro-poor” distribution of spending on state schools, a distribution for further education and post-compulsory schooling that is “also pro-poor, but less so” and a distribution of spending on higher education that is “pro-rich if the benefits are allocated to their parents” though somewhat sensitive to assumptions about how to allocate costs of supporting dependent students. Concentrating on households with children of the age appropriate to the stage of education under consideration moderates these conclusions somewhat but it remains true that state school spending appears moderately pro-poor, largely because of use of private education in the highest income group, and higher education is more beneficial to richer

income groups.

Hanushek (2003) summarises some of the reasons for public provision, including externalities and capital market imperfections. To the extent that an educated citizenry provides benefits not captured by those individuals in higher wages - benefits associated with, say, increases in the productivity of coworkers, a faster rate of productive innovation, more informed involvement in public affairs and so on - education may provide some public good benefits. However, it seems sensible to think that most of the benefits are private, some of which may be regarded as consumption benefits associated with the participation in the education process and enjoyment of the enriched possibilities for life afterwards but much of which are in the form of investment in human capital and the improved wages which follow in later years.

An enormous body of research has been devoted to quantifying the private and social returns to education - Dutta, Sefton and Weale (2003) summarise the evidence as suggesting “that the social return to higher education, at around 10 per cent p.a., is comparable to or slightly above the social return to physical capital.” The existence of this literature is possible because of the availability of data on earnings and schooling that makes possible empirical investigation of the size of returns and therefore of direct measures of this aspect of the monetary benefits to the educated.

Evaluation of the redistributive effect calls on us to consider how education and earnings would have been chosen in the absence of public provision. There are many reasons to think that children of poorer families would receive less education under a purely private system including limited resources and credit constraints which prevent borrowing against the future income returns, uncertainty about those returns and the fact - discussed further below - that returns may be lower. As a consequence the private funding of education would constrain social mobility. Biggs and Dutta (1999) outline a simple model in the spirit of Loury (1981) where earnings ability is partly inherited but partly influenced by education, allowing them to compare inequality and intergenerational mobility under different funding arrangements. Purely privately financed education leads to considerably greater inequality than a public system in which education is provided at a uniform quality to all. A mixed system with public and private provision produces an intermediate degree of inequality which is highly sensitive to the level of public spending as changes in

public quality induce richer individuals to switch between sectors.

Blanden, Goodman, Gregg and Machin (2004) report declining intergenerational mobility in incomes and attribute part of this to the role of education, on “the fact that a greater share of the rapid educational upgrading of the the British population has been focussed on people with richer parents.” Similar points are made by Blanden and Machin (2004). Blanden and Gregg (2004) draw on evidence from the National Child Development Survey, British Cohort Survey and British Household Panel Survey to show the many dimensions in which income is associated with educational attainment. In particular, higher income affects the probability of good quality GCSEs (grade A-C) and of attaining a degree. Probability of degree attainment goes from 0.18 at the tenth percentile of the parental income distribution to 0.27 at the ninetieth. Machin and Vignoles (2004) show also that social class affects degree acquisition with 46 per cent of the top 20 per cent by income in the British Household Panel Survey attaining a degree as against only 9 per cent in the lowest 20 per cent and 23 per cent in the rest. Galindo-Rueda and Vignoles (2005) show that cognitive ability has been becoming increasingly unimportant in explaining educational success and suggest that educational reforms have created the biggest gains to low ability high income children.

Reasons why the value of spending differs across the income distribution include, on the one hand, differences in participation rates and, on the other, differences in the quality of service provided or in the returns from that service. Differences in rate of participation exist at both primary, secondary and higher levels. At primary and secondary levels, education is, of course, compulsory but individuals can opt to withdraw from the public sector and educate children privately. Glennerster (2001) reports figures for 1999/2000 showing this option to be taken for 5.0 per cent of primary school age pupils, 6.7 of students between 12 and 15 years of age and 16.5 per cent of sixth formers. Figure 15 shows the proportion of households with children in the Expenditure and Food Survey from 2002 to 2007 reporting private spending on education<sup>26</sup>. This is not the same as the proportion sending a child to a private school, since it can include other expenditure such as private out-of-hours tuition, for example, but the clear income gradient is instructive. In Figure 16, the

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<sup>26</sup>The construction of this and Figure 16 is similar to Figures 13 and 14 (excepting the restriction to households with children).

corresponding levels of expenditure are shown.

In addition to this income gradient there is also evidence that there is a positive association between the income inequality in a region and the propensity to send one's child to a private school (Ryan and Sibieta 2010). Those authors also emphasise the degree of intergenerational transmission, with children being at least three times more likely to attend a private school if one of their parents attended one. This effect remains after conditioning on a variety of other observed characteristics.

Beyond age 16, education is voluntary and beyond age 18 it is public but rationed. Blanden and Gregg (2004) demonstrate that income affects the likelihood of staying on at age 16. Subsequent admission to institutions of higher education depends upon achievement of adequate results at lower stages. Participation in higher education has increased in recent years across all classes but there is a longstanding gap in participation rates by social class (Machin and Vignoles 2004). Galindo-Rueda, Marcenaro-Gutierrez and Vignoles (2004) report that in 2001 50 per cent of under 21s in social classes A to C1 participated in higher education as against only 19 per cent of classes C2-E. The difference between those from professional households (79 per cent) and those from unskilled households (14 per cent) is even more stark. Furthermore students from poorer neighbourhoods are less likely to attend university, the gap has been increasing rather than falling and this trend began before changes to student funding arrangements. The fact that the gap diminishes to the point of statistical insignificance once conditioning on earlier educational achievement suggest that the source of these differences has its origin well before entry into higher education. Chowdry, Crawford, Dearden, Goodman and Vignoles (2008) draw on detailed administrative data to strengthen the evidence for this point. They show not only that those from more deprived backgrounds are less likely to attend university but also that there are large socio-economic gaps in quality of the institutions attended. Nonetheless, given prior attainment, the substantial association between material deprivation and likelihood of university attendance largely disappears. This suggests a need to focus attention on reasons for differences in attainment at lower levels of the education system.

Differences in participation are picked up in assessments of the distributional effect based on use. Differences in the value of education are not. The reasons why returns to education may differ across income classes are several. Some of these may

have to do with differences in quality of institutions attended while some may hold even for the same level of educational resources provided. Parental education and parenting styles may be different, with less educated or less able parents less able to assist in the child's education. Resources available at home and conduciveness of the environment to study may differ, for instance because of availability of books, possibility of finding quiet space for study and so on. At school itself the influence of peers may differ. Individuals of different social classes may differ also in innate inherited abilities.

Glennister (2001) shows substantial differences in fractions of children reaching key stage targets according to socioeconomic characteristics of pupils at the school. In particular, take up of free school meals is highly correlated with performance. In 2000, in the median school with less than 5 per cent of pupils claiming free school meals, 83 per cent of pupils reached expected levels in English and Maths at Key Stage 3 (ages 11-14) and 79 per cent in science; by contrast in the median school with over 40 per cent claiming free school meals, no child achieved the expected level in English, 14 per cent did so in maths and 14 per cent in science. Burgess and Briggs (2009) show that children of poorer families are significantly less likely to get into better-achieving schools. Most of this follows from the locational disadvantage of living near to poorer schools, but even after taking account of this there is still a higher likelihood for the poorer of two families living next door to each other to send their children to a poorer performing school; the authors point to "the roles of choice by schools and middle class strategising."

Gibbons and Machin (2003, 2008) show that primary school performance is significantly associated with house prices in the locality in a way that suggests appreciable valuation of school achievements. Specifically, their best estimates suggest that a 10 per cent increase in the number of pupils at a school achieving expected Key Stage 2 (ages 7-11) levels would increase the price of houses within its catchment area by as much as 7 per cent, which translates into capitalised values comparable to private school fees. Rosenthal (2003) provides evidence of a link between secondary school performance and local house prices. Cheshire and Sheppard (2004) show an association between state school quality at both primary and secondary level and house prices in Reading while Leech and Campos (2003) argue for a link between secondary school quality and house prices in Coventry.

Chowdry, Muriel and Sibieta (2008) discuss the complex multi-layered funding arrangements for schools. Disbursement of funds from central government to lower levels follows formulae which mean that social disadvantage does attract more funds - a child eligible for free school meals attracts over 70 per cent more than one who does not - and funds allocated to the total budget for schools is “ring-fenced” but local authorities are not obliged to distribute the funds across schools within their area according to the same principles and there is a degree of “flattening” (with only 40-50 per cent of the funds allocated because of higher propensity to claim free school meals actually being directed to the schools with the more deprived children). The extent to which differing levels of resources translate into pupil performance is not straightforward. Dearden, Ferri and Meghir (2002) show that pupil-teacher ratios, for example, appear to have little effect on attainment (or later on wages) except for the very poor. On the other hand, selectivity and private schooling do seem to matter. Smith and Naylor (2001, 2005) show that independent school pupils tend to perform less well at university, other things equal, suggesting that private education possibly enhances university admission prospects conditional on ability while Naylor, Smith and McKnight (2002) demonstrate that the privately schooled nonetheless enjoy an earnings premium given their degree result.

### **3.5 Public order and safety**

Spending on public order and safety made up 5.5 per cent of total managed expenditure in 2008/9 (Crawford, Emmerson and Tetlow 2009) comprising spending on the police and prosecution services, the judicial system and the prison and probation services. For an international perspective on public expenditure in this area and a discussion of rationales for public intervention see Witt and Witte (2003).

The benefits from such spending plainly include public benefits from the deterrence of crime and the incarceration and rehabilitation of criminals and extend beyond the simple prevention of losses from specific acts of crime to the general benefit of being able to live, work and trade in an environment where it is possible to be confident of fair treatment and freedom from extortion or violence. There are also however private insurance benefits associated with police action to deter, prevent and rectify specific crimes and these benefits are not spread evenly across

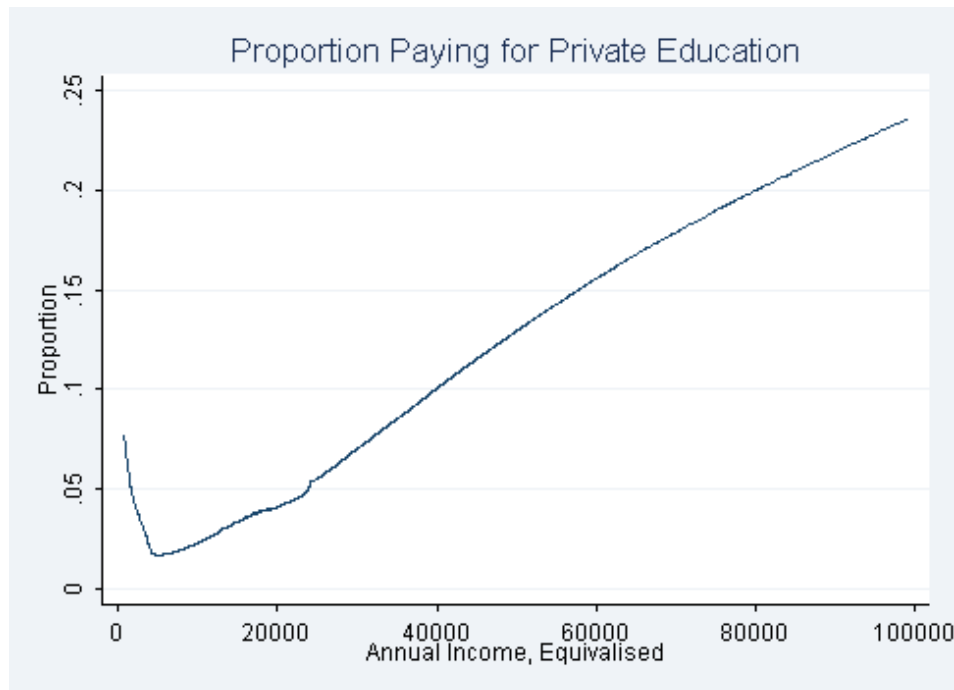


Figure 15: Purchase of education

the population. In particular, there are well established socioeconomic gradients in victimisation rates for personal and property crime. Crimes against the person and against property are both strongly geographically concentrated and tend to vary together (Trickett, Osborn, Seymour and Pease 1992) with multiple victimisation common (Hope, Bevan, Trickett and Osborn 2001). The general conclusion with regards to property crime is that it affects richer people in poorer areas. Conditioning on area of residence, property crime, and especially burglary, affects those in higher socioeconomic groups and is associated with home and car ownership by the victim (see Hope, Bevan, Trickett and Osborn 2001, Tseloni, Osborn, Trickett and Pease 2002, Tseloni 2006, for example). Criminality itself is more associated with the less affluent. Machin and Meghir (2004) show that falls in wages at the lower end of the distribution are geographically associated with rising crime rates. Taken together, the evidence is consistent with property crime being driven by poor economic opportunities and directed towards well off individuals in areas from which criminality originates, relative affluence making the property of such victims accessible and attractive to criminals. Tseloni, Wittebrood, Farrell and Pease (2004)



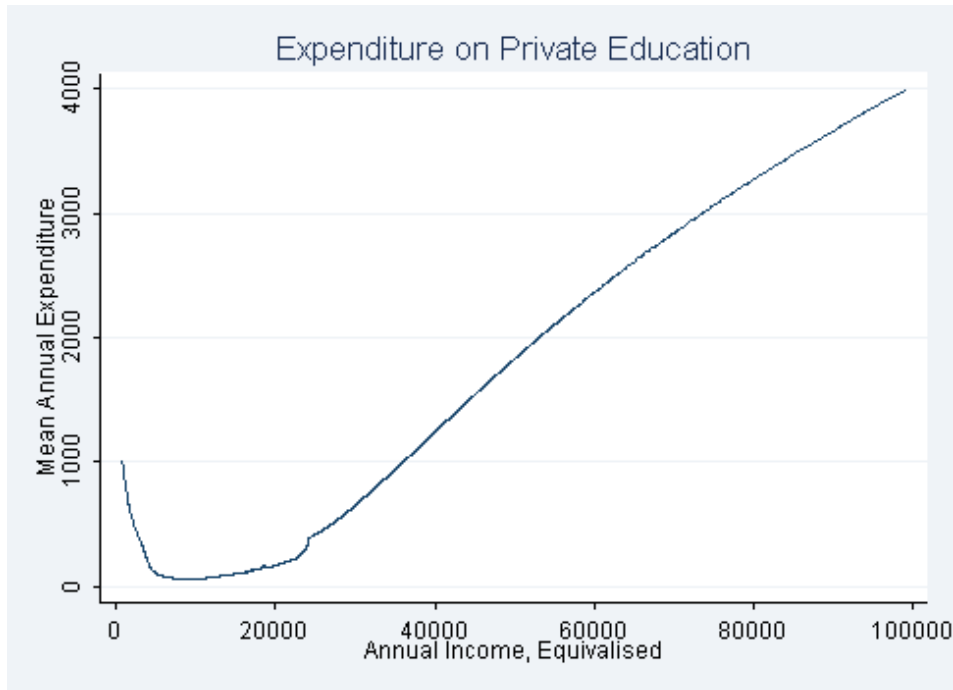


Figure 16: Expenditure on education

consider evidence from a number of countries and suggest that “potential burglars pick up their targets in the course of their everyday activities rather than outside their own environment” so that there may be a contrast between more frequent, more opportunistic acts of burglary in less affluent areas and less frequent, more planned acts of burglary in more affluent areas.

How these two effects balance out in determining whether or not, all things considered, the effects of crime are concentrated higher or lower in the distribution is shown in Table 1, drawn from the British Crime Survey (Hoare and Povey 2008, Taylor and Patterson 2008). The lower panel shows how crime rates vary across geographic areas of different type, classified according to the geodemographic ACORN system. The contrast between “hard pressed” and “wealthy” areas is apparent though urbanisation appears also to increase risk. The upper panel shows victimisation rates against ranges of household income. Vandalism and vehicle related theft are clearly concentrated on better off households; the picture for burglary and violent crime (which includes robbery) is less clear, with greatest risk at the lowest end but also some evidence that victimisation rates rise at the very top end.

How one interprets this depends upon the extent to which low rates of crime are viewed as indicative of high success of the police and judicial system in deterring and preventing crime or of a low need for police and judicial intervention in solving and dealing with the consequences of crime. The costliness of these different crimes to the victim and therefore the value to the victim of police and judicial assistance in addressing the crimes are also not the same. The types of crime differ in their intrinsic seriousness but also within a type of crime the severity of the effects may differ across income classes. In particular, the economic value of the losses incurred through property crime may vary across income groups so that even if moderately richer households suffer burglary, say, less frequently, the amounts stolen may be higher. Furthermore, it is possible also that the success of police and judicial assistance in clearing up crime and recompensing victims may also vary both across types of crime and the income class of the victim - this is something upon which it would be useful to have more evidence.

Table 1: **Victimization rates 2007/8**

	All violent crime	Burglary	Vehicle related theft	Vandalism
<i>Income</i>				
Under £10,000	3.8	3.4	5.6	5.1
£10,000-20,000	2.6	2.4	5.7	6.8
£20,000-30,000	3.3	2.2	6.5	8.4
£30,000-40,000	2.9	1.8	7.7	8.8
£40,000-50,000	3.2	1.9	7.4	9.2
Over £50,000	2.9	2.6	7.6	9.2
<i>ACORN</i>				
Hard pressed	4.6	3.3	8.1	8.5
Moderate means	3.7	2.7	9.3	10.1
Comfortably off	2.7	1.9	5.6	6.8
Urban prosperous	4.7	3.6	9.7	7.1
Wealthy achiever	1.9	1.5	4.1	5.2

Source: Hoare and Povey 2008, Taylor and Patterson 2008

The numbers in Table 1 refer to actual recorded crime rates. The fear of crime, the anxieties it leads to and its impact on individual lifestyle and wellbeing need not match up to the reality of actual rates of victimisation. Ditton and Farrall

(2007) discuss the difficulties in analysing data on perceptions of crime. Table 2, based again on the British Crime Survey and taken from Moley (2008), suggests that there are also pronounced socioeconomic effects in comparison of perceptions of crime when comparing across different types of area.

**Table 2: Perceptions of crime 2007/8**

	High perception of anti social behaviour	Burglary	High worry about Car crime	Violence	High impact on quality of life from fear of crime
<i>ACORN</i>					
Hard pressed	30	18	20	21	42
Moderate means	25	14	15	19	39
Comfortably off	12	10	11	14	35
Urban prosperous	19	11	13	15	40
Wealthy achiever	6	8	8	10	29

Source: Moley 2008

Given these geographic patterns, spatial patterns in house prices should be indicative to some extent of the economic value of crime reduction. Gibbons (2004) addresses the issue and shows that property prices are responsive to crime rates, though more to criminal damage than to burglary and to an extent too strong to be realistically compatible with the direct costs of victimisation, suggesting that there are high costs associated with general fear of crime. Private sector alternatives do exist in the area - for example, gated communities policed by private security firms at the more affluent end of the housing market - but these are rare.

### 3.6 Transport

Public spending on transport accounts for 3.5 per cent of total managed expenditure and the benefits from this expenditure include public infrastructure benefits associated with maintenance of the roads network, and private benefits from subsidies to particular modes of transport.

The distribution of benefits depends on the propensities of different income groups to use different modes of transport. Table 3 shows average miles travelled

per week (by all individuals in a household) by different modes as calculated from the National Travel Survey from 2002 to 2006. Richer households tend to travel further by all modes except bus and foot or bike. Ownership of cars is known, unsurprisingly, to be strongly linked to income (Crawford and Blow 1997) and there is strong evidence here of an income gradient in rail use. Within public transport, there are known to be differences across bus, tube and rail with subsidies to bus transport benefitting low income households whereas subsidies to rail benefitting the rich (Fearnley 2006).

The results of Gibbons and Machin (2005, 2008) on capitalisation of access to public transport infrastructure in terms of house price rewards to proximity to train stations within London suggests a decline of between one and four per cent for each additional kilometre of distance from home to station. While fairly specific to its context, this shows that the valuation of transport access can be substantial.

Table 3: **Transport**

	Miles travelled in week of interview					
	Car	Air	Bus	Tube	Rail	Foot/Bike
<i>Income Quintile</i>						
Lowest	110.04	0.84	16.20	0.95	8.57	8.44
Second	158.75	0.56	13.99	0.82	8.40	7.93
Third	240.83	1.50	12.42	1.32	13.46	8.70
Fourth	302.26	2.25	10.40	2.47	19.20	7.97
Highest	342.50	9.75	6.78	4.85	39.45	6.91

Source: National Travel Survey

### 3.7 Culture and broadcasting

Spending on culture and broadcasting takes the form of subsidies to artistic events and to museums and financing of the non-commercial parts of the British Broadcasting Corporation. Throsby (1994) in his survey of the economics of culture points out that “the benefits of subsidies to encourage artistic activity will almost certainly have a regressive incidence on consumers” given the type of arts subsidised and the patterns of consumption in the population. Peacock (2003) supports this: “If the

data on utilisation by social class can still be accepted as a guide, then the least popular art forms, opera and ballet, not only receive much larger subsidies than others but are patronised largely by the AB social classes.” Table 4, calculated from data on older households in the 2002/3 English Longitudinal Study of Aging, shows that the type of households who use museums least have lower incomes.

Table 4: **Frequency of museum visit**

How often do you visit a museum or art gallery?	Mean income	Median income
Twice a month or more	478	335
About once a month	481	389
Every few months	498	396
About once or twice a year	425	328
Less than once a year	389	322
Never	270	209

Source: English Longitudinal Study of Ageing, 2002

Funding of the BBC is through a hypothecated licence fee charged at a flat rate to anyone receiving live television transmission and covers national and local television and radio broadcasts<sup>27</sup>. Although the fee is flat, preparedness to pay for BBC broadcasts may not be. Alternative services are available, some of which are provided free and financed by advertising and others of which are paid for by subscription over satellite or cable networks. The information in Tables 5 and 6, calculated from the Expenditure and Food Survey of 2007 and provided by the Office of Communications, shows how purchase of satellite and cable services varies across income groups and social classes. In each case it is evident that demand for private supplements is highest in the better off half of the distribution.

### 3.8 Housing

Expenditure on housing takes the form of subsidies to social housing. Hills (2007) surveys the rationale for such spending and points out that the proportion of the stock of housing in the socially rented sector fell from about 31 per cent of the stock

<sup>27</sup>Other activities, such as the BBC World Service, are funded by alternative sources, such as the Foreign and Commonwealth Office in this instance.

Table 5: **Use of broadcasting services by income group**

Income Quintile	Pay for Satellite or Cable
Lowest	26
Second	35
Third	41
Fourth	46
Highest	45

Source: Expenditure and Food Survey

Table 6: **Use of broadcasting services by social class**

Social Class	Analogue	Dig. Terrestrial only	Dig. Satellite	Dig. Cable	Total
DE	16	42	31	11	100
C2	8	40	39	12	100
C1	10	40	36	14	100
AB	9	36	42	13	100

Source: Office of Communications (2009),  
Private communication with Office of Communications.

in England in 1979 to 18.5 per cent in 2004. 70 per cent of social tenants have incomes within the poorest two-fifths of the population. Sefton (2002) attempts to quantify the value of the subsidy by comparing social rents to private sector rents on similar properties. The average value of the subsidy across all individuals was £280 per year, falling from £420 for those in the bottom income quintile to £70 for those in the top income quintile. He points out also that sale of social housing under the Right-to-Buy scheme provides an ongoing flow of subsidies which can also be quantified and which appears to be largest in the third and fourth income quintiles.

### 3.9 Defence and Environment

The benefits of defence and environmental spending are more or less exclusively public and though they could in principle be investigated through, say, surveys of willingness to pay, we make no claims here about the distribution of benefits.

## 4 Conclusion

In investigating the distributional effect of public spending, we believe that the objective should be to uncover the impact on consumer wellbeing of public financing and provision of the services involved. The costs of such provision are reflected in the revenue that needs to be raised to finance provision and therefore in the tax payments and associated costs imposed on individuals as taxpayers. The benefits, however, are not appropriately measured by looking again at the cost of what is provided but by attempting an assessment of the valuation placed on the services by recipients. This is an exercise which may make more conceptual sense for some publicly provided goods than for others, depending upon the extent to which the alternative of private provision is a realistically conceivable consideration. Where it does make sense, the impact across the distribution is driven both by variation in the quantities provided and also by variation in willingness to pay. If, as we prefer to suggest, benefits are valued by equivalent cash transfers then we can expect variation in benefits within the population, even where quantities provided are equal, with valuation peaking where recipients are happiest with the level provided. The poorest households are likely to value the benefits less because of their lower ability to pay - other things equal this makes provision less redistributive than one would think by looking simply at use; richer households, on the other hand, are likely to value the benefits less because they are prepared to pay for provision of higher quality - this accentuates the redistributive effect. The latter effect may indeed be strong enough for some services to induce opting out of the benefits altogether.

For most components of public spending, the primary evidence on the distributional effect comes from surveys of use. Ideally this would be combined with information on valuation but this is difficult to come by; nonetheless, mobility in search of better services, use of private alternatives, opinion surveys and so on all contain indicative suggestion of variation within the population in the way that publicly provided goods are valued.

All things considered, there seems little reason to doubt the overall redistributive influence of the public sector. On the revenue raising side, the impact of taxation seems to be not far from proportional. On the other side of the account, however, cash transfers are strongly redistributive. Whatever can be said about differences in

quality of treatment across income groups, there is nothing that can gainsay the fact that the largest item of public spending in kind, health, also benefits most strongly lower income groups in which ill health is most strongly concentrated. The picture with education is less clear since lower income groups appear to benefit less from those parts of the education system with universal coverage and to make least use of those sections which are not. Spending on public order and safety may be directed at crimes which are incident largely on poorer areas but the greater losses of the rich to the crimes which they do suffer makes any conclusive statement on distributional impact difficult. Those parts of public spending which are most clearly regressive, such as cultural spending and certain transport subsidies, tend to be a relatively small part of the budget.



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## A Technical Appendix

There are  $N$  households with budgets determined by incomes  $Y_i$ ,  $i = 1, \dots, N$ . Suppose these households consume two goods  $q$  and  $Q$  at prices 1 and  $P_i$ . Characteristics affecting household welfare are denoted  $\theta_i$ . Preferences are captured in direct utility functions  $u(q, Q, \theta)$  with corresponding indirect utility functions

$$v(Y, P, \theta) = \max_Q u(Y - PQ, Q, \theta)$$

and expenditure functions

$$e(v, P, \theta) = \min_{q, Q} \{q + PQ \mid u(q, Q, \theta) \geq v\}.$$

Let uncompensated demand functions be  $f(Y, P, \theta)$  and compensated demand functions be  $g(v, P, \theta)$ .

Let households be ordered by utility so that

$$[v(Y_i, P_i, \theta_i) - v(Y_j, P_j, \theta_j)] (i - j) \geq 0.$$

Let  $\mathcal{Y}$ ,  $\mathcal{P}$  and  $\Theta$  denote the vector of household incomes, vector of household-specific prices and matrix of characteristics:  $\mathcal{Y} = (Y_1, \dots, Y_N)'$ ,  $\mathcal{P} = (P_1, \dots, P_N)'$ ,  $\Theta = (\theta_1, \dots, \theta_N)'$ .

### A.1 Cash transfers

Consider the case first where both goods are privately provided. Suppose that all households have the same characteristics  $\theta$  and face the same price  $P$ .

Assume that social welfare  $\Omega$  is calculated as a function of individual utilities

$$\Omega = W(\mathcal{Y}, P, \theta) = \phi(\{v(Y_i, P, \theta), i = 1, \dots, N\})$$

for some increasing  $\phi$ . Conditions under which welfare comparisons of income vectors  $\mathcal{Y}$  will be independent of  $P$  are discussed, for example, by Roberts (1980) and may be stringent. The same is true of characteristics  $\theta$ .

Let  $\mathcal{W}$  be the class of  $W$  that are Schur convex in  $\mathcal{Y}$  (which is to say, approving

of cash transfers from richer to poorer individuals)

$$\left( \frac{\partial W}{\partial Y_i} - \frac{\partial W}{\partial Y_j} \right) (Y_i - Y_j) \leq 0.$$

The government implements a vector of lump sum taxes  $\mathcal{T} = (T_1, \dots, T_N)'$  and benefits  $\mathcal{B} = (B_1, \dots, B_N)'$  so that final incomes are  $\mathcal{Y} - \mathcal{T} + \mathcal{B}$ . Then social welfare is higher after imposition of taxes and benefits,  $W(\mathcal{Y} - \mathcal{T} + \mathcal{B}, P) \geq W(\mathcal{Y}, P)$ , for all  $W \in \mathcal{W}$  if and only if

$$\sum_{i=1}^M (T_i - B_i) \leq 0, \quad M = 1, \dots, N.$$

This follows from the results of Shorrocks (1980) on the links between unambiguous welfare rankings and generalised Lorenz dominance.

If households differ in prices or characteristics then we can define equivalent incomes  $\mathcal{Y}^* = (Y_1^*, \dots, Y_N^*)'$  for some common reference price  $P^*$  and reference characteristics  $\theta^*$  by

$$v(Y_i^*, P^*, \theta^*) = v(Y_i, P_i, \theta_i)$$

or equivalently

$$Y_i^* = e(v(Y_i, P_i, \theta_i), P^*, \theta^*)$$

This is the income that would give the same utility in the reference situation as actual income does at actual prices and incomes. Use of equivalent incomes to assess distributional questions is what would sometimes be referred to as the use of equalised money metric utility (see Donaldson 1992, Blackorby and Donaldson 1988, 1994). Equivalent net transfers, adjusted onto a comparable common basis in terms of prices and characteristics, could be defined by

$$E_i^* = e(v(Y_i - T_i + B_i, P_i, \theta_i), P^*, \theta^*) - e(v(Y_i, P_i, \theta_i), P^*, \theta^*).$$

Social welfare is

$$\begin{aligned} \Omega = W(\mathcal{Y}^*, P^*, \theta^*) &= \phi(\{v(Y_i^*, P^*, \theta^*), i = 1, \dots, N\}) \\ &= \phi(\{v(Y_i, P_i, \theta_i), i = 1, \dots, N\}). \end{aligned}$$

If  $W \in \mathcal{W}$  then assessment of social welfare effect of cash transfers can proceed

using the equivalent net transfers  $E_i^*$ . The value of these equivalent transfers is not, however, independent of the choice of reference price and characteristics,  $P^*$  and  $\theta^*$ , and neither typically are welfare prescriptions based on them (see Blackorby, Laisney and Schmachtenberg 1994, Shorrocks 2004) except in limited circumstances. Homotheticity,  $v(Y_i, P_i, \theta_i) = Y_i/a(P_i, \theta_i)$ , simplifies matters considerably but may be regarded as unduly restrictive.

## A.2 Publicly provided private goods

Now suppose the first good  $q$  is privately purchased but the second good  $Q$  is publicly provided in quantities  $\mathcal{Q} = (Q_1, \dots, Q_N)'$ . Public provision is funded by taxes/fees  $\mathcal{T}$  leaving disposable incomes of  $y = \mathcal{Y} - \mathcal{T}$ .

### A.2.1 Compulsory public consumption

Assume again that households have similar characteristics and face the same prices. Suppose, firstly, that individuals are compelled to accept public provision without the option of topping up or opting out. We can value the benefit from public provision at the value of the hypothetical income transfers  $V_i$ ,  $i = 1, \dots, N$ , putting them at the same utility as if left to purchase the publicly provided good privately, as defined by

$$v(y_i + V_i, P, \theta) = u(y_i, Q_i, \theta)$$

or equivalently

$$V_i = e(u(y_i, Q_i, \theta), P, \theta) - y_i.$$

Clearly  $V_i$  is increasing in  $Q_i$  so that, other things equal, those receiving higher provision have a higher valuation of the benefit. Variation with income follows from

$$\frac{\partial V_i}{\partial y_i} = u_q(y_i, Q_i, \theta) e_u(u(y_i, Q_i, \theta), P, \theta) = \frac{u_q(y_i, Q_i, \theta)}{u_q(g(v_i, P, \theta))} - 1$$

so that  $\partial V_i / \partial y_i = 0$  only if  $(y_i, Q_i) = g(v_i, P)$  at which point  $V_i = PQ_i$ . That this is a maximum follows from the fact that

$$PQ \geq \min_{q', Q'} \{ q' + PQ' \mid u(q', Q', \theta) \geq u(q, Q, \theta) \} - q.$$

The virtual price of the publicly provided good is  $\pi_i = u_Q(y_i, Q_i, \theta) / u_q(y_i, Q_i, \theta)$  and the value of provision at the virtual price is  $A_i = \pi_i Q_i$ , a measure suggested by



Aaron and McGuire (1970). The Aaron-McGuire measure is also a money metric measure of the benefit but evaluated at different prices for different individuals. The difference between the two measures follows from:

$$B_i = [A_i + y_i] \Phi(y_i, Q_i, P, \theta) - y_i$$

where

$$\Phi(y_i, Q_i, P, \theta) = e(u(y_i, Q_i, \theta), P, \theta) / e(u(y_i, Q_i, \theta), \pi(y_i, Q_i, \theta))$$

is a price index adjusting consumers to a common price basis.

### A.2.2 Opting out

Now suppose the individual is able to opt out but only by continuing to pay into funding of public provision and relinquishing all associated benefits. Let  $y_0$  be the income at which that becomes the optimal decision for the consumer. The benefit is now defined by  $V_i = \max[u(y_i, Q_i, \theta), v(y_i, P, \theta)]$ .  $V_i$  is exactly as in the compulsory provision case for  $y_i \leq y_0$  and equal to 0 for  $y_i > y_0$ .

### A.2.3 Topping up

Finally, suppose the individual is allowed to supplement public provision without opting out. The benefit is now defined by  $v(y_i + V_i, P, \theta) = \max[u(y_i, Q_i, \theta), v(y_i + PQ_i, P, \theta)]$ . For  $y_i \leq y^*$  the individual will choose to accept the level of public spending and  $V_i$  will be as in the compulsory provision case. However for  $y > y^*$  the desired level exceeds the level of public provision and the individual will choose to top up. Across this range the value of public provision is constant and exactly equal to the expenditure saved by the individual through public provision,  $PQ_i$ .

### A.2.4 Social welfare

If  $\mathcal{V} = \{V_i, i = 1, \dots, N\}$  then social welfare is

$$\Omega = W(\mathcal{Y} - \mathcal{T} + \mathcal{V}, P, \theta) = \phi(\{v(Y_i - T_i + V_i, i = 1, \dots, N\})$$

and social welfare is higher after imposition of taxes and supply of publicly provided private goods,  $W(\mathcal{Y} - \mathcal{T} + \mathcal{V}, P, \theta) \geq W(\mathcal{Y}, P, \theta)$ , for all  $W \in \mathcal{W}$  if and only if

$$\sum_{i=1}^N (T_i - V_i) \leq 0, \quad i = 1, \dots, N.$$

### A.2.5 Heterogeneity and price change

It may be that prices which households would face in the absence of public provision differ from the publicly provided price either because of heterogeneity in the prices faced or because the public sector provides the good more cheaply or more expensively than the private sector. Suppose prices faced by households in the absence of public provision are  $\bar{P}_i$  and allow also for heterogeneity in household characteristics  $\theta_i$ . Then a measure of value adjusted to a common basis in terms of prices and characteristics and allowing for any change in prices brought about by public provision could be constructed as

$$V_i^* = e(u(y_i, Q_i, \theta_i), P^*, \theta^*) - e(v(y_i, \bar{P}_i, \theta_i), P^*, \theta^*).$$

### A.3 Public goods

Now suppose the publicly provided good is consumed in common so that  $Q_i = Q$ , some common value for  $i = 1, \dots, N$ . If the total cost of public provision is  $P$  then the cost per head is  $P/N$ . Again public provision is funded by taxes/fees  $\mathcal{T}$  leaving disposable incomes of  $y = \mathcal{Y} - \mathcal{T}$ .

The issue of price change is now unignorable. Public provision facilitates cost sharing in a way that overcomes a collective action problem that would otherwise lead to radically lower levels of provision and possibly none at all. Suppose specifically that if not collectively provided then there would be no provision of the public good,  $Q = 0$ . Then household welfare in the absence of government provision would be  $u(y_i, 0, \theta)$  and the value of the public provision can be calculated as

$$V_i^* = e(u(y_i, Q_i, \theta_i), P/N, \theta^*) - e(u(y_i, 0, \theta_i), P/N, \theta^*).$$