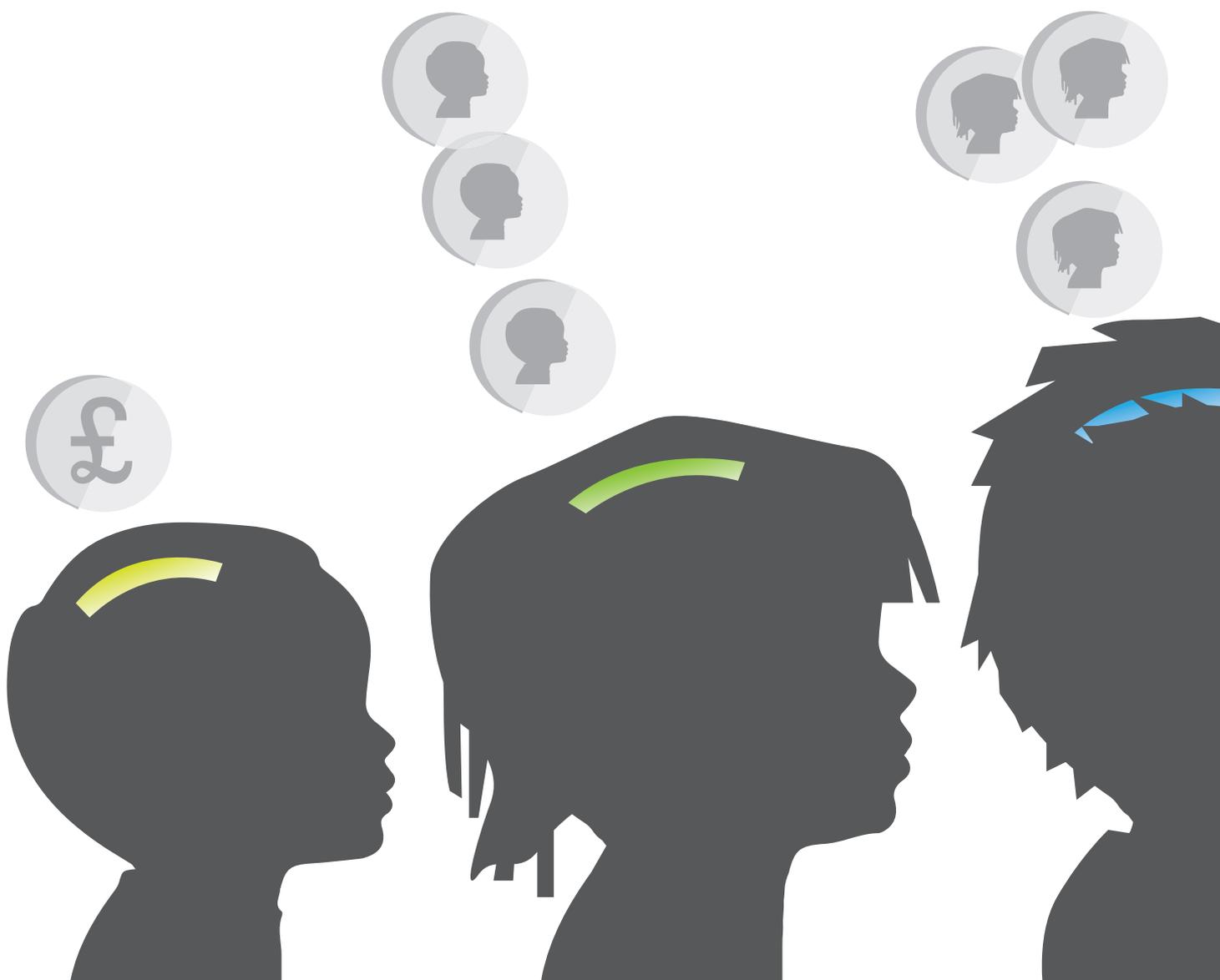


Would increasing the share of Britain's national income devoted to education make much of a difference? And what is the ideal balance of spending between early years, primary and secondary education? **Steve Gibbons** and **Sandra McNally** review the research evidence on the causal effects of school resources on pupil outcomes.

Does school spending matter?



Britain is well above the average among OECD countries in terms of the share of national income spent on primary and secondary education: roughly 4.5% of GDP compared with the OECD average of 4% and the European Union average of 3.8% (OECD, 2012). Yet at the same time, Britain's performance in the OECD's Programme for International Student Assessment (PISA) is close to the OECD average. So an important question, especially in times of austerity, is whether additional spending is worthwhile.

It is also worth asking whether the allocation of resources across the different phases of education is optimal – and whether redistribution across phases would generate benefits. Britain currently spends 10% more per pupil on secondary relative to primary education (the OECD

average is 20% more on secondary education). At the same time, Britain spends 25% less per pupil on nursery education compared with primary education (the OECD average is 11% less on nursery).

Interpretation of the evidence on the impact of school resources is the subject of long-running debate. One widespread view (influenced by Eric Hanushek's 2003 review) is that the available evidence, on balance, shows no benefits from additional spending in schools, at least at the margin available to policy-makers in developed economies. The alternative view (Alan Krueger's 2003 paper, for example) is that much of the traditional statistical evidence is of poor quality, and that reliable estimates require careful experimental or experiment-like research designs.

Our review suggests that research has moved on some way in the past decade, with a far greater number of high-quality research designs, a better understanding of the challenges of causal estimation, and better data. Ten years on, the weight of evidence is somewhat more in line with Krueger's view that 'reanalysis of the literature suggests a positive effect of smaller class sizes on pupil achievement, although the effect is subtle and easily obscured'.

To get a sense of the size of the effects, imagine ranking pupils on a 1-100 scale in terms of achievement (100 being the best). From the better quality studies we have reviewed, the smallest detectable effects on achievement are equivalent to a 0.5-1.5 point increase on this scale from a 30% increase in average expenditure.

This expenditure change is roughly equivalent to a class size reduction of 23%. The largest impacts are an improvement of between seven and nine points from a similar-sized resource increase.

In comparison, our own work on English primary schools (Gibbons et al, 2011) finds effects at the upper end of the range. The results here imply that a 30% increase in average expenditure per pupil improved test scores by about eight points on our 1-100 scale. This expenditure increase could fund average class size reductions of six or seven pupils.

The benchmark estimates from the one large-scale experimental study – the Project STAR (Student-Teacher Achievement Ratio) experiment in Tennessee in the 1980s – are somewhere in the middle of this range. Among the most frequently cited of studies, this was a large-scale randomised trial of lower class sizes for pupils during their first four years in school. A class size reduction from 24 to 16 was associated with an improvement of between four and six points on our 1-100 scale, which suggests that a 30% increase in expenditure per pupil would lead to an increase of three to four points.

Whether these impacts are small or large is debatable. The scale of the effects appears small when judged against the overall variation in pupil achievement. But countless studies

Increases in resources are typically more effective in disadvantaged schools and for disadvantaged pupils



Early years investment may offer higher returns – but the returns erode unless topped up during later phases of childhood

demonstrate that most variation in pupil test scores is due to family background, parental inputs, natural pupil abilities and purely random variation, none of which are easily manipulated by educational policy. Only a very small share of the differences in children's achievements can be attributed to differences between schools or differences between teachers.

To get a better sense of whether it is worthwhile spending these extra resources, we need some cost-benefit analyses. Take an improvement of six points on our 1-100 scale. Making some simple calculations based on previous evidence suggests that any investment that raises children's achievement by this amount at a cost of less than £6,200 per child (across all years of education to age 10) is worthwhile in terms of future labour market earnings alone. This comes from results in Machin and McNally (2008), which imply that a six-point change in average test scores at age 10 would raise earnings by about 2.4%.

The upper-end estimates of resource impacts imply that policy to increase school resources comfortably passes this cost-benefit test. But the lowest estimates suggest that the labour market benefits of additional resources would fall well short of the costs. More work is needed to narrow this down, for

example, by a statistical 'meta-analysis' of recent studies, and new large-scale randomised control trials.

Of course, higher test scores and higher labour market earnings are not the only goals of education policy. One limitation of existing research is that it is primarily about cognitive skills as measured by in-school test scores. A few studies have looked at longer-run outcomes, such as staying on rates and earnings, but this research is data-intensive, requiring linked data on pupils' schooling, post-school education and labour market outcomes.

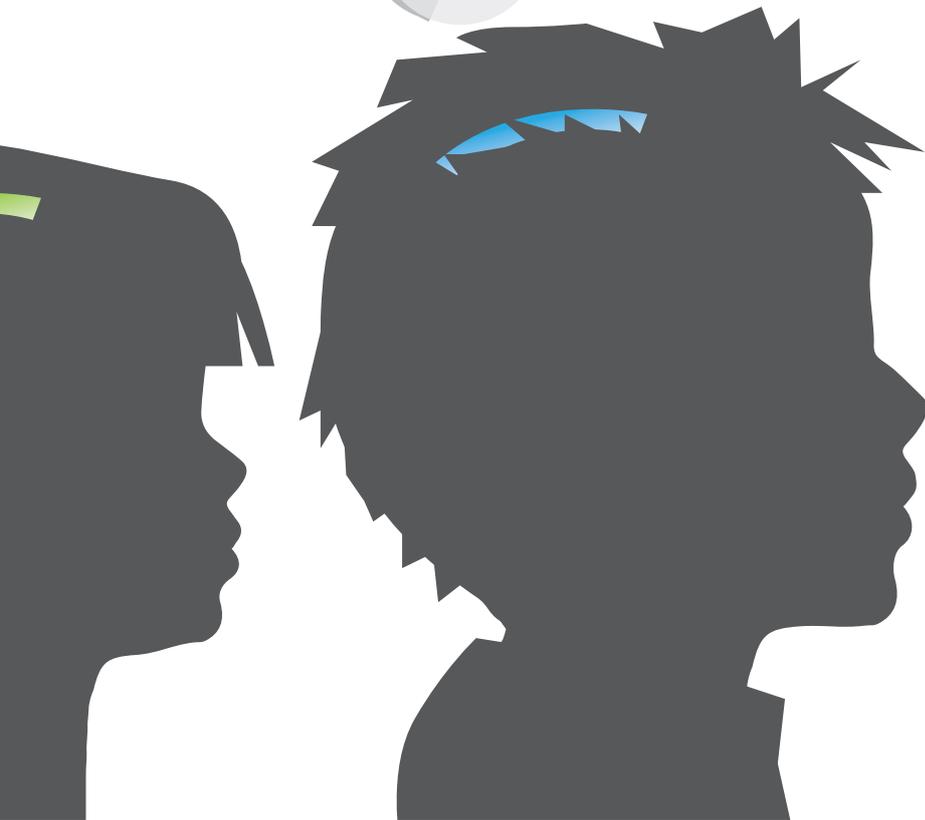
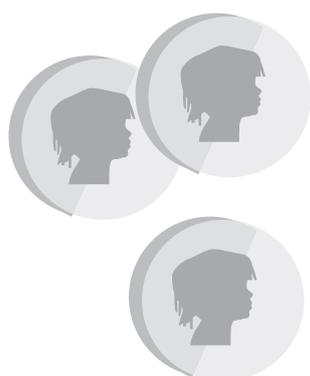
There are also many other non-cognitive and social outcomes that are hard to measure but which should form important areas of future investigation. The recent long-term study of Project STAR is important in this respect (Chetty et al, 2011).

There are some general patterns that have emerged from our review. A first notable point is that increases in resourcing are usually more effective for disadvantaged schools and/or pupils. If this indicates that disadvantaged pupils are genuinely more responsive to resource-based interventions, then targeting resources at these pupils will lead to higher average achievement, as well as more equitable outcomes.

A second common pattern is that research designs that analyse different sources of variation in resources and class sizes tend to come to different conclusions. Some studies derive their estimates from marginal changes from year to year in class sizes and resources within schools, arising from natural population variation. These studies generally struggle to find large or significant resource effects.

In contrast, studies that look at large cross-sectional resource differences between classes or schools – for example, those generated by maximum class size rules, budget allocation formula or the Project STAR experiment – typically find much bigger effects.

One potential reason for this discrepancy is that pupils and teachers might respond differently to small and large changes. For example, schools, teachers, pupils and parents involved in the educational process adapt more easily to marginal changes in resources from year to year, and accommodate these



changes by adjusting effort and engagement in the educational process. Compensatory behaviour of this kind will tend to 'crowd out' and mask the effects of resource changes.

If this behaviour is more feasible for incremental changes in resources than for large changes, then estimates based on marginal year-to-year changes in resources tell us little about the impacts of more substantial policy changes. Teachers may be able to accommodate changes of one or two pupils in a class easily without any impact on achievement, but they would respond very differently to a halving or doubling of class size. More work is needed to assess whether these different ways of measuring the impact of resource change threaten the value of the interpretation of the evidence on resources.

A key question is whether an increase in resources invested in early years and primary education are more effective than an increase allocated to secondary education and later years, which would justify a transfer of resources to earlier educational stages. Our reading of the evidence is that there is no compelling case to support a transfer from later to early stages of education given the current state of knowledge.

There is certainly evidence that differences in achievement open up early in a child's life, and subsequent achievements are closely linked to early achievements. This in turn implies that there is a theoretical advantage in addressing disparities in achievement early on, so that these disparities are not propagated to, and amplified in, later stages of the lifecycle (Cunha and Heckman, 2007).

The problem is that it is not obvious from the existing empirical evidence that it is any easier to address the small disparities early on in life through policy interventions than it is to address disparities later on. So it would be premature to advocate a shift of resources given the current information available.

On balance, there are more studies finding positive resource impacts in primary school and early years than in secondary school. But this is partly because there have been more studies of primary education and the research designs have typically been better. Where comparable designs are available in the same economic and educational context (for example, studies using the National Pupil Database in England), the effect sizes at different phases seem comparable.

Moreover, a closer reading of the research evidence suggests that a balanced approach spreading investments evenly across the various stages of education is preferable to interventions at any one stage. The benefits of investments at an early age, although potentially offering higher returns, erode during later phases of childhood unless they are topped up with subsequent investments.

This article summarises 'The Effects of Resources Across School Phases: A Summary of Recent Evidence' by Steve Gibbons and Sandra McNally, CEP Discussion Paper No. 1226 (<http://cep.lse.ac.uk/pubs/download/dp1226.pdf>). The report was commissioned by Ofsted, Britain's official body for inspecting schools, as part of a project aimed at evaluating the effectiveness of educational policy across all phases of schooling.

Steve Gibbons is director of the Spatial Economics Research Centre (SERC) and reader in economic geography at LSE.

Sandra McNally is professor of economics at the University of Surrey and director of CEP's research programme on education and skills.

Further reading

Raj Chetty, John Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Whitmore Schanzenbach and Danny Yagan (2011) 'How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project STAR', *Quarterly Journal of Economics* 126(4): 1593-1660.

Flavio Cunha and James Heckman (2007) 'The Technology of Skill Formation', *American Economic Review* 97(2): 31-47.

Steve Gibbons, Sandra McNally and Martina Viarengo (2011) 'Does Additional Spending Help Urban Schools? An Evaluation Using Boundary Discontinuities', SERC Discussion Paper No. 90 (<http://www.spatial-economics.ac.uk/textonly/serc/publications/download/sercdp0090.pdf>).

Eric Hanushek (2003) 'The Failure of Input-based Schooling Policies', *Economic Journal* 113: F64-98.

Alan Krueger (2003) 'Economic Considerations and Class Size', *Economic Journal* 113: F34-63.

Stephen Machin and Sandra McNally (2008) 'The Literacy Hour', *Journal of Public Economics* 92: 1441-62.

OECD (2012) 'Education at a Glance 2012', OECD Indicators, Organisation of Economic Cooperation and Development.

There is no compelling case to support a transfer of resources from later stages of education to early years

