

Measuring equity in pupil attainment

A new perspective...

Professor Anthony Kelly is Director of Research and (acting) Head of the School of Education at the University of Southampton, one of the UK's elite Russell Group universities. He specialises in effectiveness and school improvement theory (specifically in governance, quantitative modelling, school choice and capability). He discusses here his recent work in devising (what has been called) an 'equity metric' that has been widely quoted by both supporters and opponents of the UK government's drive towards more diverse schooling provision.

So what's the problem?

Education policymakers have struggled to marry their measures of effectiveness with the aspiration to provide equity in schooling outcomes. Whether using raw threshold indicators – such as the percentage of pupils achieving certain examination grades – or value added measures that take account of context (CVA), there is no metric for gauging the extent to which these outcomes meet

expectations of equity. Of course, defining equity, never mind measuring it, is problematic in political terms as it links education policy to notions of freedom, yet many governmental and supra-governmental organisations have defined it in terms of outcomes, and in due course we can expect international studies like PISA to take it into account.

“Equity has been a fundamental concern for school effectiveness research (SER) since its inception, but the field has largely focused on the moral imperative of improving education and attenuating the impact of disadvantage.”

The EU (2006) defines educational equity as ‘the extent to which individuals can take advantage of education

in terms of outcomes’ and the OECD (2005) states that ‘the success of an education system depends upon a fair distribution of outcomes among participants with different characteristics’. The link between examination success and equity is therefore unambiguous, but it is not clear what the targets should be or how they should be spread across the range of prior attainment. For example, is it ‘fair’ to expect the ‘bottom’ 40% (say) of pupils (as measured by their prior attainment, say) to achieve 40% of certain examination grades?

On the one hand, it could be argued that a school should expect a greater proportion of all grades from its more able (and more privileged) pupils; on the other hand, that an equitable school might reasonably expect a greater proportion of the top grades to come from its more able pupils, but a more or less equal distribution of standard grades across the whole cohort. There is strong evidence in the official literature that the latter is the official aspiration (eg in the UK, DFEE 1997; in the US, NCLB 2001; in Europe, EU 2006), which is consistent with national and trans-national policies in other (social and economic) policy areas, so as a starting point for developing a metric for equity, it seems reasonable to assume it too; ie to assume that it is the intention of public policy that a given proportion of a school's examination success be attributable to an equal proportion of its pupil population.

A proposed solution: developing an Attainment Equity (Æ) Index

The ‘Gini Coefficient’, as shown on Fig. 1, is a measure of statistical dispersion for income and wealth. The straight line $y=x$ represents

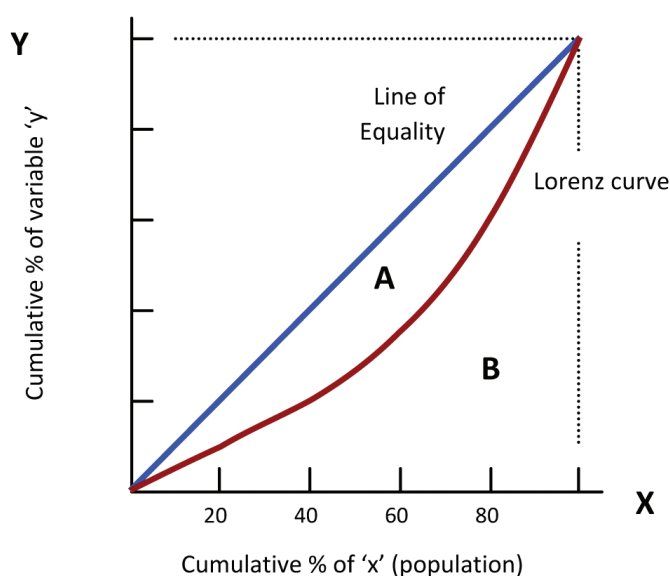


Fig. 1

'perfect' equality in the distribution of variable y over the population x , and the curve represents actual distribution. If B is the area under the curve, and A is the area between the line and the curve, the Gini is defined as $A/(A+B)$, or $1-2B$ for normalised axes. The Lorenz curve that separates A and B plots the proportion of a variable y that is cumulatively attributable to the population x , and as such it is a cumulative distribution function where every point represents a Pareto-type statement. If the Lorenz curve is represented by the function $y = L(x)$, the Gini is

$$\frac{1}{1-2 \int_0^1 L(x) dx} \quad (\alpha)$$

It will usually, if not always, be the case that the Lorenz equation $L(x)$ will be undefined in which case it can be approximated to a continuous piecewise linear function, and area B to trapezoids, in which case a Gini-type 'Attainment Equity Index' ($\mathcal{AE}$) will be given by:

$$\mathcal{AE} = 1 - \sum_{k=1}^n (X_k - X_{k-1})(Y_k + Y_{k-1}) \quad (\beta)$$

Where (X_k, Y_k) are the known points on the Lorenz, with $X_0=0, X_n=1, Y_0=0$ and $Y_n=1$.

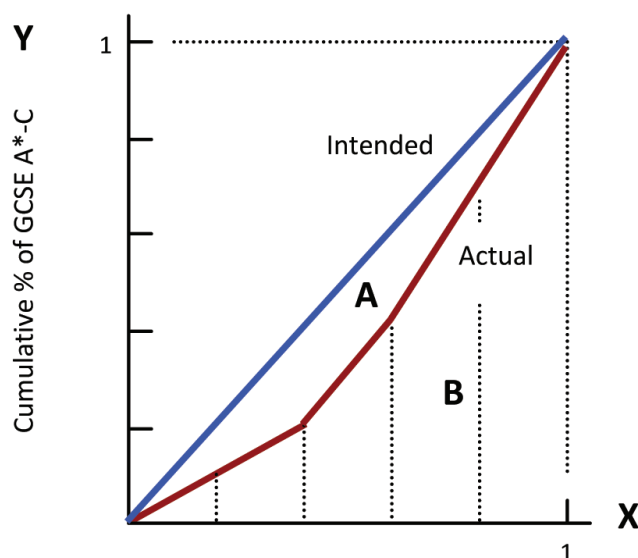


Fig. 2

Calculating an $\mathcal{AE}$ index for a school: an example

'School R' has the following grade distribution (using prior attainment at age 11 as benchmark): the bottom 20% obtained 8% of all pass grades; the bottom 40% obtained 19%; the bottom 60% obtained 40%; the bottom 80% obtained 68%. This is shown on Fig. 2 as a piecewise linear function. Using equation (β), with $X_k - X_{k-1} = 0.2$, the Attainment Equity Index for School R is 0.260.

Calculating and comparing $\mathcal{AE}$ indices for Local Authorities: an example

Portsmouth and Southampton are two English local authorities (LA) with

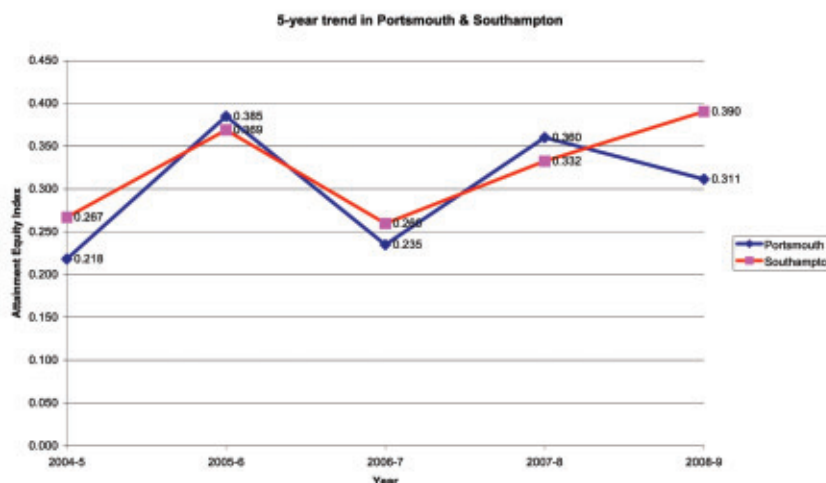


Fig. 3

much in common in terms of context. A LA-wide $\mathcal{AE}$ Index calculated for both LAs (and individually for each of their schools) reveals a significant difference between $\mathcal{AE}_{Ports}$ and $\mathcal{AE}_{Soton}$ (0.311 and 0.390 respectively) suggesting that pupil attainment in Southampton is less equitable than Portsmouth across the range of prior attainment. Fig. 3 shows the five year trends for the two LAs. They are very similar up to 2007/8, after which time attainment equity in Portsmouth improved and that in Southampton worsened. There are several possible reasons for this, which may or may not relate to a major school restructuring in Southampton, but of course what is missing from this analysis is *context* and that needs to be addressed in terms of developing an Index like this.

Making contextual adjustments

It might seem a simple matter to develop a 'Contextual $\mathcal{AE}$ Index' to take account of school-level factors like gender balance, percentage of Special Educational Need (%SEN), and various proxy variables that reflect social circumstance like the percentage of pupils entitled to free school meals (%FSM). These are all factors for which schools are 'responsible', though UK government policy has recently turned against including them because they 'expect different levels of progress from different groups of pupils on the basis of their ethnic background or family circumstances',

which the government 'thinks is wrong in principle' (DfE, 2010). When making comparisons across similar contexts (as with statistical neighbours) or within the same context over time, it is relatively easy to avoid making adjustments, but for schools with disproportionate numbers of students from disadvantaged groups, the conceptual problem is how to incorporate factors like %FSM and %SEN into the index when academics are unable to quantify the precise percentage impact of these variables at school-level (though they are known to have a negative effect, especially for pupils with low prior attainment).

‘Whether using raw threshold indicators – such as the percentage of pupils achieving certain examination grades – or value added measures that take account of context (CVA), there is no metric for gauging the extent to which these outcomes meet expectations of equity.’

One way forward would be to make an ‘elbow’ in the line of intended equity to reduce area A at the low attainment end, which seems like a reasonable suggestion, but such an approach has its flaws.¹ Firstly, we must not produce the same reduction in the index for all variables because they do not all have the same size effect. Secondly, there is no theoretical warrant for iterating two or more consecutive adjustments. For example, by adjusting the index first to take account of %FSM (say) and then subsequently adjusting it to take account of %SEN (say) and the alternative, namely making a

series of independent adjustments and then summing them all to get a single collective adjustment – risks reducing the index to zero for no good reason, or compounding errors where they exist.

One modification that could be made to overcome these objections would be to combine the $\mathcal{AE}$ Index (which is output-focused) with existing value added measures (that are process-focused) to categorise schools and LAs in terms of both attainment equity and context (see Fig. 4). Schools with a low $\mathcal{AE}$ Index and high CVA are adding value and doing so across the range of pupil ability and background characteristics (‘High Equitability Schools’), whereas schools with a high $\mathcal{AE}$ Index and high CVA are adding value but not across the range of ability and background, and we can use this construct to tighten up our definition of ‘differentially effective’ schools. And to return to the example of our two local authorities, if we plot Portsmouth and Southampton schools against a backdrop of Fig.4 it reveals something that neither the CVA measures (which were almost identical) nor the respective $\mathcal{AE}$ Indices (which suggested that Southampton was less equitable in terms of attainment) tell us; namely, that Portsmouth schools are more attainment-equitable mainly because so many of its schools are ‘uniformly ineffective’, and that Southampton LA is more polarised in terms of the ‘equitability’ of its schools (see Kelly 2012).

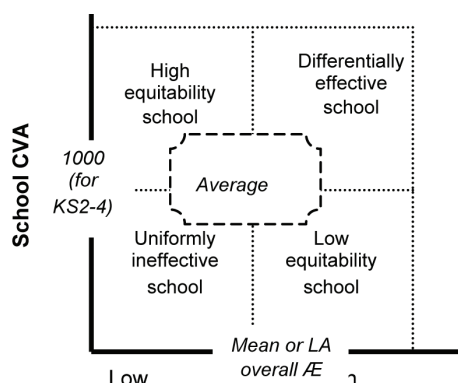


Fig. 4

Conclusion

Equity has been a fundamental concern for school effectiveness research (SER) since its inception, but the field has largely focused on the moral imperative of improving education and attenuating the impact of disadvantage. Attempts to define equity have conflated it with equality and notions of social justice, inclusion and access, so in this sense SER has traditionally viewed equity in terms of equality of opportunity for different groups, without equating it, as policymakers have done, to the spread of attainment. The aim of the $\mathcal{AE}$ Index is not to replace existing measures, but rather to augment them as part of a suite of situated metrics, and the fact that it uses ‘raw’ data, albeit adjusted for prior attainment, is, in the UK at least, in line with current government thinking.

¹ It is also possible to develop ceiling adjustments, though this would mean departing from linearity and from the notion of an index warranted by SER

References:

- DfE (White Paper) (2010) The Importance of Teaching (London, Stationery Office)
- DfEE (1997) Excellence in Schools (London, DfEE)
- EU (Commission) (2006) Communication from the Commission to the Council and to the European Parliament: efficiency and equity in European education and training systems
- A Kelly, (2012) Measuring ‘equity’ and ‘equitability’ in school effectiveness research, British Educational Research Journal
- NCLB Act (2001) Public Law print of PL 107-110. (Washington DC)
- OECD(2005) School Factors Related to Quality and Equity: Results from PISA 2000(Paris, OECD)

UNIVERSITY OF
Southampton

Professor Anthony Kelly
School of Education
University of Southampton
Highfield
Southampton SO17 1BJ
Tel: +44 (0)23 8059 3351
a.kelly@soton.ac.uk
www.soton.ac.uk