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Are Schools Drifting Apart? Intake Stratification in English Secondary Schools

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Executive Summary

Expansion of choice is a central theme in current debates on education policy in the US, UK and elsewhere. Proponents argue that freedom of choice ensures that pupils and schools are efficiently matched, and that the quasi-market discipline induced by open competition for pupils encourages schools to adopt efficient teaching technologies. However, opponents point to increased segregation in terms of pupil characteristics and abilities, leading to inequality in educational provision and child outcomes. Existing research on this issue has usually focused on segregation in terms of student characteristics such as ethnicity and free school meal eligibility, whilst the real consideration that seems to be in the back of most parents' and pupils' minds is the issue of segregation or stratification of schools along lines of pupil ability.

In this paper we offer an empirical analysis of the extent of school sorting and stratification by pupil attainment or ability between 1996 and 2002. We use administrative data on the population of pupils in England, which provides test scores of pupils at the end of primary schooling, linked to information about which secondary schools these pupils attend. Using different approaches, our key findings are that:

- There are large and stable differences between secondary schools in the average ability of pupils upon entry, even between different schools of the same general type and even if these schools have little autonomy in control of pupil admissions.
- In a comprehensive Community school that is at the bottom-end in terms of pupil intake attainment, the average pupil is just above the lowest 35 percent of pupils nationally in terms of age-11 attainment, whilst the average pupil in the best Comprehensive schools is in the top 35 percent.

- There are distinct differences between types of school in terms of ‘exclusivity’ of their intake. Voluntary Aided (primarily Faith) schools are, on average, amongst the most segregated 36% of schools nationally. This may be part because they have greater autonomy over their admissions than other schools, or it could be because pupils from a narrower range of backgrounds apply for admission to these schools.
- However, there has not been any dramatic or systematic *change* in school composition in terms of pupil intake abilities between 1996 and 2002: almost nothing has changed in terms of the way the pupils of different abilities are sorted into different schools. Recent policy moves towards facilitating parental choice do not seem to have resulted in greater segregation of high and low ability pupils. If anything, the trend has been towards greater diversity within schools.
- The only exception here is that there is now slightly less diversity in pupil abilities in selective Grammar schools relative to the situation in 1996.

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1. Introduction

Expansion of school choice is a central theme in current debates on educational policy in the US, UK and elsewhere. On the one hand, proponents argue that freedom of choice ensures that pupils and schools are efficiently matched, and that the quasi-market discipline induced by open competition for pupils encourages schools to adopt efficient teaching technologies. However, opponents point to the possible adverse consequences of a more 'segregated' school system, in which pupils become less likely to mix in schools with others who are dissimilar to themselves in terms of background and ability – a possible, though not necessary outcome of greater school choice. According to these arguments, more choice is bad, either because segregation is inherently socially undesirable, because segregation coupled with peer group influences exacerbates educational inequalities, or because it is claimed that a 'segregated' school system is educationally inefficient.

Existing research on this second set of issues has been largely concerned with describing school segregation in terms of characteristics like ethnicity and free-school meal eligibility (proxy for low-income). In this paper we investigate the more fundamental and policy-relevant question of 'ability' segregation, and find out to what extent high-ability and low-ability pupils are sorted into different schools in England, and to what extent this ability 'stratification' has increased or decreased over time. In common with other work in the field, we make no attempt to determine whether this stratification is good or bad educationally or socially, though we tackle some aspects of this question in a related paper (Gibbons and Telhaj (2006)) on peer-group effects. The current paper contributes to the wider literature on the potential impact of school choice, by carefully documenting what has happened in the English school system during a period of admissions policy reform.

UK public policy on education has been radically altered since the 1980s, transforming the education system (Scott, 1995 and West and Pennell, 1997). Since the Education Act 1980, successive governments have introduced and bolstered quasi-market reforms to the secondary education system to provide parents and pupils with more choice, give some schools more autonomy and make schools more accountable to their 'stakeholders' in an effort to improve standards. Part of this transformation involved attempts to provide better information on school quality, with publication and refinement of school performance indicators since the mid 1990s. The trend continues, with greater autonomy for schools and more choice for pupils and parents forming the centrepiece of recent government proposals (DfES 2005). Since the early 1990s there has been a general political will and several legal reforms to school admissions[1] which have been aimed at increased openness, giving parents more choice and making admissions authorities more responsive to parental preferences.

The present system has certainly provided parents and pupils with more information about schools they might attend; though the extent to which families can really exercise choice is less clear and there is evidence that the ability to exercise choice is differentiated by social background (Butler and Robson 2003). This will be true if admission to schools is limited to local residents, in which case demand is controlled by housing costs (Gibbons and Machin 2003, 2006). But, it may also be true under other admissions schemes if, for instance, better-off, educated parents are more informed about school quality, or if transport costs limit the choices of poorer families. Indeed, the research on choice behaviour in Flatley et al (2001) shows that higher socioeconomic status parents are more likely to use league tables and other

[1] Examples include: the introduction of school league tables in the early 1990s; the expansion of school diversity through Specialist schools, City Technology Colleges and Academies; the introduction and refinement of a 'Code of Practice on Admissions' and other moves to make the admissions system transparent and responsive to preferences included in the Schools Standards and Framework Act 1998

information sources when choosing schools, more likely to be aware of admissions criteria, and less likely to cite travel convenience as a reason for choosing schools. Some of the reforms since the 1980s have also given some schools greater freedom in terms of who to admit, leading to the possibility of covert school-side selection even when schools are ostensibly open to all abilities (West 2005). This, and the increased pressure on schools to perform well in the league tables, has raised fears that schools may engage in 'cream-skimming', leading to a situation in which higher-and lower-ability children are educated in separate schools.

Based on this anecdotal evidence about changes in the schools system and patterns of school choice in England over the last decade, we might expect to see substantial changes in the way that pupils of different ability are distributed across schools. Our starting aim in this paper was to measure these changes and then analyse their causes, by tracking the way that Primary schools pupils are sorted amongst Secondary schools by their prior academic attainment when they make the school phase transition at age 11. As we shall see below, our analytical intentions have been somewhat thwarted by the fact that we find it hard to detect any general increase in school intake ability stratification over the seven year period we study (1996-2002). The idea that pupils of high ability and low ability are becoming increasingly segregated seems to be something of a myth – at least in recent years. Having said that, although there is no change *on average*, in some schools the distribution of pupil abilities has narrowed whilst in others it has widened. However, these changes do not seem to be systematically related to any particular institutional types or geographical contexts. The only exception here is the case of schools (essentially Grammar schools) that explicitly select according to pupil ability, where the range of abilities within schools seems to have narrowed considerably.

A considerable literature has evolved to document school segregation in terms of ethnicity and poverty indicators, and its trends over time. However, the key issue of sorting and stratification by pupil attainment or ability – which is presumably the key concern to those worried about inequality in education – has received relatively little attention. In this paper we fill this gap in the English context. The paper is structured as follows. In Section 2, we briefly outline the earlier research on school segregation and stratification. In Section 3 we describe the methods we have used to illustrate and quantify patterns of school stratification and Section 4 provides details of the data on which we employ them. Our results fall in two sections: one describes the differences in mean intake ability of schools (Section 5), and the other (Section 6) explores the variation between pupils within schools and how these have changed over time. Section 7 concludes.

2. Related Literature

Study of social 'segregation' across neighbourhoods, districts and other geographical units has a long history in the US, UK and elsewhere and has been accompanied by numerous methodological developments and re-development (Duncan and Duncan 1955, Massey and Denton 1988, Waldorf 1993, Wong 1993, Cutler Glaeser and Vigdor 1999, Hutchens 2004). The standard approach has been to construct an index at one geographical level of aggregation – let's say the City – that measures differences in the demographic composition of geographical units at a smaller geographical level – say, Census tracts. Analysis then proceeds by plotting how these indices vary across Cities or change over time. A smaller literature on segregation in schools has inherited these methods directly.

Work on segregation in the school system in England has been dominated by educational researchers, and in particular by a series of papers by Gorard and co-authors culminating and summarised in Gorard (2000) and Gorard et al (2003). The motivation in their work, as in our paper, is to observe what has happened during a period of institutional change in the school system. The basic approach follows the geographical segregation literature and constructs indices of social dissimilarity between schools – either at national or a more local district level – based on the numbers eligible for free school meals (which is a proxy for low-income in England). Gorard et al's studies employ a modification of the "Dissimilarity" index that dates back to the 1950s, based on the proportion of pupils that would have to change schools to ensure that disadvantaged children are evenly distributed. In general, the finding is that income segregation in Secondary schools decreased over the 1988-1994 then rose slowly between 1996 and 2001. In international comparisons (Gorard and Smith (2004), Jenkins et al (2006)) the UK emerges as low to middle ranking country in terms of segregation along social lines and in terms of attainments, relative to the rest of the developed world,.

The finding that school segregation showed an overall downward trend after 1988 has not gone unchallenged: Goldstein and Noden (2003) investigate the change in between-school variance in free-school meal entitlement within a multilevel model and highlight an *increase* between 1994 and 1999. Although there has been quite a lot of vigorous debate over the direction of the trends in segregation ((Gorard (2004), Allen and Vignoles (2006)) it is hard to see an overwhelming empirical basis for disagreement since the general impression in all these studies is of a small rise in income segregation across schools during the late 1990s, but no real sign of strong increases over the overall period of quasi-market reform since 1988.

Turning to other dimensions of segregation, some studies focus on racial or ethnic segregation in schools, in particular in the US where this is tied in with government ethnic

desegregation policies. Clotfelter (1999), for example, finds high level of school segregation driven by differences between, rather than within school districts, though Clotfelter, Ladd and Vidgor (2005) find few changes in Southern states over the decade from 1994-2004. Elsewhere, researchers have shown that although ethnic segregation in schools largely tracks residential segregation, there is some excess variation which could be attributable to school choice processes – for example Burgess et al (2005) for England, and Gramberg (1998) for Amsterdam.

A few papers explore the impact of school choice more directly. For example, both Burgess et al (2004) and Soderstrom (2005) show that sorting of pupils into secondary schools along lines of ability is associated with sorting along lines of ethnicity and social background – the first study for England and the second for Stockholm. Burgess et al also demonstrate that segregation across schools tends to be high *relative* to segregation across surrounding neighbourhoods when there is a wider choice of local schools, whilst Soderstrom show that – unsurprisingly – segregation increased as a result of a policy reform that allowed schools to select pupils on the basis of prior exam grades. Again in the British context, Gibbons and Silva (2006) show that choice linked to greater school accessibility tends to compress the distribution of pupil abilities *within* primary schools in the London area, suggesting more stratification in high-choice systems – though the results are not statistically significant. None of the studies for Britain anything about changes in ability stratification over time; this is part of the focus in the empirical work to which we now turn.

3. Empirical Framework

As outlined above, studies that have tackled measurement of segregation have employed various indices to measure segregation based on dichotomous pupil characteristics – such as black versus white, poor versus non-poor. Although these indices have been used for around 50 years by researchers (since the influential work by Duncan and Duncan in 1955), there are still debates over which index to use. Studies that have attempted to measure the extent and the impact of segregation on educational achievement, labour market, or housing, have employed around 20 indices (Echenique and Fryer 2005). Some recent studies suggest different desirable properties of 'good' segregation index (e.g. Hutchens 2004, Echenique and Fryer 2005). The debate about which index is best still continues, though the bottom-line is that any single index that attempts to summarise the entire distribution of a particular pupil characteristic across schools is bound to have its limitations – especially when the characteristics in question is dichotomous.

Our intention in this paper is not to join the debate on the merits of various indices, but only to emphasise the problems and disagreement over the use of indices when judging segregation and other forms of stratification. This is why our main empirical strategy is not based on indices derived from dichotomous classifications but on measuring the underlying distribution of pupil prior *attainment,* both between and within schools. Our focus, then, is on school *stratification* by pupil ability – or more accurately, stratification by prior attainment at the time pupils enter school. In our view this is the salient characteristic on which to measure school stratification because it best captures the stratification in terms of peer group "quality". We imagine that this is parents' main concern in relation to school choice and perceptions of school quality and is the most relevant characteristic to consider if there are influences from

peer group ability on individual pupil attainment (as we show in Gibbons and Telhaj 2006). For example, academic outcomes at the end of secondary schools tend to track the mean attainment of the intake quite closely and Flatley et al (2001) indeed find that "Academic outcomes" is (just above "Convenience") the most frequently cited reason for wanting a place at a particular school.

Our data (see Section 4 below) provides us with a continuous measure of pupils' prior attainment at the time they enter Secondary school at age 11 in standardised tests in Maths, English and Science. We use factor analysis to condense the Science, English and Maths tests to a single measure of attainment[2]. As a shorthand, we will often refer to this as pupil 'ability', though this is not intended to suggest that we believe that these abilities are innate. With this data in hand, the objective is to show how pupils leaving Primary school with different abilities are sorted across Secondary schools, and to show how this pattern of stratification changed from 1996 to 2002 – the period being dictated by data availability. Because stratification across schools will also reflect stratification across geographical areas, we measure stratification of ability within Local Education Authority[3] (LEA) zones and explore differences in the degree of stratification between regions.

Our first approach to this is simply to plot a smoothed estimate of the cumulative distribution of average pupil ability across schools, or strictly speaking the inverse-cumulative distribution since we have average ability on the vertical axis and school ranking on the

[2] These test scores are highly correlated and give rise to a single dominant factor. We experimented with using the Maths, Science and English test scores separately but this offers no advance over the combined score and just complicates the presentation.

[3] Local Education Authorities are now referred to as Local Authorities, but we stick with the terminology that prevailed at the time of the empirical research.

horizontal axis. We do this separately for each of nine English regions in our sample years. The details about our method are provided in Appendix A.

The resulting graphs, which are presented and discussed in Section 5, show how the distribution of 'ability' across pupils maps into the distribution of school-mean 'ability' across school intakes at age 11. This method serves to illustrate to what extent pupils who did well academically at primary school, relative to others in their Local Education Authority, attend secondary schools alongside other pupils who also did well at primary school. There are two benchmark cases which will allow us to assess the degree of stratification across secondary schools in a given regional group. We define an unstratified school system as one in which pupils of different abilities are randomly assigned to secondary schools. In the limit, as the number of pupils per school tends to infinity, an unstratified school system implies that each school has a mean intake ability of 50 and our inverse-cumulative distribution is a horizontal line. In practice, even with random assignment, schools will differ in mean intake ability simply through random variation, so the inverse-cumulative distribution will be upward sloping to an extent that depends on the number of pupils per school in the sample under investigation.[4]

The second benchmark is the perfectly stratified case, when the pupil distribution is perfectly partitioned by assignment to schools. In this case the bottom n% of pupils (ranked by ability) are in the bottom n% of schools (ranked with intake-size weights according to mean intake ability), the next highest n% of pupils are in the next highest n% of schools and

[4] Note that the Lorenz curve at school ranking x would be the integral of our inverses cumulative distribution between 0 and x, so the zero-stratification case would correspond to the upward sloping 45 degree line in the Lorenz curve.

so on until all pupils are allocated to schools. If the number of secondary schools and pupils is large, then the inverse cumulative distribution is an upward sloping 45-degree line.

In addition to these graphical methods, we present some simple statistics to summarise the extent to which secondary schools are stratified. The first is the R-squared from a regression of pupil ability percentile (calculated within LEA) on a set of school dummy variables. This indicates the between-school proportion of the total variance in pupil ability (relative to others in their LEA). The second is a measure of the proportion of schools attended by the top ranked 5% of pupils and the proportion of schools attended by the bottom ranked 5% of pupils.

These between-school approaches portray the general patterns in the regions and periods, but will not reveal what is happening in individual schools or schools of specific types. The distribution of pupil abilities in some schools or school types may be becoming increasingly different from the distribution of pupil abilities in their geographical surroundings, whilst in others the distribution may be becoming more similar; on average there is no change, and the methods described so far will not detect any. An alternative way of looking at stratification is to consider the distribution of abilities *within-schools*. In stratified school systems, pupils are more similar to other pupils in the same school than they are to pupils elsewhere, so the variance of abilities within schools will be less than the variance of abilities in unstratified systems. In fact, the within-school dispersion of abilities is a natural way to consider the extent of stratification because it explicitly measures the extent to which pupils are 'segregated' into alongside pupils of similar ability. Shifting to a within-school analysis makes it possible to illustrate changes in the mix of pupil abilities within schools and to see how these patterns depend on school-specific factors. We use this analysis in the results presented in Section 6.

4. Data

In this study we use National Pupil Database (NPD) for England which is a census of all pupils in England in LEA maintained schools. In England the state compulsory-age education is organized in 4 Key Stages that depend on pupil's age. Key Stage 1 (ages 5-7) and Key Stage 2 (ages 8-11) form Primary schooling, while compulsory Secondary schooling runs from age 11/12 to age 15/16, spanning Key Stage 3 and Key Stage 4. Funding of schools is organized mainly through the central government grant distributed to Local Education Authorities (LEAs) and these LEAs handle most of the school admissions and administrative procedures. Information on school type, location and other characteristics are taken from the DfES Edubase data for 2003.

Around 65 percent of schools are "Community" comprehensive schools, which means essentially that they are non-selective in admission and are administered by the LEA. Some other schools have religious affiliations and are allowed to choose pupils on the basis of religious or other commitment ("Voluntary Aided"), some are run by other types of charitable institution but still are state schools ("Foundation schools"), and a few are religious schools but with admissions handled by the LEA ("Voluntary Controlled"). Some Community, Voluntary Aided, Voluntary Controlled and Foundation schools can pick pupils on the basis of academic ability; these Selective "Grammar" schools make up about 5% of the total number of schools and there are a corresponding number (4.5%) of "Modern" schools that receive those not admitted to Grammar schools in localities where this two-tier system prevails. There are a few other urban schools (20 or so) called City Technology Colleges and Academies that receive some private sponsorship and can admit a limited proportion of their pupils on the basis of specific aptitudes. There is also a small private sector, that accounts for

around 6 percent of all pupils (up to 13 percent in Central London[5]) but we have no useful data on these and do not consider them here.

The NPD data contains information on pupil level academic attainment at the end of each Key Stage from 1995/6 through to 2002/3 (at the time of the empirical analysis). To analyze stratification along lines of prior ability, we need to link pupils in secondary schools to their Key Stage 2 (age-11) primary school test data. For pupils who sat Key Stage 2 SATS in 1995/6 through to 1998/9 we can do this using the NPD by looking at which school they attend when they sit their Key Stage 3 (age-14) SATS. Pupils who were at the end of Key Stage 2 in 2000/2001 and 2001/2002 academic years are in secondary schools in the following year, but we do not have data on their Key Stage 3 results in the NPD dataset since it will take few more years until they sit on Key Stage 3 exams. However, we can get the necessary information from the Pupil Level Annual School Census data (PLASC) which has been conducted by the Department of Education and Skills since 2001/2. This tells us in which secondary schools these pupils were enrolled in the following academic year when they are aged 12. In this way we end up with seven years of data[6]. In total, we have data on pupils'

[5] Authors' own calculations based on Annual School Census data from the Department of Education and Skills and information on the Independent Schools Council web site www.isc.co.uk.

[6] Note this means that for 1996 to 2001, pupils are linked in our data to the secondary schools in which they took their age-14 SATS, whilst for 2002 and 2003 pupils are linked to the secondary school which they attended at age 12. Prior attainment is recorded at age 11 for both groups. Clearly, if pupils who move Secondary schools between ages 12 and 14 are more or less likely to be sorted into schools alongside pupils of similar abilities then our results for 2002 and 2003 will not be directly comparable with results for other years. In pratices, only 9% of pupils arrive at secondary school between ages 12 and 14 and the correlation between the attainments of these pupils and their peers is slightly lower (0.32) than it is for pupils arriving at age 12 (0.36). This means that, if anything, our 2002 and 2003 results based on stratification at age 12 will overstate the degree of stratification compared to those from 1996 to 2001 based on stratification at age 14.

age-11 attainment for the academic years 1995/1996 to 2001/2002 with around 4 million pupils spread across all 9 English regions, namely, North East, North West, Yorkshire and Humberside, East Midlands, West Midlands, East of England, London, South East and South West. We present much of the analysis separately for each region to allow us to distinguish within and between-region effects, and also consider differences between non-selective Community comprehensive schools and other types of state school.

5. Variation in Ability Between Schools

Our analysis is largely descriptive and the key information will arise during the course of the exposition so we do not start with any summary statistics, other than to show – in Table 1 – the proportions in the different regions and school types, which we will go on to analyse below. In any case, everything we present is based on pupil percentiles, which means that the pupil ability measures have a mean of about 50, standard deviation of just under 29, minimum of 1 and maximum of 100 in every sample. So, our description of stratification patterns in English schools begins directly with the plots of the inverse-cumulative distributions explained in Section 3.

The plots in Figure 1 illustrate how the distribution of pupil ability maps into the ranking of Secondary schools for each region in England. We do this for two school groups in each region. In the left hand Figure, for each region we show the picture for Community comprehensive secondary schools that do not select pupils according to their primary-age attainment, in which any changes in stratification must be almost exclusively due to changing patterns of pupil and parental choice over schooling, or due to changing residential demographic patterns which shift the intake profile of local schools. In the right hand Figure,

for each region we show the full picture for all schools in our database (state schools only). This includes Grammar schools and any others classed as "Selective" in our data[7] – meaning that only admit pupils whose academic standards meet the schools' entrance requirements (around 5% of schools). It also includes a substantial proportion of other schools – predominantly church schools and schools run by other charitable organisations – that do not ostensibly select pupils on the basis of academic ability, but sometimes have scope to scrutinize pupils' applications or seek references to ensure that they are compatible with the school's ethos or religious tradition. So, in the right hand plot, we expect to see more evidence of stratification induced by schools overtly or covertly "cream skimming" the best pupils, alongside greater stratification induced by families of different types aligning themselves with schools of distinctive religious or ethical character.

Recall, the plots show where the average pupil in a school is in the distribution of pupil ability within Local Education Authorities in each region. Let us focus on London as an example. Looking at the plot for London Community comprehensive schools in 1996 (solid line), note that the average pupil in the middle ranking school (50 on the horizontal axis) is at zero on the vertical axis. This is a normalisation we have introduced to ensure that lines for different years cross at the same point. If we move to the right hand end of the horizontal axis (100) and read off on the vertical axis we can see that the very best Community comprehensive schools in the region enrol pupils who are about 19 percentiles above pupils in the median school in terms of their position in the pupil distribution in their own Local Education Authority. Moving to the left hand end, the average pupil in the worst school lies about 15 percentiles below the average pupil in the median school. So, differences between mean intake ability represent about 34% of the overall distribution of Community school

[7] A few schools with ambiguous selection status are dropped.

pupil ability within Local Education Authorities in London. The right hand Figure adds in the other school types (Voluntary Aided, Voluntary Controlled, Foundation, CTCs, Academies, and Grammar schools) and the average slope of the cumulative plot in 1996 is noticeably steeper indicating greater stratification by ability across these school types. In London, some 3.7 % of pupils attend schools which select according to ability (Table 1) – which is clearly evident in the sudden steepening of the distribution plot at about this point in the upper end of the school distribution. We can read off from the figure that top 5% of schools in London enrol pupils whose mean ability ranges from 20 percentiles to 40 percentiles above the mean ability of pupils in the median school.

Since we can see now how the plots illustrate differences in stratification across secondary schools, what can they tell us about the way this has changed over the years from 1996 to 2002, which is central focus of our investigation? The figures plot the distributions for intakes into Secondary school in 1996 (solid), 1999 (dashed) and 2002 (dotted) and it is completely clear looking at the charts for London that almost *nothing* here has changed. The distributions are almost identical in each year. We have also looked at the intervening years, but there are no more interesting facts to report from this exercise. None of these figures report any confidence intervals and we have made no attempt to test for differences between the years – which would clearly be small, even if statistically significant. Appendix D shows the picture for London with 95% confidence intervals derived using bootstrap methods and it is fairly clear that most of the changes over the years lie within the 95% confidence interval for 1996.

Before considering the other regions in Figure 1, let us consider the numerical indices of stratification for London in Table 2 and Table 3. These are R-squared statistics from regressions of pupil test-score percentile on a set of school dummies, as described in Section 3. The R-squared figures reported in Columns 1-3 of Table 2 for London Community

comprehensive schools range from 0.052 in 1996 to 0.045 in 1999 back to 0.052 in 2002. Apparently, the differences in mean intake ability between Community schools induced by pupil sorting accounts for only around 4.5-5.2% of the variance in overall pupil ability in Community schools in London[8]. In other words, some 95% of the variance in pupil ability at entry to Secondary school is within-school. We do not present a formal statistical test of the differences between years, but we show that the point-wise standard errors are tiny, and, since we have almost the whole population from each cohort it is pretty clear that these fluctuations represent population changes and not sampling variation. However, there is no general trend over the seven years we have available here. If we look at the figures for all schools in London (Columns 4-6 of Table 2) we see that there is a much greater between-school variance – around 16% of the total – but again there is only a very slight change over the years, with a slight trend towards less stratification by intake ability.

Perhaps we are missing something here and there are changes in sorting at high-ability and low-ability tails of the distribution which the R-squared is unable to detect and which are just not clear in our graphical presentation. We go on to explore this in Table 3, where we show the proportion of secondary schools enrolling pupils from the top 5% and bottom 5% of the primary school attainment distribution (again relative to their peers within the Local Education Authority). In 1996, 95% of Community comprehensive schools enrolled someone from the top 5% of age-11 Community school pupils (Column 1) and 87% of all schools enrolled someone from the top 5% of all age-11 pupils in London. By 2002 the proportion had *increased* to nearly 97% in Community schools and nearly 90% in all schools together; in

[8] To link this to **Figure 1**, note that an R-squared of 0.05 implies that the coefficient of a regression of pupil percentile on school-mean-pupil percentile is 0.22, which is approximately the average slope of the line shown for Community schools in **Figure 1**.

other words the best pupils became more widely distributed across schools. For the low-ability range we see no change for Community schools with 98% of schools enrolling someone from the bottom 5% in age 11 ability, and again a slight increase in all schools from 90% to 92% of schools accommodating this ability group.

So far, we have been unable to find any evidence that school stratification by ability has increased within the London area since the mid-1990s, either through family choice of school, or schools cream-skimming pupils. Perhaps the picture is different outside London. The remaining panels of Figure 1 illustrate what has been happening in all the other eight regions of England. We will not describe them all in detail, but it is clear that whilst the cross-sectional stratification patterns show some differences between regions – particularly due to the differences in the proportions of selective pupils shown in Table 1 –there are no systematic changes over time. In some regions there are small differences between the years, for example in the lower tails of the distribution in the South West, but if anything, this is usually towards a flatter curve indicating greater school integration. Looking at the R-squared results in Table 2, we can see that in almost every region, the between-school variance in ability is less in 2002 than in 1996. The only exception is in the South East where the between-school share increased by about 1.3 percentage points across all schools. Again, looking at the allocation of high and low-ability pupils shown in Table 3, there are almost no regions in which the proportion of schools accommodating someone from the top 5% is less in 2002 than in 1996, or where the proportion of schools taking someone from the bottom 5% has decreased. In fact, the general trend is towards wider distribution of these groups across Community schools and across schools of other types.

6. Variation of Ability Within Schools

Our finding that there has been little *general* change in ability stratification in any region does not mean that there are no changes happening at school level. Some schools may become increasingly ability-stratified relative to others – in the sense that the dispersion in intake ability of pupils is decreasing relative to other schools – whilst other schools may become increasingly ability-integrated. This would show up as *no change* in our analysis so far. To see to what extent this is true, Figure 2 plots the density of the mean annual change in the within-school standard deviation of our ability measure between 1996 and 2002 for England as a whole. Looking at the picture it can be seen, as we would probably expect, that abilities have become more concentrated in some schools (taking pupils who are increasingly similar to each other relative to others in their LEA), whilst abilities have become more dispersed in others. Nevertheless, the changes are not large. The median change is an increase in the within-school standard deviation of ability of about 0.02 percentiles. In other words, the within school variation in ability has barely changed on average (which is consistent with the earlier analysis). However, 1 in 100 secondary schools show a decrease in the within-school standard deviation in intake ability of about 1 percentile per year over this period, whilst 1 in 100 schools show an increase of about 1 percentile per year.

The key question then remains: are these differences between schools systematic, in the sense that they can be attributed to particular school types, school characteristics, geographical setting or aspects of educational policy? In Table 4 we provide part of an answer to this question by regressing the levels and mean annual changes of within-school standard deviation in intake ability on indicators of school type (which is equivalent to showing the difference in the means of the standard deviation in each group from the Community school

group, alongside a t-test of the difference). The school type indicators are taken from the last year in our sample, and the numbers of schools in each cell are set out in Appendix E.

Columns (1)-(3) in Table 4 show the association between school type and the cross-sectional within-school standard deviation of pupil ability (as before, measured as percentiles within the pupil's Local Education Authority). The top-row, baseline schools in this analysis are Community-comprehensive schools, that do not select pupils according to ability, which have no religious affiliation, and offer no curriculum specialisation. The standard deviation of pupil abilities in these schools is about 27.5 percentiles, which is only slightly less than the 28.6 percentiles that is (by construction[9]) the standard deviation of pupil abilities within the LEA as a whole.

The coefficients in the remaining rows in Table 4 show how other school types differ from this baseline, and there are some clear differences. Unsurprisingly, the distribution of pupil achievements is much more compressed in schools with an admissions policy classed as Selective – mainly Grammar schools – which pick pupils in the basis of ability: The standard deviation of pupil ability is about 14 percentiles compared to 27.6 in baseline non-selective Community schools in 2002 – that is about half. In Modern schools (typically the low-ability counterpart to selective schools in LEAs that have Grammar school systems) the distribution is also significantly more compressed than in Community comprehensive schools, though by only about 4.5 percentiles in terms of the standard deviation. More interestingly, we also see that Voluntary Aided and Foundation schools also generally draw pupils with a narrower range of ability than in their LEA overall, though the difference is quite small for Foundation schools. These are schools –generally religious – which, although they do not select on

[9] Because pupil ability scores are uniformly distributed between 1 and 100 within LEAs by construction. The standard deviation of a uniformly distributed variable bounded by 100 and 1 is $(100-1)/\sqrt{12}=28.6$.

ability, have autonomy over their admissions and have some control the composition of their intake for the purposes of maintaining their character and ethos (e.g. by evidence of church attendance, or reference from a local minister)[10]. This is consistent with other evidence which shows that these schools are more segregated along socioeconomic lines (e.g. Goldstein and Noden (2003)). These schools may also have a narrower range of abilities because they are sought out by families from a narrower range in the social spectrum. However, looking further down the list, the results provide some indication that the selection into Voluntary Aided schools is closely linked to autonomy in admissions: In comparison, Voluntary Controlled schools, which also usually have a religious ethos (specifically Church of England) but *do not* run their own admissions, take in a similar range of abilities as the baseline Community comprehensive schools.

The City Technology Colleges (less than 20 schools) also have a narrower ability distribution, which probably reflects the fact that they select pupils with aptitude for science and technology. In other categories there are few interesting patterns. Religious affiliation does not seem to be linked to a narrower ability distribution. In fact, Roman Catholic schools have a more dispersed intake than other voluntary-aided schools, but less dispersed than community schools. It should be remembered, however, that most church schools are Voluntary Aided so the difference in the standard deviation from the baseline for these schools is derived from the sum of the Voluntary Aided and faith-school coefficients. "Beacon" schools – DfES designated exemplars of good practice and performance – do not seem to attract a narrower range of abilities. Neither do any of the "Specialist" schools – which offer curriculum specialisations – seem any more specialised in intake from non-

[10] During the period covered by this research, faith-based schools were allowed to interview to determine religious commitment though very few did and this practice is ruled out under current admissions regulations.

specialist Community schools, at least no more than we would expect by chance; and there is some evidence that their intakes are in fact more dispersed. These Specialist schools can select up to 10% of their intake by aptitude, though only very few actually do according to DfES figures[11].

Comparing the distributions in 1996, 1999 and 2002 we can see some marked changes. For instance, the variance in the distribution in Selective schools seems to have declined, though elsewhere there are few clear trends. A similar picture emerges if we consider the relationship between school type (measured towards the end of the period in 2001 or 2002) and the mean annual *change* in the standard deviation of ability within schools. The standard deviation of ability in Selective schools decreased by about 0.13 percentiles per year, showing that Selective schools became more selective over the period. This fits in with the trends in income segregation over the late 1990s observed by Goldstein and Noden (2003) in LEAs operating selective systems. However, other school types show no significant difference from the baseline Community schools in terms of the trend in the distribution of intake ability, either individually or when tested as a group (the F-tests for the school type, specialisation and denomination dummy sets all give p-values >0.70).

On their own, these results may not be informative about the overall patterns of stratification, since schools that are "cream-skimming" would generate falling within-school dispersion in Community school abilities too as they siphon off the best pupils. Hence, if Community schools and other schools' intake dispersion fall at the same rate, then we would not expect to see any significant coefficients in Column (4) of Table 4. However, looking at the constant in the top row of Column 4, we see that overall trend in baseline Community schools has been towards *greater* within-school dispersion relative to the distribution across

[11] Source: personal communication.

pupils within LEAs, which is not consistent with a general cream-skimming story. The distribution of ability in Selective schools is narrowing, but this is not through loss of high ability pupils in Comprehensive schools.[12]

As a further test, Column (5) looks at the change in within-school coefficient of variation (standard deviation/mean x 100) as an indicator of concentration at the upper end of the distribution relative to the lower end. If schools at the upper end of the within-LEA distribution of pupil ability are increasingly picking pupils of higher ability, then we would expect their within-school ability dispersion to decrease and their mean ability to increase: an unambiguous *decrease* in the coefficient of variation. If, as a consequence, lower-ability pupils are becoming more concentrated in other schools, then we would expect the within-school standard deviation in these schools to decrease whilst the mean goes down leaving the coefficient of variation unchanged[13]. However, looking down Column (5), there are few significant individual coefficients, though again there is evidence that Selective schools are increasingly pulling in more able pupils, and the church and specialisation coefficients are significant as groups (p-value ≤ 0.01). Only a few other school types show an (insignificant)

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[12] The intake in Selective schools may just be shrinking as lower ability pupils are excluded, or they may be drawing more able pupils from some of the other school types in our sample (e.g. Voluntary Aided/Controlled), or even from the private sector which is excluded from our analysis.

[13] To see this formally, note that the distribution of pupil percentiles within LEAs is uniformly distributed with (approximate) mean 100/2 and standard deviation 100/√12, so the coefficient of variation is 0.577. Suppose the top of the distribution in some schools is truncated to x due to cream-skimming by other schools, then the mean becomes x/2 and the standard deviation x/√12 which leaves the coefficient of variation unchanged. For schools attracting the best pupils, the upper part of the pupil distribution from x to 100 has mean (x+100)/2 and standard deviation (100-x)/ √12, so the coefficient of variation is proportional to (100-x)/(100+x) which is clearly decreasing in x.

decrease in the coefficient of variation over time relative to the Community school baseline, significant or not –Voluntary Aided schools, Church of England Schools, Specialist Sports schools. Therefore, there is little hard evidence of a general cream-skimming for any school type other than explicitly Selective schools, according to this metric.

For completeness, in Column 6, we show how these school types differ in terms of the mean prior attainment of their intake. This Column reports the results from a regression of the school-mean of pupil attainment on the school type dummy variables in 2002. By comparison of the results in columns 3 and those in Column 6 it can be seen that most school types that take in higher-ability pupils have more compressed intake ability distributions. The only exception here is for Modern schools, which is to be expected since these are schools that receive pupils who do not reach the standards necessary for admission to Selective schools.

The patterns observed in Table 4 suggest that any school-level changes in the distribution of ability are not strongly related to basic institutional type. We briefly extend the analysis to consider some more general indicators of the school's size and geographical setting in Table 5 – in particular the extent to which a school is likely to be exposed to greater competition from other schools. These indicators are: school size in 1996 (the number of pupils on the roll in the intake year), the number of schools in the Local Education Authority district in which the school is situated (again in 1996), and the number of schools within 5km (straight-line distance) of each school. In terms of the cross-sectional pattern in 1996, the results are interesting in that they show that bigger schools have wider dispersion in pupil intake ability – with each additional pupil increasing the standard deviation by 0.0025 percentiles (the coefficients here are multiplied by 100). Also, secondary schools in more competitive and urbanised settings where families seem to have more choice, that is where there are more schools within the LEA or within the nearest 5 kilometres, have a narrower distribution of intake abilities than the LEA as a whole. A one-standard deviation increase in

the number of schools in an LEA (25.7) is linked to a fall in the standard deviation of pupil abilities on intake of around 0.69 percentiles or about 19% of one standard deviation (3.69 percentiles). At a more local level, an increase of one-standard deviation (8.4) in the number of schools within 5 kilometres (irrespective of whether these are in the same LEA) results in a fall in the within-school ability dispersion of 0.24 percentiles or about 6.5% of one standard deviation. Taken together, these coefficients seem to suggest that a school has a lower dispersion of pupil intake ability when it is small relative to the average size of school in the Local Education Authority. However, none of these factors seems to have influenced the change in dispersion of abilities within schools over the period from 1996-2002. All the coefficients in Columns 2 and 3 are small and statistically insignificant.

Again for completeness, we show how school-mean intake ability is linked to these geographical factors in Column 4. The most interesting feature revealed here is that schools in dense urban settings have strikingly low mean intake ability. This is to be expected considering what is known about the concentration of poverty and disadvantage in cities, and is a story which is followed up in Gibbons and Silva (2006).

7. Discussion and Conclusions

Using a number of different approaches, we have been unable to show any dramatic or systematic changes in school composition in terms of pupil intake abilities. The bottom-line of our analysis is that really, in the last decade, almost nothing has changed in terms of the way the pupils of different abilities are sorted into different schools. On the other hand, these are important results as they run counter to tales of increased stratification and segregation that have become commonplace in academic, media and political circles. Clearly, we have

said nothing about stratification along lines of income, race, social class or other demographic lines and which may well have changed. Whether or not this type of segregation has increased in England is difficult to assess, since the work in this field is characterised by disagreement (Gorard et al 2000, Goldstein and Noden 2003, Allen and Vignoles 2006). Whatever the truth, we argue that any changes that have taken place have made little difference to whether or not low or high ability pupils are likely to find themselves amongst low-ability or high ability peers. The only exception here is in the case of the small proportion of schools that admit pupils on the basis of ability, in which the distribution of pupil ability has become noticeably more compressed. One thing we are not able to analyse given the data available is whether intake stratification has increased across the state and independent sectors. It is quite possible that the private sector is drawing more and more of the highest ability pupils away from the state schools we consider here.

This is not an argument for complacency. Looking at the cross-sectional differences reveals that there are some distinct, though small differences between types of school in terms of 'exclusivity' of their intake. Voluntary Aided and Foundation schools in particular have narrower ranges of ability than other schools (apart from overtly Selective schools), possibly in part because they have greater autonomy over their admissions than other schools (West 2005). The evidence we have presented is consistent with the view that a policy move towards handing *schools* greater freedom of choice in admissions may result in more strategic selection[14] and greater stratification. However, it is equally consistent with other processes based on pupil-side school selection: The kind of pupils that *apply* to these schools may be

[14] On the other hand, recent changes that have removed schools' right to interview families for admission seem likely to reduce school-side selection.

more similar to each other than to other pupils in the population; as an example, most of the pupils applying to Catholic schools will be Catholic.

Whether we would consider the compression of the distribution of pupil abilities within Voluntary Aided and Foundation schools large or small depends on which comparison we make. Compared to the overall variation in pupil attainments it seems quite small – on average the standard deviation of within-school intake ability in Voluntary Aided schools is about 96% of the standard deviation within Community schools. Then again, if we consider that there is actually relatively little variation *between* schools in terms of the *within-school* standard deviation of ability, the compression in these more autonomous schools seems much less trivial: Voluntary Aided schools are about one-third of one–standard deviation below the average school in terms of the diversity of their intake.[15]

Similarly, smaller schools in locations where there are many alternative schools have a narrower dispersion of pupil intake ability, (in line with the evidence in Burgess et al 2004 for Secondary schools and Gibbons and Silva 2006 for Primary schools). This suggests that policies which expand the number of schools available to parents may encourage stratification – although in the analysis here we cannot distinguish these choice-related impacts from more general urban effects that are associated with an increase school density.

Importantly, we have illustrated the large and stable differences in intake between schools of the same general type even if they have little autonomy in control of pupil admissions: the average ability of pupils going into the 'best' Comprehensive schools is some 30 percentiles of the pupil ability distribution above the average ability in the worst. It is

[15] For the first figure: The standard deviation within Community schools is about 27.6 percentiles, whilst within Voluntary Aided schools it is about 27.6-1.3 = 26.4 percentiles. For the second figure: The standard deviation (between schools) of the standard deviation within schools is 3.8, so 1.3 = 34% of one standard deviation.

surely this fundamental empirical contrast – presumably driven for the most part by geographical disparities in pupil background – that drives perceptions of inequity in school provision and of failings in the school system. Whether or not these differences are cause for concern depends in part on whether such stratification is considered socially desirable, but also on whether peer-group ability has a real impact on individual attainments. In other work (Gibbons and Telhaj 2006) we show that school intake ability *does* matter for pupil attainments in English Secondary schools, so pupils in schools with high mean intake ability are at a real advantage over others[16]. What we have shown here though, is that changes in recent years seem to have done very little to *exacerbate* these inequities in school composition.

[16] In Gibbons and Telhaj (2006) we show that a move between the worst and best Community schools could increase individual pupil attainment at age 14 by about 6 percentiles

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Figure 1 Stratification of Secondary schools intake ability, 1996-2002.

Figures plot average pupil-ability percentile against school's percentile in the mean intake ability distribution. Vertical axis is centred on median school.

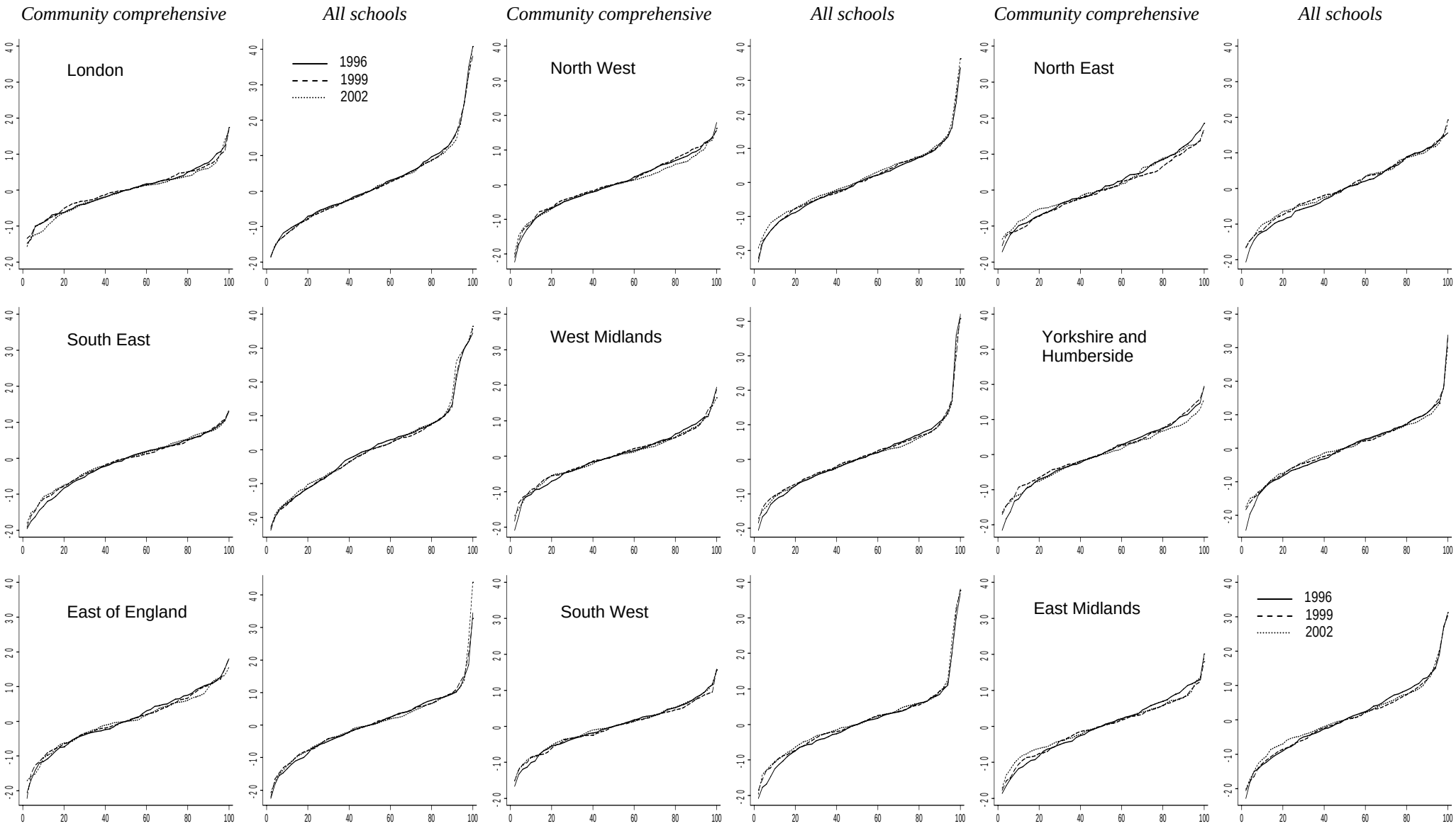

Figure 2 Density of mean annual changes in within-school ability variation, 1996-2002

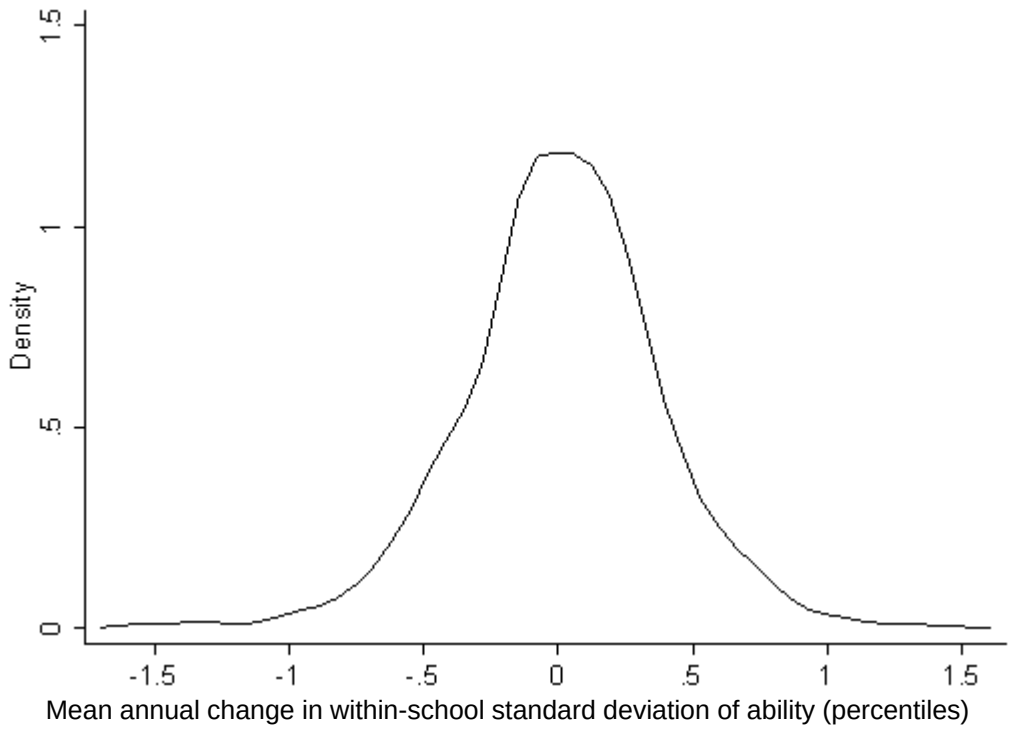

Figure shows kernel density of the annual change in within-school standard deviation of ability score. Top and bottom 0.5% of the sample trimmed to remove outliers.

Table 1 Percentage of Pupils in Schools by Region and School Type (2002)

	Comprehensive Community Schools	Selective Schools	Other Non-Selective Schools
North East	77.75	0	22.25
North West	62.35	2.95	34.7
Yorkshire	79.86	1.17	18.97
East Midlands	60.38	3.7	35.92
West Midlands	68.05	3.01	28.94
East of England	45.97	1.83	52.2
London	49.76	3.65	46.59
South East	50.68	9.76	39.56
South West	66.63	4.29	29.08

Note: other non-selective schools include CTC, Foundation, Voluntary Controlled, Voluntary Aided and City Academies.
Schools where selection status is ambiguous have been dropped.

Table 2 Intake ability stratification in English Secondary schools; between-school share of variance, 1996-2002

	Community schools			All schools		
	(1)	(2)	(3)	(4)	(5)	(6)
	1996	1999	2002	1996	1999	2002
North East	0.087	0.072	0.067	0.094	0.083	0.078
	(0.0018)	(0.0016)	(0.0017)	(0.0017)	(0.0015)	(0.0016)
North West	0.081	0.076	0.065	0.130	0.129	0.124
	(0.0013)	(0.0011)	(0.0011)	(0.0012)	(0.0010)	(0.0010)
Yorkshire	0.095	0.078	0.070	0.119	0.104	0.096
	(0.0014)	(0.0012)	(0.0019)	(0.0013)	(0.0012)	(0.0018)
East Midlands	0.083	0.067	0.062	0.140	0.129	0.120
	(0.0018)	(0.0015)	(0.0014)	(0.0016)	(0.0014)	(0.0013)
West Midlands	0.075	0.064	0.061	0.138	0.127	0.129
	(0.0014)	(0.0012)	(0.0012)	(0.0014)	(0.0012)	(0.0012)
East of England	0.085	0.077	0.071	0.120	0.117	0.120
	(0.0017)	(0.0015)	(0.0017)	(0.0013)	(0.0012)	(0.0013)
London	0.052	0.045	0.052	0.161	0.160	0.156
	(0.0015)	(0.0013)	(0.0013)	(0.0014)	(0.0012)	(0.0012)
South East	0.071	0.062	0.062	0.198	0.203	0.211
	(0.0014)	(0.0011)	(0.0012)	(0.0013)	(0.0012)	(0.0012)
South West	0.057	0.047	0.050	0.133	0.122	0.123
	(0.0016)	(0.0012)	(0.0013)	(0.0015)	(0.0013)	(0.0013)

Table shows R-squared and standard error from regression of pupil's test score percentile on school dummy variables, by region and year. Test score percentiles are calculated from Local Educational Authority distribution. All coefficients are significant at 1% level.

Table 3 Proportion of schools enrolling any top-5% and bottom-5% ability pupils, 1996-2002

	Community schools			All schools		
	(1)	(2)	(3)	(4)	(5)	(6)
	1996	1999	2002	1996	1999	2002
North East Top 5%	0.912	0.962	0.973	0.928	0.938	0.957
North East Bottom 5%	0.993	1.000	0.982	0.982	1.000	0.986
North West Top 5%	0.900	0.939	0.955	0.864	0.923	0.912
North West Bottom 5%	0.980	0.990	0.990	0.941	0.948	0.935
Yorkshire Top 5%	0.888	0.943	0.930	0.873	0.928	0.908
Yorkshire Bottom 5%	0.988	0.991	0.988	0.968	0.950	0.975
East Mids Top 5%	0.882	0.951	0.974	0.827	0.847	0.881
East Mids Bottom 5%	0.976	0.988	0.993	0.931	0.936	0.933
West Mids Top 5%	0.922	0.957	0.970	0.879	0.907	0.929
West Mids Bottom 5%	0.973	0.976	0.991	0.926	0.920	0.917
East England Top 5%	0.906	0.955	0.964	0.889	0.929	0.916
East England Bottom 5%	0.978	0.978	0.978	0.962	0.952	0.951
London Top 5%	0.953	0.969	0.968	0.873	0.908	0.898
London Bottom 5%	0.984	0.984	0.984	0.903	0.918	0.918
South East Top 5%	0.939	0.948	0.961	0.787	0.795	0.775
South East Bottom 5%	0.987	0.991	0.985	0.877	0.872	0.858
South West Top 5%	0.929	0.966	0.965	0.855	0.900	0.916
South West Bottom 5%	0.973	0.989	1.000	0.905	0.913	0.931

Table shows proportion of schools taking at least one pupil from top 5% and bottom 5% of the distribution of pupil abilities in their Local Educational Authority.

Table 4 Association between school types and within-school inequality in ability

	(1)	(2)	(3)	(4)	(5)	(6)
	Standard deviation 1996	Standard deviation 1999	Standard deviation 2002	Annual change in st. dev.	Annual change in cv (x 100)	Mean 2002
Community (constant)	**27.378**	**27.582**	**27.575**	**0.027**	-0.030	**47.253**
non-selective, non-specialist	-0.049	-0.042	-0.044	-0.010	-0.038	0.197
Selective	**-12.894**	**-13.423**	**-13.614**	**-0.131**	-0.152	**31.223**
	-0.24	-0.231	-0.239	-0.037	-0.067	0.514
Modern	**-4.432**	**-4.773**	**-4.509**	-0.020	0.054	**-11.172**
	-0.161	-0.176	-0.168	-0.028	-0.11	0.536
Voluntary Aided	**-1.204**	**-1.515**	**-1.298**	-0.016	-0.150	**5.745**
	-0.395	-0.396	-0.385	-0.073	-0.184	1.391
Voluntary Controlled	0.584	0.115	0.500	-0.066	0.331	1.032
	-0.329	-0.349	-0.382	-0.071	-0.195	1.248
Foundation	**-0.308**	**-0.501**	**-0.334**	-0.012	-0.011	**1.66**
	-0.103	-0.097	-0.098	-0.018	-0.067	0.399
City Technology Colleges	**-3.631**	**-4.354**	**-3.118**	0.002	0.161	**12.56**
	-0.501	-0.828	-0.726	-0.126	-0.370	2.768
Church of England	0.200	0.385	0.140	-0.006	-0.098	1.449
	-0.368	-0.382	-0.392	-0.069	-0.193	1.359
Roman Catholic	0.805	0.859	0.667	-0.017	0.321	-0.87
	-0.403	-0.404	-0.395	-0.074	-0.190	1.444
Other religion	-0.066	0.017	-0.289	0.018	-0.008	2.301
	-0.276	-0.321	-0.336	-0.056	-0.143	1.02
Beacon	0.103	0.056	0.184	0.018	0.092	**6.115**
	-0.116	-0.109	-0.114	-0.02	-0.064	0.427
Specialist: Technology	0.142	0.143	0.118	-0.002	-0.035	**1.683**
	-0.101	-0.101	-0.100	-0.019	-0.067	0.423
Specialist: Language	0.143	0.215	**0.433**	0.037	**0.275**	**3.96**
	-0.169	-0.146	-0.154	-0.027	-0.093	0.648
Specialist: Sport	0.136	-0.004	0.37	0.046	0.06	1.376
	-0.187	-0.152	-0.168	-0.032	-0.114	0.685
Specialist: Arts	0.315	0.069	0.198	-0.003	0.025	1.996
	-0.188	-0.177	-0.177	-0.032	-0.116	0.791
Number of obs	3168	3137	2948	3208	3208	2952
R2	0.638	0.699	0.713	0.006	0.005	0.5188

Table reports regressions using within-school standard deviation, change in standard, deviation, coefficient of variation or mean of pupil age-11 attainment percentile as dependent variable.
Column 5 reports CV in terms of sd as *percentage* of mean
Regressions are weighted by school size. Robust standard errors in parentheses. Bold underline indicates significance at 1% or better; underline significant at 5% or better
Regressions include only schools classed as Selective, Comprehensive or Modern in the DfES Edubase 2003 data.

Table 5 Association between size and choice indicators and within-school inequality in ability

	(1)	(2)	(3)	(4)
	Standard deviation 2002	Annual change in st. dev.	Annual change in c.v (x 100)	Mean 2002
School intake 1995 (100s of pupils)	0.252	0.000	0.002	3.628
	(0.072)	(0.014)	(0.001)	(0.287)
Number of schools in LEA (coefficient x 100)	-2.538	-0.075	0.003	-4.453
	(0.823)	(0.145)	(0.006)	(3.107)
LEA intake (100s of pupils)	0.010	0.000	0.000	0.019
	(0.005)	(0.001)	(0.000)	(0.019)
Number of schools within 5km (coefficient x 100)	-2.605	0.080	-0.005	-12.696
	(0.444)	(0.096)	(0.003)	(1.715)

Table reports regressions using within-school standard deviation, change in standard, deviation, coefficient of variation or mean of pupil age-11 attainment percentile as dependent variable.
Regressions include all school type dummy variables as in **Table 4**
Column 3 reports CV in terms of sd as *percentage* of mean
Regressions are weighted by school intake size. Robust standard errors in parentheses.
Bold underline indicates significance at 1% or better; underline significant at 5% or better

Appendix A: Construction of the smoothed inverse-cumulative distributions

To construct the inverse cumulative distribution of age-11 attainments ('ability') for region *r* and year *t*, we first extract from our pupil-level data all pupils in school year 6 (age 10-11 at the end of primary school) in year *t*, who move on to attend secondary school in region *r* in year *t*. Consider now the position of a pupil *i* within the distribution of ability in their own year group; this pupil enters secondary school *s* in Local Education Authority zone *z* (within *r*) in year *t* . We define the relative ability of pupil *i* (y_i^{zt}) as his or her percentile position in the distribution of pupil age-11 attainments in zone *z* in year *t*. Now, to set the relative position of school *s* in the ranking of mean intake ability in year *t* we calculate the mean ability of pupils entering each school *s* ($\overline{y}_s^{zt}$). Next, we assign each school *s* to a 50 category intake-ability ranking x_s^{zt} equal to its intake-size-weighted percentile in the regional distribution of school-mean intake ability at time *t*. We then simply the plot the median value of $\overline{y}_s^{zt}$ in each school-intake ability category against x_s^{zt}.[17] The vertical axis representing school-mean intake ability is centred such that zero corresponds to the median school and the horizontal axis is re-scaled from 0-100.

[17] The point of doing this rather exercise than just plotting the standard empirical cumulative distribution function based on school ranks is that our method is less sensitive to outliers in school intake attainment and random fluctuation from year to year in schools with small intakes.

Appendix B

Table 6 Sample sizes in base year

1996	Community schools			All schools		
Region	pupils	schools	leas	pupils	schools	leas
North East	21607	136	12	26344	166	12
North West	43814	303	21	70198	493	22
Yorkshire	38251	248	15	48056	316	15
East Midlands	22360	169	8	36992	289	9
West Midlands	36308	257	14	52781	379	14
East of England	25317	181	10	49534	341	10
London	26016	191	31	53378	401	32
South East	35247	229	18	67320	478	19
South West	25963	183	14	41863	304	16

Appendix C

Factor analysis of pupil age-11 Science, English and Maths tests used to construct the measure of intake ability used throughout the analysis. Example shown is for London, 1996, but other regions give similar results.

Table 7 Factor analysis of pupil test scores, London 1996

Principal factor method, unrotated, number of pupils = 53378				
Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.10085	2.18959	1.1124	1.1124
Factor2	-0.08874	0.03484	-0.047	1.0654
Factor3	-0.12357	.	-0.0654	1
Regression scoring coefficients for Factor 1				
Variable		Coefficients		
English test percentile		0.25451		
Maths test percentile		0.35300		
Science test percentile		0.40618		

Appendix D

Figure 3 Bootstrap 95% Confidence interval on inverse-cumulative distribution, London, 1995

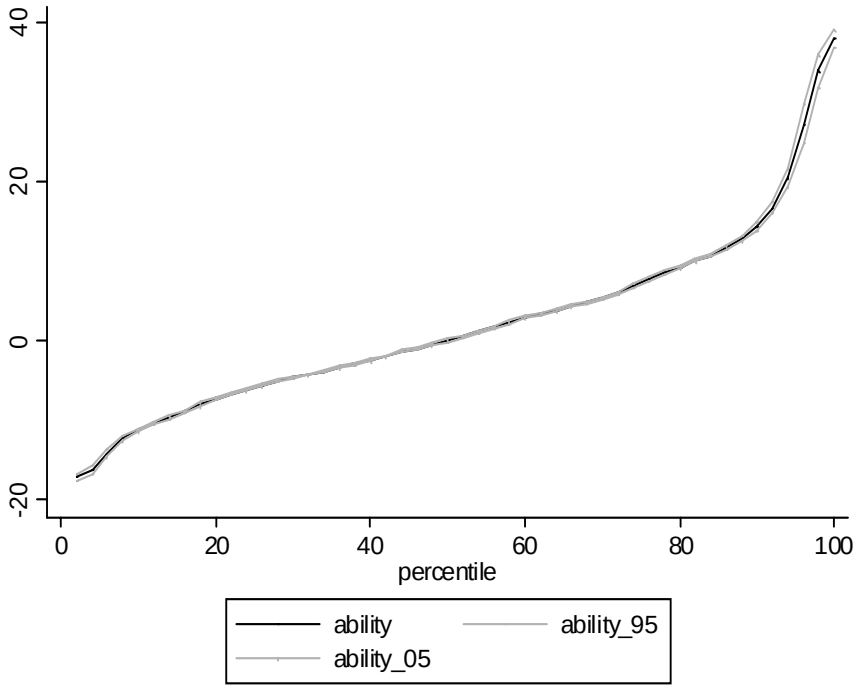

Figure shows the inverse cumulative distribution of intake ability for all schools in London (as in **Figure 1**), alongside 95% confidence interval (light grey) derived by bootstrap estimation using 100 repetitions.

Appendix E

Table 8 Cell sizes for school types in Table 4

	(1) 1996	(2) 1999	(3) 2002
Community	2055	2022	1881
Selective	163	164	161
Modern	185	182	178
Voluntary Aided	508	510	500
Voluntary Controlled	89	89	78
Foundation	502	503	484
City Technology Colleges	14	14	15
Church of England	140	142	134
Roman Catholic	346	342	332
Other religion	185	186	182
Beacon	277	275	265
Specialist: Technology	354	355	326
Specialist: Language	126	126	118
Specialist: Sport	97	97	89
Specialist: Arts	87	88	86

Table shows numbers of schools in each school type year cell, corresponding to the regression results in Table 4