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Acknowledgments

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Executive Summary

In the UK, there is a marked gender gap in the educational attainment of boys and girls. At the end of compulsory education, 10 per cent fewer boys achieve 5 or more good GCSEs. This gap is by no means confined to GCSE. It is evident at all Key Stages. Furthermore, some indicators suggest that the gap has widened over time.

In this paper, we document the evolution of the gender gap at various stages of compulsory education in England. We consider the importance of some possible explanations for the gender gap – in particular, factors that may explain the observed changes over time. Analysis of this issue is important in the context of research on the gender wage gap. However, it also raises policy-relevant issues in relation to whether changes in the school system can effect a change in the gender gap in educational achievement.

We find that it is in secondary school, rather than primary school, where the gender gap has widened most noticeably over time. Controlling for attainment at the end of primary school makes very little difference to the measured gender gap at age 16. We consider the potential role of school based factors: school inputs; teaching practice; and the examination system. We show that the average gender differential cannot be explained by factors that vary across schools (i.e. it cannot be attributed to heterogeneity across schools in how they use inputs). However, this does not mean that teachers cannot influence the gender gap in attainment. We show that the introduction of the 'literacy hour' and 'numeracy hour' in primary schools made a difference to the gender gap in English and Maths respectively at Key Stage 2. However, these strategies are too recent to have made an impact on the gender gap observed in secondary school. The timing of the emergence of the gender gap in secondary school coincides with the change in examination system from O-levels to GCSEs. We argue that the importance of coursework in the GCSE examination is likely to be a key explanation for the emergence of the gender gap at age 16. Another very important explanation may be a gender differential in skills that are taught and tested in different types of system (as well as the mode of assessment).

We also consider the potential role of social and economic changes that would influence the relative achievement of boys and girls at age 16. However, the most compelling explanation to explain the specific timing of the gender gap at this age in the England comes from the change in examination system. Taken together with the

evidence on the literacy and numeracy strategies, this shows that education policy can most definitely have an impact on the gender gap in achievement, whether this is intended or not.

1 Introduction

Major controversy surrounds examination performance in recent times. The lower educational achievement of boys relative to girls has received a great deal of publicity, in particular following publication of results from General Certificate of Secondary Education (GCSE) examinations that children take at the end of their years of compulsory education. There is currently a sizable 'gender gap' of 10.2 percentage points between girls and boys who achieve five or more GCSEs at grades A*-C. This has been deemed 'unacceptable' by the government and some commentators have suggested that the government's performance targets will not be met if solutions are not found.

The gender gap in educational achievement is neither a new problem nor one confined to achievement at GCSE. There is evidence that, in most subjects, the average performance of girls now exceeds that of boys at all levels of education. International studies such as PISA suggest that a 'gender gap' in attainment is also an issue in other countries (OECD, 2004)[2] and in the US women have been consistently more educated than men since the mid-1970s (Charles and Luoh, 2003; Freeman, 2004). As will be shown later in this paper, some indicators suggest that this problem has become worse over time in the UK (although this is in the context of an overall improvement in achievement for boys and girls). An important caveat in this debate is that GCSE (or indeed any other measure of achievement) does not fully measure the 'gap' in human capital between boys and girls, but rather a gap at compulsory school leaving age which is also coupled with those aspects of achievement that are deemed important by the education and examination system (which can also change over time).

Many explanations have been put forward for the existence of a gender gap in achievement. In the national press, explanations for the comparatively low performance of boys include 'too much time watching football', an 'anti-learning laddish culture', the 'teachers in the classroom, the school and the organisation'.[3] There is a large educational literature about the role of school characteristics (such as whether the school

[2] The OECD study shows that girls had 'significantly higher average performance' in reading in all but one of the 40 countries included in the analysis. However, in most countries, boys out-perform girls in Maths.
[3] BBC News Online, 22 August 2002, 'Addressing the Gender Gap'.

is single-sex) and modes of assessment.[4] There are several papers in the economic literature, most of which deal with gender differences in post-compulsory educational outcomes.[5] As noted by Gorard *et al.* (2001), few studies deal with the evolution of the gender gap over time.

In this paper, we analyse changes over time in the gender achievement gap for school age children in England at different stages of compulsory education, particularly at the end of primary school (age 11) and at the end of compulsory education (age 16). We consider the importance of some possible explanations for the gender gap – in particular, factors that may explain the observed changes over time. Analysis of this issue is important in the context of research on the gender wage gap. However, it is also raises policy-relevant issues in relation to whether changes in the school system can effect a change in the gender gap in educational achievement. The implication of a gender gap at compulsory education is that it may persist to later stages of education and subsequently into the labour market. In fact, in the last few years, female participation in higher education has risen (and from a higher base) in comparison with male participation.[6]

The structure of the paper is as follows. We first discuss the most recent statistics for England, showing the gender gap at each stage in the education system (Section 2). We then describe how the gender gap has evolved over time in primary and secondary schools using two birth cohort studies and more recent administrative data (Section 3). We also examine (in 'value added' models) whether the gender gap has changed at the end of secondary school conditional on achievement at the end of primary school. Then we provide some empirical evidence for the role of factors that influence the gender gap: school inputs; teaching practice; the examination system (Section 4). We then discuss the role of non-school based factors (Section 5) and draw together conclusions (Section 6).

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[4] There are a number of good reviews such as Gipps and Murphy (1994); Powney (1996); Arnot *et al*. (1998).

[5] In the UK, examples are McNabb *et al.* (2002) and Smith and Naylor (2001). Burgess *et al.* (2004) and Gorard *et al*. (2001) consider gender differences in educational achievement at school in England and Wales respectively. See Jacob (2002) and Charles and Luoh (2003) for the US.

[6] The 'higher education initial participation rate' for English domiciled first-time entrants (full and part time) to Higher Education Courses in 1999/2000 was 38% for men and 43% for women. In 2003/04, the statistics were 38% for men and 47% for women.
http://www.dfes.gov.uk/rsgateway/DB/SFR/s000572/index.shtml

2 The Gender Achievement Gap at School: The Current Situation

National statistics for 2004 reveal the extent of the gender gap in student achievement through the education system. The eleven years of compulsory education in England are divided into 4 'Key Stages' for different age categories: age 5-7; age 7-11 (the end of primary school); age 11-14 and age 14-16. After each Key Stage, there is a national examination, which is externally set and marked. The government has targets associated with the percentage of children expected to meet a required standard (as set out in the National Curriculum).

In Table 1, we show the percentage of children achieving the government target at the end of Key Stage 1 (age 7); Key Stage 2 (age 11) and Key Stage 4 (the GCSE examination at age 16). The gender gap is shown overall and also for disadvantaged pupils (i.e. pupils eligible for free school meals – FSM) and for pupils who speak English as a second language. This is based on administrative data for all school children in England.

Table 1 shows the gender achievement gap to be evident throughout the school years, particularly in reading and writing from the age of 7 onwards. It is also visible in maths, though the differential is much lower. At GCSE, headline statistics relate to the percentage of pupils attaining 5 or more GCSEs at grades A*-C. As discussed above, the gender differential is substantial, at 10 percentage points. There is also a gender gap at the lower end of the distribution – the percentage of children leaving school without any qualifications at all. This applies to 5 per cent of 16 year old boys and 3 per cent of 16 year old girls, a gap of 2 percentage points.

For children who speak English as an additional language, the percentage of children reaching government targets at each stage is lower. However, this is equally true for boys and girls as the gender gap for these pupils does not diverge from the average. Poverty (as indicated by free school meals) appears to be a greater source of disadvantage than language difficulties in terms of whether children achieve government targets at each stage of education. Furthermore, in most cases, the gender differential widens: in terms of educational achievement, there is a greater penalty for being a boy if he is part of a low income household. It is very notable that despite substantial investment in education and efforts to help pupils in disadvantaged areas, as many as 10.2 per cent of boys from low income households still leave school without

any qualifications whatsoever. This applies to 7.3 per cent of girls. The gender gap of 2.9 percentage points is double the national average.[7]

3 Evolution of the Gender Achievement Gap Over Time

3.1 Data on achievement over time

We now consider the evolution of the gender gap over time at the end of primary school (age 11) and at the end of compulsory education (age 16). We use a range of measures so as to enable analysis over a long period, focusing on the average gender gap in each case. For earlier periods, we use data from the two best known birth cohort studies: the National Child Development Study (NCDS) and the British Cohort Study (BCS), longitudinal data sets of all people born in a particular week of March 1958 (NCDS) and April 1970 (BCS).[8] With regard to more recent years, we use administrative data sets for all pupils in the country (the National Pupil Database, NPD). In all data sets, there are tests in reading and maths at a similar age (10 or 11). We convert marks to a percentile score and consider the raw gender differential and how this has changed over time. We then show the evolution of the gender gap in public examinations at age 16 using these data sets. We examine whether controlling for prior achievement can help to close the gender gap observed at age 16.

It is important to note that the nature of education and assessment has changed over time – in particular following the change in public examinations in 1988 (which will be discussed in Section 4.3 in some detail). Therefore it is difficult to make fully precise statements about trends over time. However, a clear picture emerges from analysis of this range of measures: girls outperform boys (especially in English). There has been no tendency for these differences to disappear over time – if anything, the gaps seem to be widening.

[7] This compares to a gender gap among 'non-FSM' students of 1.1 percentage point (favouring girls). The number of boys on free school meals is 41,756 (14% of the total number of boys in maintained schools in England).

[8] Both the NCDS and the BCS are nationally representative in terms of results attained in public examinations. We show some relevant statistics in Appendix 1. However, there is a problem with the BCS in that there was a teacher's strike at the time of the age 16 survey. Hence the analysis relying on the BCS is not as reliable as that coming from the NCDS or the NPD.

3.2 Primary schools

In Table 2, we show the gender differential at the end of primary school over time using the data sets described above. We report the average gender differential for maths and reading for this age group in 1969, 1980, 1996 and 2003. With regard to maths, traditionally there has been a small gender gap in favour of boys. The magnitude has fluctuated between .79 and 2.71 percentile points on average over the four time periods. The gender gap is far more pronounced for reading – and this favours girls. On average, there was an increase over the first three time periods, moving from a differential of .44 percentile points (and not statistically significant) to 4.06 in 1980 and 8.96 in 1996. In the most recent time period (2003), the gap has reduced to 6.79 percentile points.

3.3 Secondary schools

In Table 3, we show how the gender gap has evolved at age 16 using the following indicators: whether the student obtained 5 or more A*-C grades in public examinations at age 16 and whether he/she obtained an A*-C grade in maths and English respectively. It should be borne in mind that there have been increases over time in all these indicators of achievement for both boys and girls. This is shown in Appendix 2. Figure 1 (discussed in Section 4.3) shows the percentage of boys and girls who obtain 5 or more grades at A*-C in each year since 1975. There was a change in the examination system in 1988, which has important implications for the interpretation of the gender gap (see Section 4.3).

Across all three indicators, there have been marked changes over time which favours girls. The overall measure of performance (5 or more A*-C grades) was small in the 1969 (two percentage points), negligible in 1980 and highly pronounced in 1998 and 2003, where it was 9.7 percentage points (favouring girls) in both periods.

With regard to maths, the gender differential favoured boys in 1974 (3 percentage points) and 1986 (6.8 percentage points). In 1998, the gap favoured girls – they were more likely to get an A*-C grade by 1 percentage point. By 2003, this had risen to 1.7 percentage points.

There has always been a strong differential in English which favours girls. There is small difference between the NCDS and the BCS, where the gap was 9 and 7.2 percentage points respectively. By 1998, the gap had more than doubled to 16.1 percentage points. It was slightly lower in 2003, at 15.4 percentage points.

One question is to what extent these patterns are sensitive to differential entry to the examinations – especially bearing in mind that participation was much lower in the earlier cohorts (NCDS and BCS). In general, results are very similar to those reported in Table 3 if the reference group is the whole birth cohort. The one important difference applies to the BCS where the coefficient on achievement in maths reduces from 0.068 to 0.002, suggesting that the gender differential in maths at this time is mainly driven by differential selection into the examination.[9]

The next question we consider is whether these differentials are reduced when achievement at age 11 is taken into account. This will be the case if the gender gap at this age explains most of the gender gap observed at the end of secondary school. Results are shown in Table 4. With regard to the overall measure of performance (5 or more A*-C grades), there is very little difference. In the most recent year, the gap closes by 1 percentage point. In maths, the gap closes by over half if we consider the NCDS (to 1.9 percentage points) but widens in the most recent cohort (to 2.3 percentage points). This shows that while in the past much of the gender gap in this subject could be explained by a differential emerging by the age of 11, in more recent times the gap widens during secondary school. In English, the gap widens slightly in earlier cohorts and reduces slightly in later cohorts. Even controlling for prior achievement, the gap is sizeable in each period.

Overall, the gender gap is little changed after taking account of prior achievement. This suggests that it cannot be dealt with simply by addressing what gives rise to the gender gap in primary school (and before that). The early teenage years are vitally important in explaining the observed gender gap at age 16. We now consider some possible explanations and remedies.

4 Possible School-Based Explanations for the Gender Achievement Gap

4.1 School inputs

One possibility is that the gender gap at a point in time (or changes over time) might be explained by differences between schools in terms of resources, gender mix, teachers (and gender of teacher) etc. According to a review by Arnot *et al.* (1998), attempts over

[9] Other differences are as follows: for the NCDS, the gender differential in maths and English changes to 0.029 and -0.075 respectively. For the BCS, the gender differential in 5+ A*-C grades changes to -0.023.

the last two decades to show that one system of school organisation is more effective than another have not yielded much fruit. They report that very little work has focused directly on the question of whether some schools are more effective for one sex or the other. Burgess *et al.* (2004) examine this question using the National Pupil Database. They compare the gender differential across different types of school in terms of good or poor performance, gender mix, admissions policy and percentage of pupils eligible for free school meals. They find that the gender gap is not affected by any of the leading observable school characteristics.

However, it is possible that the gender gap may be affected by a combination of observed and unobserved characteristics of schools or pupil intakes that vary across schools. To examine this possibility, we use the National Pupil Database for two adjacent years (2002 and 2003) and we examine whether the gender gap is reduced when one removes the effect of time constant school characteristics (through the inclusion of school fixed effects) and prior achievement of the student. This is reported below in Table 5, where we show the gender differential without controlling for school fixed effects (row 1) and controlling for school fixed effects (row 2). Although there are small differences between these sets of results, there is little change in the gender gap. Hence the average differential cannot be explained by factors that vary across schools. This should not be interpreted as suggesting that there is nothing schools can do to reduce the gender gap. Rather, these results suggest that variation between schools in what they do is not the factor which gives rise to the observed gender gap. One possibility is that teaching strategies might mitigate against factors giving rise to the gender gap.

4.2 Teaching practice

Researchers often point to differences in the personal characteristics of boys and girls that may explain the gender differential in achievement. Salisbury *et al.* (1999) suggests that girls and boys prefer to learn in different ways and that boys get bored more readily as their levels of concentration are lower and organisational skills poorer than girls. Jacob (2002) points to poor 'non-cognitive' skills among boys including inability to pay attention in class, to work with others, to organise and keep track of homework or class materials and to seek help from others. He finds such non-cognitive skills to be a very important reason for gender differences in college attendance rates in the US. He states that it would be interesting to know whether certain school characteristics foster the

development of such skills and if certain types of curriculum, pedagogy or learning environments are more effective for one gender than the other.

There has been much interest in the effect of strategies such as single-sex teaching (e.g. Younger and Warrington, 2003), although reviews of this literature point to no conclusive evidence that single-sex schooling is better than co-educational schooling (Elwood and Gipps, 1999; OfSTED, 2003).[10] Other strategies suggested to deal with gender differences in performance include mentoring and role-modelling (West and Pennell, 2003) and grouping arrangements (Francis *et al*. 2002). In terms of large-scale changes in teaching practice that may help to explain observed changes in the gender gap since the late 1990s, the National Literacy and Numeracy Strategies may be important. One might expect the highly structured method of teaching introduced as a result of these strategies ('the literacy hour'; 'the numeracy hour') to help deal with low 'non-cognitive' skills among boys. Indeed, the School Inspectorate for England reports that boys often respond better to lessons that have a clear structure (OfSTED, 2003). The School Inspectorate in Wales reports that boys are more likely to respond negatively to poor teaching through disengagement and indifference or through disruptive behaviour (OHMCI, 1997). Hence it might be thought that the 'literacy hour' and 'numeracy hour' would be particularly beneficial for boys. These strategies aim to raise standards of literacy and numeracy in primary schools by improving the quality of teaching through more focused instruction and effective classroom management. Key components are a *framework for teaching*, which sets out termly teaching objectives for the 5-11 age range and provide a practical structure of time and class management for a daily literacy and numeracy hour. Before the introduction of the National Strategies, they were introduced into a subset of Local Education Authorities (LEAs) in the context of the National Literacy Project and the National Numeracy Project. The 'literacy hour' was introduced to particular LEAs between September 1996 and 1998 (when the policy was rolled out nationally). The 'numeracy hour' was set up within different LEAs between September 1996 and 1999 (when the policy was rolled out nationally).[11]

[10] Looking at the NPD (2003), the gender gap between boys and girls in terms of the percentage obtaining 5 or more GCSEs is lower in single sex schools (6%) than in mixed schools (8%), after controlling for prior attainment at Key Stage 2. However according to Burgess *et al.* (2004), there is a high degree of collinearity between 'single sex' status and whether the school is a grammar school. Furthermore, there may be differential selection into single sex schools according to other pupil characteristics. Hence, a lower gender gap given entry into a 'single sex' school is not evidence of the efficacy of single sex teaching.

[11] The literacy hour and numeracy hour were introduced in different schools in the context of the National Literacy Project (1996-98) and the National Numeracy Project (1996-99). They are largely within

Machin and McNally (2004) explain the details of the 'literacy hour' and its evaluation in some detail. In brief, we aim to see whether the 'literacy hour' and 'numeracy hour' had a differential impact by gender by comparing schools where the respective strategies were introduced before the national roll-out relative to similar schools where they were not introduced. We implement a 'difference-in-differences' strategy since we compare treatment and control schools before and after the respective policies were introduced.[12] The 'policy on' years are school years 1996/97 and 1997/98 and the 'policy off' year is 1995/96.[13] The regressions control for a range of school characteristics and school fixed effects.

In Table 6, we report the 'difference-in-difference' coefficient for the National Literacy Project (NLP) and National Numeracy Project (NNP) respectively. There are four outcome variables. With regard to the NLP, they are as follows: the probability of attaining the required standard or above at age 11 ('level 4') in English and the percentile score in reading. For the NNP, they are the probability of attaining the required standard or above in maths and the percentile maths score.

The results show that both strategies were effective for boys and girls. However the magnitude of the impact is greater for the gender that is generally weaker in a particular subject. Hence with regard to English, the 'literacy hour' had a greater relative impact on boys, raising the probability of attaining the required standard by 4.2 percentage points (compared to 2.1 percentage points for girls) and the reading score by 3.412 percentile points (as compared to 1.781 for girls). In contrast, the 'numeracy hour' had a greater relative impact on girls, raising the probability of attaining the required standard in maths by 3.8 percentage points (compared to 2.5 percentage points for boys) and the maths score by 2.135 percentile points (compared to 1.969 for boys). Although these results are consistent with the idea that the 'literacy hour' in particular is helping to mitigate against the poor non-cognitive skills of boys, they are also consistent with a more general explanation: whatever the reasons for the differential performance of boys and girls in maths and English, a better way of teaching these subjects disproportionately helps the weaker student: traditionally boys have been weaker in

different LEAs (a deliberate policy). Furthermore, it was intended that non-participating LEAs would not learn about these Strategies (at least not formally).

[12] Control schools are in LEAs that are geographically adjacent to schools in treatment LEAs, with a similar prior educational performance. See Machin and McNally (2004) for further details.

[13] Although we could have used one more 'policy on' year for the NNP, we know that many schools implemented the 'numeracy hour' the year before the national roll-out (as discussed with John Stannard, former director of the National Literacy Project and National Literacy Strategy).

English and a little stronger in maths at age 11. With regard to changes in the gender differential between 1996 and 2003 (observed in Table 2), the introduction of these national strategies are consistent with the narrowing of the gender gap with respect to reading and the widening of the gender gap with respect to maths at age 11.

4.3 The examination system: O-levels to GCSEs

Although the literacy and numeracy strategies may help to explain changes in the gender differential over time at primary school, they are too recent to impact on the gender gap at secondary school that widened so dramatically between 1986 and 1998. A vital clue as to the possible explanation can be obtained by observing the whole time series of achievement at age 16 from the mid-1970s to the present time. In Figure 1, we show (by gender) the percentage of students achieving 5 or more A*-C grades in the examination at age 16.

The gender gap in this measure of achievement was very slight or non-existent between 1975 and 1987. From 1988, there was a divergence, which quickly increased and then subsequently displayed very little variation. The National Curriculum was introduced by the 1988 Education Reform Act (which reduced the scope for specialisation in particular subjects). This was also the year in which the GCSE examination (General Certificate of Secondary Education) replaced O-levels (the General Certificate of Ordinary Education). As described by Gibbs and Murphy (1994), this reform involved a number of important changes. Importantly, there was a move away from measuring performance in relation to peers to 'criterion-based assessment'. This ended rationing of the top grades. Many more pupils were entered for GCSE than they were for O-levels.[14]

Given the timing of the change in the gender gap, it seems reasonable to infer that the change in examination system was a major contributory factor. One of the consequences was the enhanced role given to coursework (i.e. continuous assessment by teachers) in the GCSE system. Initially, the weighing of the continuous assessment component varied from 20 to 100 per cent depending on the subject and on the syllabus offered by the centres responsible for the GCSE examination. The permissible weight

[14] Together with the introduction of the National Curriculum, this may explain why the differential entry by gender into Mathematics has reduced over time. For example, for those entering the exam in 1974 (i.e. in the NCDS survey), 33% of boys entered the Maths exam compared to 27% of girls. The equivalent numbers for 2003 (from administrative data sets) are 97.4% for boys and 97.8% for girls.

given to the continuous assessment component has reduced over time. The coursework is marked by the teacher of the pupil and moderated by someone external to the school.

The importance of coursework in the GCSE examination is likely to be a key explanation for the emergence of the gender gap at this time. Powney (1996) cites a number of studies showing that the mode of assessment is a factor explaining the differential performance of boys and girls. They show that boys tend to be favoured by multiple choice questions and girls by essays and coursework.[15] In the present context, Stobart *et al.* (1992) find a direct relationship between the relative improvement in girls' achievement and the weighting and type of coursework required in different subjects for GCSE between 1988 and 1990. It is more difficult to identify the reasons for this. Gibbs and Murphy (1994) cite evidence showing that females do less well in timed examinations due to higher levels of anxiety.

However, it is unlikely that the relative advantage of girls in the GCSE system was entirely driven by the coursework component. According to Elwood (1995), the gender gap did not reduce in parallel with the restriction of the coursework component to 40 per cent of the overall score for English from 1994 onwards. However, she suggests that both the examination and coursework material in GCSE English emphasises aspects of the subject where girls are more proficient - large amounts of extended writing 'may be putting boys at a disadvantage, but this is compounded by boys' own devaluation of the subject'. Also, coursework is a relatively small component in GCSE Maths, but the syllabus in GCSE is very different to that for O-levels. Hence an important reason for why a gender gap might emerge to coincide with a change in the examination system is a gender differential in skills that are taught and tested in different types of system (as well as the mode of assessment). This implies that an apparent gender gap can emerge in measured outcomes, whereas there might be no change if boys and girls were tested over time using the same mode of assessment and based on the same syllabus. Yet, even in this case the phenomenon would be of substantive interest since performance at GCSE matters for what students go on to achieve in the education system and in the labour market. In Appendix 3, we show the evolution of the gender gap at A-level (i.e. school leavers with 2 or more A-levels as a

[15] With regard to performance in multiple choice, this is often attributed to less willingness on the part of girls to guess, preferring to respond only where they are confident (Powney, 1996).

percentage of the 17 year old population).[16] The emergence of a gender gap favouring girls at A-level is consistent with the hypothesis that transition to the GCSE system had consequences for subsequent educational outcomes.

5 Relevance of Non-School Based Factors

There are many other factors that may be relevant in explaining the gender gap at a point in time or its evolution over time. In an economic, Becker-type model, the education of children is viewed as a family investment (Haveman and Wolfe, 1995). The essence of such models is that children begin life with 'inherited ability' and parents make subsequent investments, influenced by preferences, income and fertility. A question arising from this is whether factors influencing parental investment decisions have changed over time in a way to affect the gender differential in educational achievement. Possible candidates are (1) the rise of women's education over time – and hence a change in the human capital of mothers; (2) the rise in household income over time. With regard to the former, the social and cultural changes over recent decades that have changed women's participation in the labour force and the incentive for women to obtain education might impact more strongly on their daughters than on their sons, since it may change the daughter's expectation of her own future and the preference of mothers for investing in their daughters' education. With regard to the second issue, a rise in household income might be expected to increase investment in the education of sons and daughters. Blanden *et al*. (2005) show that the relationship between income and education has become stronger over time in the UK. Whether this change impacts more strongly on sons or daughters depends on factors such as the mechanism giving rise to the higher income (e.g. which parent receives the income) and household preferences regarding investment decisions.

To investigate the importance of such issues, we examine how the gender gap changes for the NCDS and BCS cohorts when controls for parental education and parental income are included (Table 7). In both cases, there is almost no change in the

[16] A-levels are the academic qualifications that students may pursue after they obtain their qualifications for GCSE/O-levels (and examinations are held two years later). In most cases, students must obtain the equivalent of at least two A-levels to proceed to higher education.

gender gap.[17] This is also the case when one uses more recent data (as reported in Appendix 4, using the General Household Survey).

However, there are other studies that suggest an important role for economic factors in explaining the gender differential in educational achievement. For example, Jacob (2002) shows that that higher wage returns are an important reason for the college attendance gap between men and women in the US. Charles and Luoh (2003) show that the anticipated dispersion of future wages is important in explaining gender differences in completed years of schooling in the US. Although such factors are used to explain variation in educational decisions at a later stage – post-compulsory schooling decisions – it is entirely possible that such considerations affect achievement prior to school-leaving. UK evidence shows that the wage returns to educational qualifications are higher for women than for men. Machin (2005) shows that the average wage return to degree-level qualifications increased faster for women than for men from 1985 to 1990. However, from 1990 onwards, the average return to a degree changed very little for women, whereas this continued to rise for men. It seems likely that wage returns to qualifications affect the incentive for boys and girls to work hard at school – though it is harder to believe (especially given Fig. 1) that the timing of the change in the gender achievement gap at age 16 is related to contemporaneous trends in the wage return to qualifications.

6 Conclusions

Girls now outperform boys in most subjects at all stages of compulsory education in England. The relative under-performance of boys is raised time and again as a serious policy concern. Questions arise as to what caused the gender gap and whether there is any role for policy in advocating methods to reduce it.

We show how the gender gap has evolved over time in English schools at the end of primary and secondary education. With regard to primary school, the more important change over time has been in reading, where the gender gap favouring girls is more pronounced than it was in the past. However, the gap reduced between the mid-

[17] Of course, parental education and income are important determinants of GCSE performance themselves, but this is true for both boys and girls, and thus they do not explain the existence of gender achievement gap.

1990s and the present. The gender gap in secondary schools has displayed greater change over time. This has been particularly dramatic for the overall indicator of performance (whether the student obtains 5 or more grades at A*-C). It is also true for specific subjects in secondary school: the relative performance of boys used to be higher in maths - now the opposite is true; girls always performed better in English than boys, but the gender differential has doubled since the mid-1980s. Furthermore, across all indicators, the gender gap at age 16 is not strongly influenced by whether or not we take account of prior achievement at age 11. This suggests that causes of the gender gap (and possible solutions) should not be thought of only in relation to young children. From this analysis, it appears that the explanation for changes in the gender gap over time is to be found in the teenage, secondary school, years – and not in early experience at school or at home.

We consider some possible explanations for the gender gap. We find that variation in school-level characteristics in secondary schools across England cannot be used to explain the average gender differential in achievement. This does not mean that school practices are unable to address gender-specific learning difficulties. We show that both the National Literacy and the National Numeracy Strategies have had a differential impact by gender. The impact of these highly structured methods of teaching literacy and numeracy has been greater on the gender that is traditionally weaker in a particular subject. Hence, the 'literacy hour' had a more positive impact on boys whereas the 'numeracy hour' had a stronger impact on girls. The evidence presented here is consistent with the argument that these strategies have influenced the observed trend in the gender differential at age 11 in recent years.

These strategies are too recent to have had an impact on trends in the gender achievement gap at age 16. It is very notable that the change in the gender gap at age 16 coincides exactly with the introduction of the GCSE examination. This seems likely to be the primary factor responsible for changes in the gender gap since 1988. There is evidence to suggest that the importance of coursework in the GCSE exam is a reason for the high relative performance of girls. It may not be the only reason – other factors could include assessor bias or a gender differential in skills that are rewarded by assessment in GCSE.

Finally, one might think that large social and economic changes which affect girls and boys differently would influence their relative achievement at age 16. For example, the large increase over time in the education and labour market participation

of mothers might be important. However, including controls for parental education and income does not help to explain the gender gap in educational achievement. Other studies point to the importance of relative wage returns in explaining gender differentials in post-compulsory education. It is likely that such considerations could also be relevant for influencing the incentive to work hard at school. But trends over time in relative wage returns are unlikely to explain the specific timing of the emergence of the gender gap in educational achievement at age 16. The most compelling evidence for this comes from a change in the examination system. Taken in conjunction with the evidence from the literacy and numeracy strategies, it is therefore evident that education policy can have the potential (whether intended or unintended) to impact upon the achievement gap between boys and girls.

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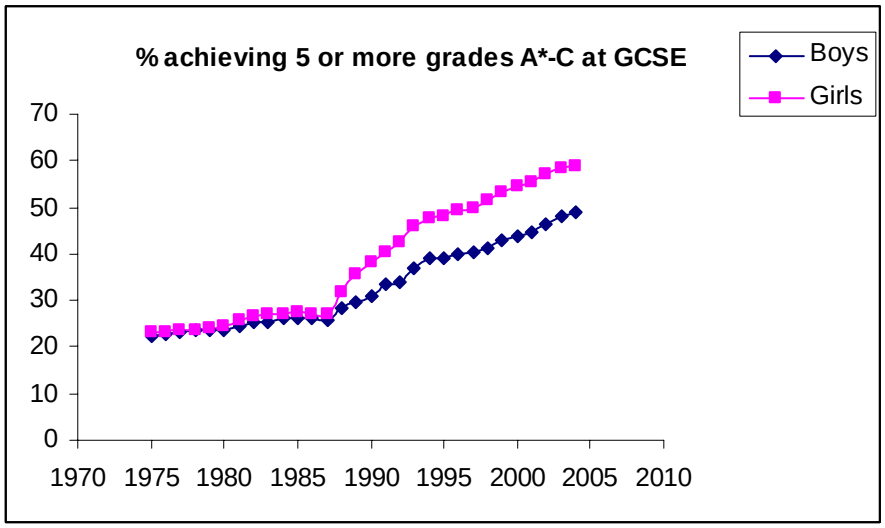
Figure 1 Percentage of students achieving 5 or more A*-C grades



Source: Department for Education and Skills

Table 1 Gender Differences in Achievement: National data, 2004

	Gender Gap			Gender Gap for pupils who speak English as a second language			Gender Gap for pupils eligible for Free School Meals		
	Boys	Girls	Gender Gap	Boys	Girls	Gender Gap	Boys	Girls	Gender Gap
Key Stage 1 (age 7)									
% achieving target in Reading	81	89	-8	75	82	-7	64	76	-12
% achieving target in Writing	76	87	-11	70	81	-11	58	74	-16
% achieving target in Maths	89	91	-2	84	87	-3	78	82	-4
Key Stage 2 (age 11)									
% achieving target in English	72	83	-11	65	76	-11	51	66	-15
% achieving target in Maths	74	73	1	68	67	+1	55	55	0
GCSE (age 16)									
5 or more grades at A*-C	47	57	-10	45	57	-12	22	30	-8
No qualifications	5	3	2	5	3	2	10	7	3

Source: Department for Education and Skills

Table 2 Gender Differences in Achievement at the End of Primary School

	Percentile Gaps (Boys Relative to Girls)			
	NCDS Age 11 in 1969	BCS Age 10 in 1980	KS2 Age 10/11 in 1996	KS2 Age 10/ 11 in 2003
Maths	.79 (.49)	2.65 (.53)	1.24 (.08)	2.71 (.07)
Reading	-.44 (.49)	-4.06 (.51)	-8.96 (.08)	-6.79 (.07)

Notes: Standard errors in parentheses; Sample sizes are NCDS Maths 14129, NCDS Reading 14133, BCS Maths 11706, BCS Reading 12775, KS2 1996 Maths 564538, KS2 1996 Reading 560262, KS2 2003 Maths 645998, KS2 Reading 622830.

Table 3 Gender Differences in Achievement at the End of Secondary School

	Gaps in Proportion Achieving Qualification Level (Boys Relative to Girls)		
	5+ A*-C grades	Maths A*-C grade	English A*-C grade
(1) 1974 NCDS	-0.018 (0.006)	0.042 (0.006)	-0.090 (0.007)
(2) 1986 BCS	0.009 (0.011)	0.068 (0.011)	-0.072 (0.012)
(3) 1998 NPD	-0.097 (0.001)	-0.010 (0.001)	-0.161 (0.001)
(4) 2003 NPD	-0.097 (0.001)	-0.017 (0.001)	-0.154 (0.001)

Notes: Standard errors in parentheses; Sample sizes are (1) 14331 (2) 6949 (3) 551,046; 528780; 521497. (4) 600,522; 586218; 578965.

Table 4 Gender Differences at the End of Secondary School: Value Added Model

	Gaps in Proportion Achieving Qualification Level (Boys Relative to Girls) Conditional Upon Key Stage 2 Performance		
	5+ A*-C grades	Maths A*-C grade	English A*-C grade
(1) 1974 NCDS	-0.021 (0.004)	0.019 (0.003)	-0.113 (0.007)
(2) 1986 BCS	-0.008 (0.011)	0.053 (0.012)	-0.098 (0.013)
(3) 2003 NPD	-0.087 (0.001)	-0.023 (0.002)	-0.140 (0.001)

Notes: Probit regressions. Marginal effect on dummy for boys reported; Standard errors in parentheses; Sample sizes are (1) 14331 (2) 6949 (3) 600,522; 586218; 578965.

Table 5 Gender Differences at the End of Secondary School: Controlling for School Inputs and Value Added

	Gaps in Proportion Achieving Qualification Level (Boys Relative to Girls) Conditional Upon Key Stage 2 Performance		
	5+ A*-C grades	Maths A*-C grade	English A*-C grade
(1) 2003 and 2002 KS Data	-0.070 (0.001)	-0.014 (0.001)	-0.117 (0.001)
(2) As (1) School fixed effects	-0.072 (0.001)	-0.011 (0.001)	-0.125 (0.001)

Notes: OLS regressions. Coefficient on dummy for boys reported; Standard errors in parentheses (clustered at school level in row 2); The sample sizes are 1190237; 1156903; 1141296. Controls for reading score, age 11, maths score, age 11, missing variable dummies for Maths and English and year dummy.

Table 6 The Role of Teaching Strategies

	Boys	Girls
(1) Proportion Level 4 or above		
Literacy hour	0.042 (0.012)	0.021 (0.011)
Numeracy hour	0.025 (0.010)	0.038 (0.011)
(2) Percentile score		
Literacy hour	3.412 (0.741)	1.781 (0.752)
Numeracy hour	1.969 (0.630)	2.135 (0.658)

Notes: OLS regressions. Standard errors (clustered on school) in parentheses; all specifications include year dummies; a range of school characteristics; school fixed effects (interacted with gender). Sample sizes are 104608 for the 'literacy hour' and 140537 for the 'numeracy hour'. See Machin and McNally (2004) for a detailed explanation of the data and methodology with regard to the 'literacy hour'. Analysis for the 'numeracy hour' is done in a similar way using the same set of controls. The treatment and control groups of schools are different for the 'literacy hour' and the 'numeracy hour'.

Table 7 Gender Achievement Gaps and Parental Education and Income

	5+ A-C O Levels (Boys Relative to Girls)	
	NCDS Age 16	BCS70 Age16
(1) Basic Value Added Specification	-.021 (.004)	-.008 (.011)
(2) (1) Plus Parents' Education	-.020 (.004)	-.011 (.011)
(3) (1) Plus Parental Income	-.018 (.004)	-.008 (.014)
(4) (1) Plus Parents' Education and Parental Income	-.018 (.004)	-.010 (.014)

Notes: Standard errors in parentheses. Sample sizes range from 9025 in (4) to 14257 in (1) for NCDS and from 4846 in (4) to 7307 in (1) for BCS70. The same pattern of results emerge if restricted to the smallest sample size within each cohort. All specifications include age 10/11 maths and reading test scores.

Appendix 1 Comparing Cohort and National data

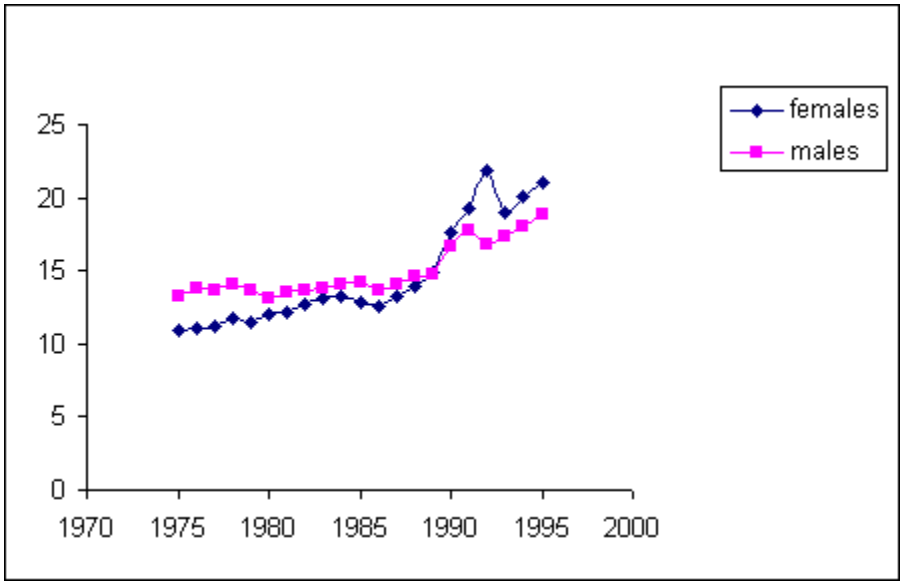
1975 national data and the NCDS	All	Boys	Girls
5+ O-Levels A-C			
National data	0.23	0.22	0.23
NCDS	0.18	0.17	0.18
English O-Level A-C for entrants			
National data		0.55	0.66
NCDS		0.69	0.78
Maths O-Level A-C for entrants			
National data		0.59	0.53
NCDS		0.76	0.70

1986 national data and the BCS	All	Boys	Girls
5+ O-Levels A-C			
National data	0.27	0.26	0.27
BCS	0.31	0.32	0.31
English O-Level A-C for all			
National data:	0.41	0.35	0.46
BCS	0.43	0.39	0.46
Maths O-Level A-C for all			
National data: % leavers	0.32	0.35	0.30
BCS	0.33	0.37	0.30

Appendix 2 Gender Differences at End of Secondary School

	5+ A*-C grades	Maths A*-C grade	English A*-C grade
Boys			
1974 NCDS	0.17	0.20	0.23
1986 BCS	0.32	0.37	0.39
1998 KS Data	0.44	0.47	0.48
2003 KS Data	0.50	0.50	0.57
Girls			
1974 NCDS	0.18	0.15	0.32
1986 BCS	0.31	0.30	0.46
1998 KS Data	0.53	0.48	0.64
2003 KS Data	0.60	0.52	0.73

Appendix 3 Gender Differences at A-level: School Leavers with 2 or more A-levels as a percentage of the 17 year old population



Source: School Assessment and Curriculum Authority (SCAA), 1996
1975-1987: from the Department of Education and Science 'Statistics of Education' CSE and GCSE; 1989-1991: 'Schools Examination Survey'; 1992-1995 'School Performance Database'. Data based on A level candidates of all ages in England, Wales and Northern Ireland.

Appendix 4 Gender Gaps and Parental Education and Income, Evidence from the General Household Survey

		5 or more grades at A*-C in GCSE/O-level, Boys Relative to Girls			
Years	Sample Size	Basic Gender Gap	Plus Parental Education	Plus Parental Earnings	Plus Parental Education and Earnings
1977-79	1467	-.002 (.021)	-.007 (.018)	-.004 (.021)	-.007 (.018)
1978-80	1506	.000 (.021)	-.002 (.020)	-.001 (.021)	.000 (.020)
1979-81	1593	.007 (.020)	.000 (.020)	.005 (.021)	.003 (.020)
1980-82	1516	.026 (.021)	.024 (.021)	.026 (.021)	.031 (.021)
1981-83	1396	.029 (.022)	.030 (.022)	.029 (.022)	.035 (.022)
1982-84	1221	.026 (.024)	.025 (.024)	.029 (.024)	.031 (.024)
1983-85	1148	.001 (.025)	.002 (.025)	.002 (.025)	.005 (.025)
1984-86	1129	-.004 (.025)	-.005 (.025)	-.003 (.025)	-.002 (.025)
1985-87	1097	-.028 (.026)	-.031 (.026)	-.028 (.026)	-.032 (.026)
1986-88	975	-.042 (.026)	-.038 (.026)	-.038 (.026)	-.038 (.026)
1987-89	857	-.067 (.026)	-.063 (.026)	-.068 (.026)	-.064 (.026)
1988-90	771	-.050 (.026)	-.041 (.026)	-.044 (.026)	-.038 (.026)
1989-91	746	-.066 (.027)	-.066 (.027)	-.061 (.027)	-.063 (.027)
1990-92	718	-.071 (.028)	-.062 (.028)	-.055 (.028)	-.055 (.028)
1991-93	666	-.120 (.029)	-.106 (.030)	-.114 (.030)	-.105 (.030)
1992-94	696	-.089 (.032)	-.077 (.033)	-.097 (.032)	-.078 (.033)
1993-95	709	-.124 (.034)	-.126 (.036)	-.135 (.035)	-.128 (.036)
1994-96	790	-.095 (.035)	-.116 (.037)	-.111 (.036)	-.121 (.037)

Note: Standard errors in parentheses.