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Gender differences in GCSE

Tom Bramley, Carmen Vidal Rodeiro & Sylvia Vitello

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Author contact details:

ARD Research Division
Cambridge Assessment
1 Regent Street
Cambridge
CB2 1GG

Bramley.T@cambridgeassessment.org.uk
Vidal.C@cambridgeassessment.org.uk
Vitello.S@cambridgeassessment.org.uk

http://www.cambridgeassessment.org.uk/

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Introduction

This report presents some analysis of gender[1] differences in examination outcomes, focussing mainly on GCSEs taken in England. This is a topic of perennial interest, because it connects with a number of issues, including:

- Gender equality in the workplace (opportunity and remuneration);
- The proportion of women in STEM related jobs;
- Gender choices and outcomes in subjects studied at HE level;
- Gender stereotypes;
- Whether there are gender differences in cognitive ability, and the role of genes and the environment in creating or maintaining them;
- Whether certain types of school structure (e.g. single-sex schools), curriculum, teaching style or assessment style are better suited to one or other gender;
- Whether there are 'gender gaps' in exam performance and whether such gaps are closing or widening.

We start by briefly summarising recent research on gender differences in cognitive ability and achievement in academic examinations. The bulk of the report presents some analysis of gender differences in subject choice and examination outcomes, mainly at GCSE.

Background

A large proportion of research on gender differences in cognitive ability and educational attainment has focused on mathematics, verbal performance and the cognitive abilities related to them.

Mathematics and related abilities

Historically, the widely held view is that males outperform females in tests of mathematical ability (Halpern, 1986; Hill, Corbett, & St Rose, 2010; Hyde, Fennema, & Lamon, 1990). Early reviews of empirical research in this field concluded this was a "robust" finding (Halpern, 1986, p. 57) or, at least, it was one of several "fairly well-established" gender differences (Maccoby & Jacklin, 1974, p. 352). Although subsequent formal analyses of these data indicated that gender differences in mathematical ability were often small in size (Hyde et al., 1990), recent research continues to show some differences but they vary according to certain factors, including level of mathematical ability, type of mathematical ability and examination format.

There is little evidence of a male advantage in high school mathematics tests in either the US or the UK. In the US, "trivial differences" between boys' and girls' mathematics results have been found in all school years between Grade 2 (7–8 year olds) and Grade 11 (16–17 year olds) (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). At the end of high school, it is girls who have been achieving, on average, higher Grade Point Average points (in mathematics and science combined) than boys since at least the 1990s (Hill et al., 2010). Similarly, the UK Department for Education and Skills' (2006) report on gender and education emphasises a female advantage amongst students gaining an A*-C grade in GSCE mathematics in England, although this pattern has changed from the pre-1991 pattern when males outperformed girls (DfES, 2006a). Despite a female advantage in school results, males in the U.S show a persistent trend to perform better in high-stakes examinations such as in the mathematics sections of the SAT and ACT examinations which are taken for entry to universities in the U.S (Hill et al., 2010). Recent international standardised tests examining 10-11 year-old (TIMSS), 13-14 year-old (TIMSS) and 15 year-old

[1] In fact these are sex differences but we follow the usual practice of describing them as gender differences. When describing data from GCSEs and A levels we use 'boys' and 'girls' but in some other contexts we use 'males / females' as appropriate.

(PISA) performance show inconsistent gender differences across countries, although most countries either show a male advantage or no gender difference.

There is more consistent evidence that, if there is a male advantage for mathematics, it occurs amongst the high achievers rather than throughout the continuum of ability levels. For several decades, males have been overrepresented amongst high mathematics performers in high-stakes mathematics in the U.S, although the male to female ratio has decreased over time and has stabilised to a much lower rate since the 1990s (Miller & Halpern, 2014; Wai, Cacchio, Putallaz, & Makel, 2010). Male overrepresentation has also been found amongst 15 year olds who were high mathematics achievers in the PISA 2012 international test in most countries and economies that took part (OECD, 2014). In contrast, this gender gap was not found for science performance. The PISA results also showed that the proportion of girls was marginally larger amongst the lowest mathematics achievers.

Several reasons have been proposed to explain why males outperform females in certain mathematics tests but not others and why this advantage is found especially amongst high achievers. Spelke (2005) argues that gender differences could result from a sample bias; for example if fewer boys take a particular test they may represent a more selective (i.e., higher achieving) sample than the girls who take the test. Gender differences may also arise at test level because tests "consist of a variety of items assessing a complex mix of capacities and strategies" that vary differentially favour boys compared to girls depending on their composition (Spelke, 2005, p. 954). This hypothesis is supported by empirical evidence showing that boys and girls outperform each other on different mathematical operations and related cognitive abilities. Researchers have highlighted various trends in the literature, including that males tend to perform better on certain spatial ability tasks, mental rotation, reasoning and problem-solving tasks, geometry, trigonometry and statistics while females tend to perform better on algebra and test items that require understanding numerical patterns or representing quantities and quantifiable attributes of objects (Ceci, Williams, & Barnett, 2009; Liu & Wilson, 2009; Miller & Halpern, 2014). In addition, the format of the mathematic question may have an impact; for example Liu and Wilson (2009) note that males have been found to perform better with "word problems involving the applications of mathematical theories", while females perform better on "items purely presented by formulas, equation, or theory" (p.167). Girls also have a tendency to perform better in solving conventional problems based on textbook content, while boys deal better with unconventional items, which may disadvantage girls on large-scale standardised tests that do not follow the content of textbooks studied at school (Gallagher & De Lisi, 1994; Liu & Wilson, 2009).

Some of these differences may relate to the use of differential strategies to solve the mathematics problems (Liu & Wilson, 2009; Spelke, 2005) such as the preference for females to use conventional text-based strategies (Gallagher & De Lisi, 1994), which may produce an advantage if tests are answered more effectively by certain strategies.
In addition, a particular concern for mathematics (and other subjects) is the impact of test format on gender differences. Test format may affect the magnitude and direction of gender differences. There is some evidence that boys perform better on multiple-choice tests than free-response tests (DeMars, 1998, 2000). This pattern, however, has sometimes been found only amongst high achievers (DeMars, 1998) or has not been replicated (Liu & Wilson, 2009).
While the above explanations related to test-construction are important in understanding why certain mathematics tests might produce gender differences, they do not explain why these differences occur. Recent reviews have highlighted that performance in mathematical or related cognitive ability tests are, to some extent, explained by biology (e.g., hormones affecting mental

rotation), environment (e.g., video gaming affecting mental rotation), psychology (e.g., lower self-confidence in mathematics amongst girls) and social factors (e.g., negative gender stereotypes affecting girls' performance) (Hyde, 2014; Miller & Halpern, 2014; OECD, 2015).

Verbal and related abilities

Early reviews of the literature on gender differences in verbal abilities concluded that this is an domain of female superiority (Maccoby & Jacklin, 1974). In a recent review, Hyde (2014) argues that this conclusion has not been strongly supported by formal meta-analyses of the data, which generally have shown only small differences, although they still favour females (Hedges & Nowell, 1995; Hyde & Linn, 1988).

Miller and Halpern (2014), in contrast, call for another re-examination of the magnitude of gender differences in verbal ability in light of PISA test results that have shown a consistent, moderately large female advantage in reading across numerous countries. International standardised tests of reading performance for 9-10 year olds (PIRLS), 11-12 year olds (PIRLS) and 15 year olds (PISA) have found female superiority in reading in almost all countries that have taken part (Mullis, Martin, Foy, & Drucker, 2012; OECD, 2014). PISA 2012 data has shown that this gender gap has increased in 11 countries between 2000 and 2012s (OECD, 2014). The PISA data has also shown that the gender gap exists amongst both high and low achievers, with fewer boys achieving high reading proficiency scores and a larger proportion not achieving basic levels of reading literacy. In the UK, governmental attention has been drawn to the underperformance of boys' writing test scores, especially since the introduction of the national tests which showed girls substantially outperforming boys in writing scores (HMI, 2000). The government has published specific advice on how to improve boys' writing (DfES, 2006b). However, recent Ofsted (2012) and DfE (2012) reports on English standards, have still reported that girls perform better than boys across all phases and levels of primary and secondary education.

Gender differences in verbal ability have not always been found. No gender difference is any longer found in sub-tests of high-stake U.S university admission exam that measure vocabulary and reading comprehension (SAT-Verbal and ACT-R) (Ceci et al., 2009; Wai et al., 2010), although sub-tests of writing ability (SAT-W) and verbal reasoning ability (ACT-E) have shown female advantages (Wai et al., 2010).

Miller and Halpern (2014) discussed potential biological (e.g., brain lateralisation and hormones), psychological and social reasons (e.g., gender stereotypes) for gender differences in verbal abilities but the evidence is not as convincing and/or more complex than it is for mathematics (e.g., they are counterintuitive such as negative stereotypes improving males' verbal performance). Clearer understanding of potential reasons for gender differences in reading has come from the OECD's PISA 2012 study. The OECD (2015) administered questionnaires to students taking part in the PISA 2012 administration which has revealed potential environmental and motivational differences between boys and girls that might explain their differences in reading performance. In particular, boys reported spending less time doing homework and were more likely to have negative attitudes towards school across most countries and economies.

Variability in cognitive ability and achievement tests

Strand, Deary, and Smith (2006) note that most studies have focused on the average performance of males and females but it is also important to assess the variability of performance . There is converging evidence showing that males are more variable in their scores than females in a variety of cognitive and achievement tests (Hedges & Nowell, 1995; Strand et al., 2006).

GCSE and A-level attainment

Research examining the existence of gender differences in secondary school achievement has consistently revealed a female advantage across a range of subjects. In one of the earliest investigations of gender differences in secondary school attainment, Murphy (1980) reported that females achieved higher pass rates than males in all years between 1951-1977 in GCE O-level and A-level (combining performance in 13 subjects). The female advantage has been demonstrated in more recent research. Meadows (2003) examined gender effects in seven Advanced Subsidiary (AS) specifications across a variety of subjects: biology, psychology, English, ICT, mathematics, history and general studies. Females performed significantly better than males in all specifications except mathematics, which showed no significant gender difference. More recently, Sammons et al. (2014) showed similar gender differences in the results of a longitudinal study funded by the Department for Education (DfE) that examined a sample of students from primary through to the end of secondary school. The results showed that female students achieved higher total GCSE scores, were more likely to achieve 5 A*-C, 5 A*-C including English and maths and the EBacc, and were also entered for more full GCSEs than male students. Despite those overall differences, different gender gaps were found between GCSE English and mathematics. Females outperformed males in GCSE English by, on average, half a grade, which continued the female advantage in reading and English found at younger ages. In contrast, no gender differences were found in GCSE mathematics, although females had better mathematics and science outcomes in primary school. Various researchers have emphasised that effects of gender on GCSE performance are small in comparison to other factors. For example, Sammons et al. (2014) reported that gender effects on GCSE results were smaller compared to effects of other factors such as parents' qualifications, family socio-economic status, family income and ethnic heritage. This supports the results of an earlier study looking at GCSE performance between 1997 and 2001, which showed that social class and ethnicity had a greater impact on the GCSE attainment than gender (Connolly, 2006). One striking example was highlighted by Connolly (2006) who reported that "while girls have been about one and a half times more likely to gain five or more GCSE grades A*-C than boys, those from the highest social class backgrounds have been between five and nine times more likely than those from the lowest social class backgrounds." (p. 14). Oates (2007) further argues that there is considerable overlap in GCSE marks between boys and girls which is "more substantial than the difference" (p. 2).

Furthermore, various studies have found that gender differences in GCSE and A-level performance are moderated by several factors. Sammons et al. (2014) found some evidence of an interaction between gender and the quality of the pre-school students attended, which suggested that "male students' attainment in GCSE English may be more sensitive to the quality of the pre-school" (p. 86). There is some evidence that secondary school type may also affect gender differences in terms of whether the schools are same-sex or co-education. However this conclusion was not supported in a review of UK and US research in which Smithers and Robinson (2006) concluded that "comparisons of girls' and boys' achievement by school type come out more often in favour of single-sex schools…but the differences tend to be small and inconsistent and open to other explanations, for example, the ability and social background of the pupils" (p. 10).

As with tests of mathematic ability discussed above, the magnitude and direction of gender differences in GCSE and A-level (or equivalent) examinations have been found to be influenced by the type of content and format of the examinations. In a study examining GCSE science questions, Bell (2001) found gender differences on questions that required the retrieval of declarative knowledge but not on those that required scientific procedural knowledge. In addition, the direction of this gender difference was found to vary according to the subject such that boys had an advantage in certain physics contexts whereas females had an advantage in the context of human biology.

Moreover, a set of early research found that changes to the format of GCE examinations can alter the pattern of gender differences within the same subject. In particular, Murphy (1980) found that a change to a Geography O-level syllabus in 1977 increased the male advantage in Geography O-level to the extent that the percentage of male students who obtained a C or above changed from being 1% to 10% higher than that of female students. This difference was driven by the introduction of an objective tests paper on which male students were found to perform even better than written papers when compared to girls. Murphy (1980) suggested that "one possible explanation for this particular sex difference manifestation in academic performance is the lower emphasis on verbal ability in objective test papers, as compared with more conventional written papers" (p. 176). This male advantage on objective test papers was supported in a subsequent study that examined GCE examinations in a large proportion of 16 subjects (Murphy, 1982). As for female advantages, there is a widespread belief that females' superior performance in certain subjects is due to the introduction of coursework in GCE/GCSE qualifications. Although there is some evidence that females perform better on coursework than males, there is more converging evidence that strongly suggests that coursework cannot fully explain the increase in female performance (Elwood, 1999; Oates, 2007).

Data analysis

For many of the presentations of results in this report we have grouped the different examination subjects into the following areas, using the categorisation scheme described in Bramley (2014):

- STEM subjects: Science, Technology, Engineering and Mathematics
- Humanities subjects: those where knowledge, skills and understanding are expressed mainly through extended writing
- Languages: subjects requiring learning some of the grammar and vocabulary of a different language to English
- Applied subjects: those where knowledge, skills and understanding lead more directly to jobs or job-related further study
- Expressive subjects: those where knowledge, skills and understanding are expressed mainly through performances or artefacts.

Of course, there are inevitable difficulties in applying any such categorisation scheme because for some subjects a case could be made for different categorisations (e.g., psychology, economics). But given the large number of different examinations available it is helpful to have some way of grouping them for presentation purposes. We hope that the categorisations are reasonably plausible.

The analyses consider gender differences in subject choice and in examination outcome. The former is simply represented by the proportion of boys entering an examination[2]. Quantifying the latter is more problematic. The reported outcome of GCSE and A-level examinations is a grade (A*, B, C, etc.), and so it seems natural to report differences in the proportion or percentage of boys and girls achieving at or above a particular grade (e.g. at GCSE, differences in the proportion or percentage achieving a grade C or better). These differences traditionally form the basis of most discussions of gender differences in exam outcomes, and for some of the analyses, where the only information we have is the grade obtained, this is what we report. However, this is not an ideal

[2] And the proportion of girls is hence 1-p(boys).

metric for exploring gender differences, for several reasons. First, the grades are relatively crude categorisations applied to a more finely divided underlying mark scale. For some questions of interest (such as the proportions of boys or girls at the extremes of the distribution) it can be more informative to consider the underlying mark scale instead of the grades. Second, the difference in cumulative proportion or percentage achieving a grade is a ‘vertical’ measure of difference in performance which can be very dependent on where the grade boundaries are in relation to the distribution of scores on the underlying mark scale (see Holland, 2002). This makes it difficult to compare across subjects where the grade distributions are different. It also makes it particularly difficult to draw conclusions about changes in ‘gaps’ over time (for example Ho (2008) illustrates how a situation where both boys and girls increase underlying scores by exactly the same amount can lead to conclusions about the gender gap both widening and narrowing, depending on where the grade boundary is).

For this reason, for some of our analyses we used data from OCR where we could obtain the scores on the underlying mark scale, and instead of considering differences in the proportion or percentage achieving a particular grade or better we calculated the ‘probability of superiority’ statistic (see for example Ruscio & Gera, 2013). This can be interpreted as the probability that a randomly sampled boy would have a higher score than a randomly sampled girl, with the (hypothetical) sampling coming from the actual distribution of scores on the exam. This is a very convenient measure of difference because it is relatively easy to calculate and communicate, and it is ‘scale-free’ both in the sense that examinations with mark scales of different lengths can be compared and also in that effect sizes can be compared with those found in completely different attributes, such as height, which helps with interpreting the findings. Further analyses also considered the mean and standard deviation (SD) of scores on the underlying mark scale.

1. Subject choice at GCSE (all boards)

The first area we explored was the proportion of boys and girls taking GCSEs in the different subjects. The data source was the National Pupil Database (NPD)[3].
We took data from the first year the NPD was available (2005) and the most recent year (2014) for comparison. Note that some syllabuses available in 2005 were not available in 2014 and vice versa. Figures 1.1 to 1.5 show the percentage of boys in the entry in each of the five categories, with subjects ordered vertically by the proportion of boys in the entry in 2005. The reference line at 50% is for visual convenience – subjects to the right of this line had a greater proportion of the entry from boys; those to the left had a greater proportion of the entry from girls. Table A1 in Appendix A gives the data on which Figures 1.1 to 1.5 were based.

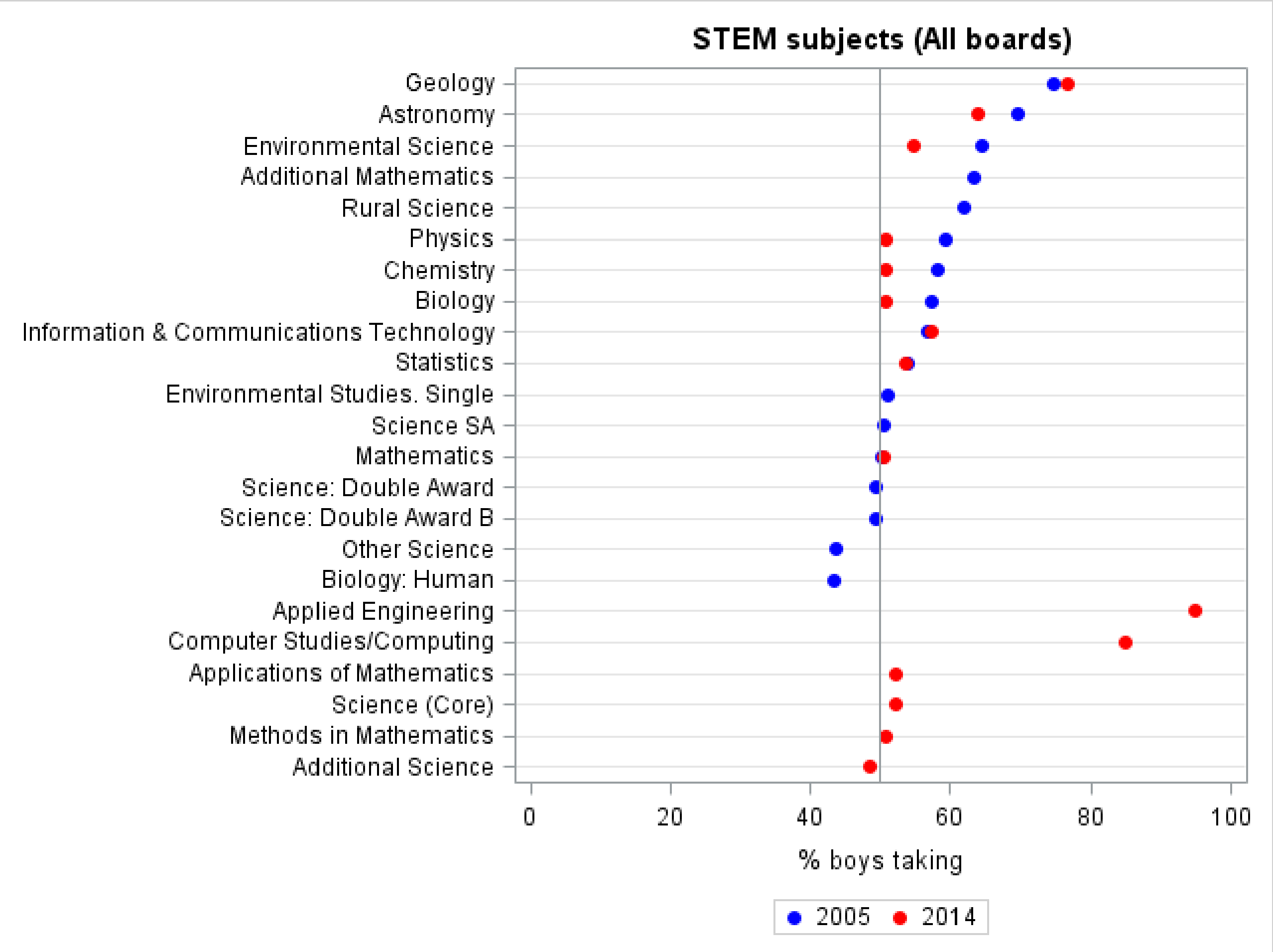


Figure 1.1: Percentage of exam entry that were boys in STEM subjects at GCSE in 2005 and 2014.

The most salient features of Figure 1.1 are that in the vast majority of cases the proportion of boys in the entry for STEM GCSEs was greater than that of girls; and that in 2014 the proportion of boys and girls taking single sciences (Physics, Chemistry and Biology) was much more similar than in 2005, when a greater proportion of the entry was from boys. Applied Engineering and Computer Studies/Computing in 2014 had the largest proportion of the entry from boys (these two subjects were not available in 2005).

[3] The NPD, which is compiled by the Department for Education, is a longitudinal database for all children in schools in England, linking student characteristics to school and college learning aims and attainment.

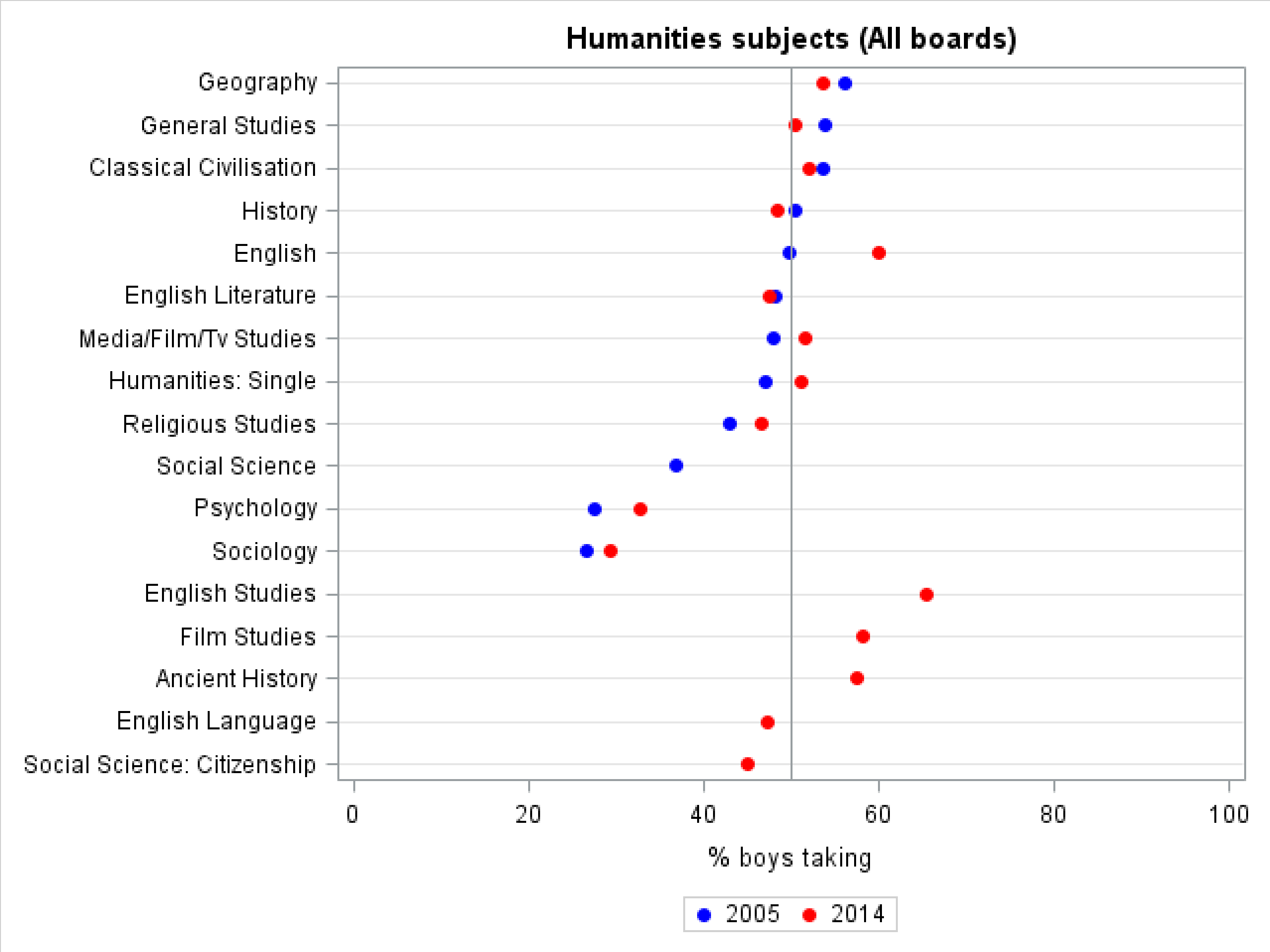


Figure 1.2: Percentage of exam entry that were boys in Humanities subjects at GCSE in 2005 and 2014.

Figure 1.2 shows the majority of the entry for Psychology and Sociology came from girls, but that differences in other subjects were smaller. Where the same subject appeared in both 2005 and 2014 it was usually the case that the percentage of boys and girls was more similar in 2014 than in 2005. The exception was English, but there were large changes in the entry for this subject between the two years. In 2005, GCSE English (a combination of language and literature) and GCSE English Literature were available. The majority of the students took English only. In 2014, three subjects were available: GCSE English, GCSE English Language and GCSE English Literature. Most of the cohort took both English Language and English Literature, and a small percentage continued with English.

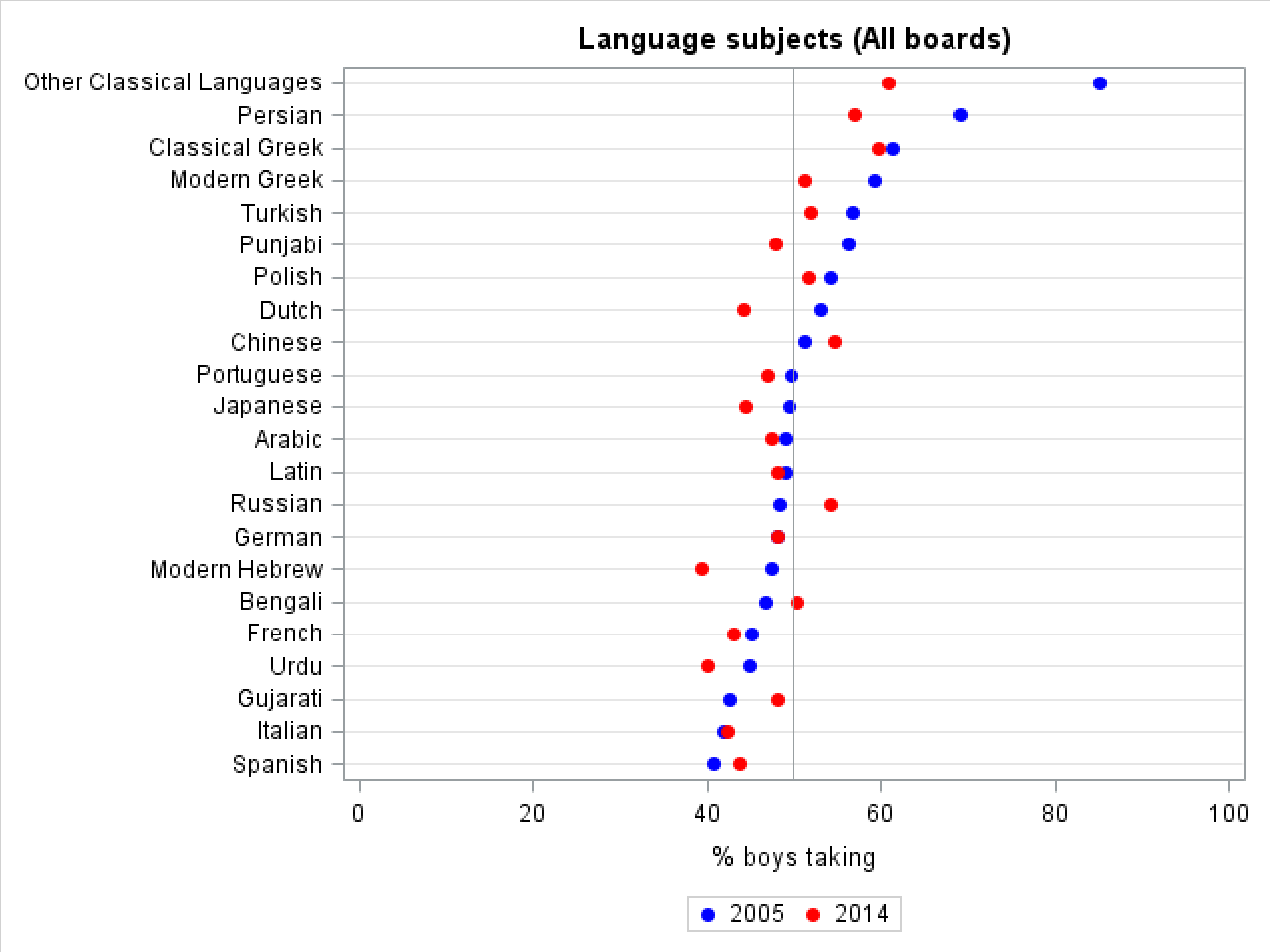


Figure 1.3: Percentage of exam entry that were boys in Language subjects at GCSE in 2005 and 2014.

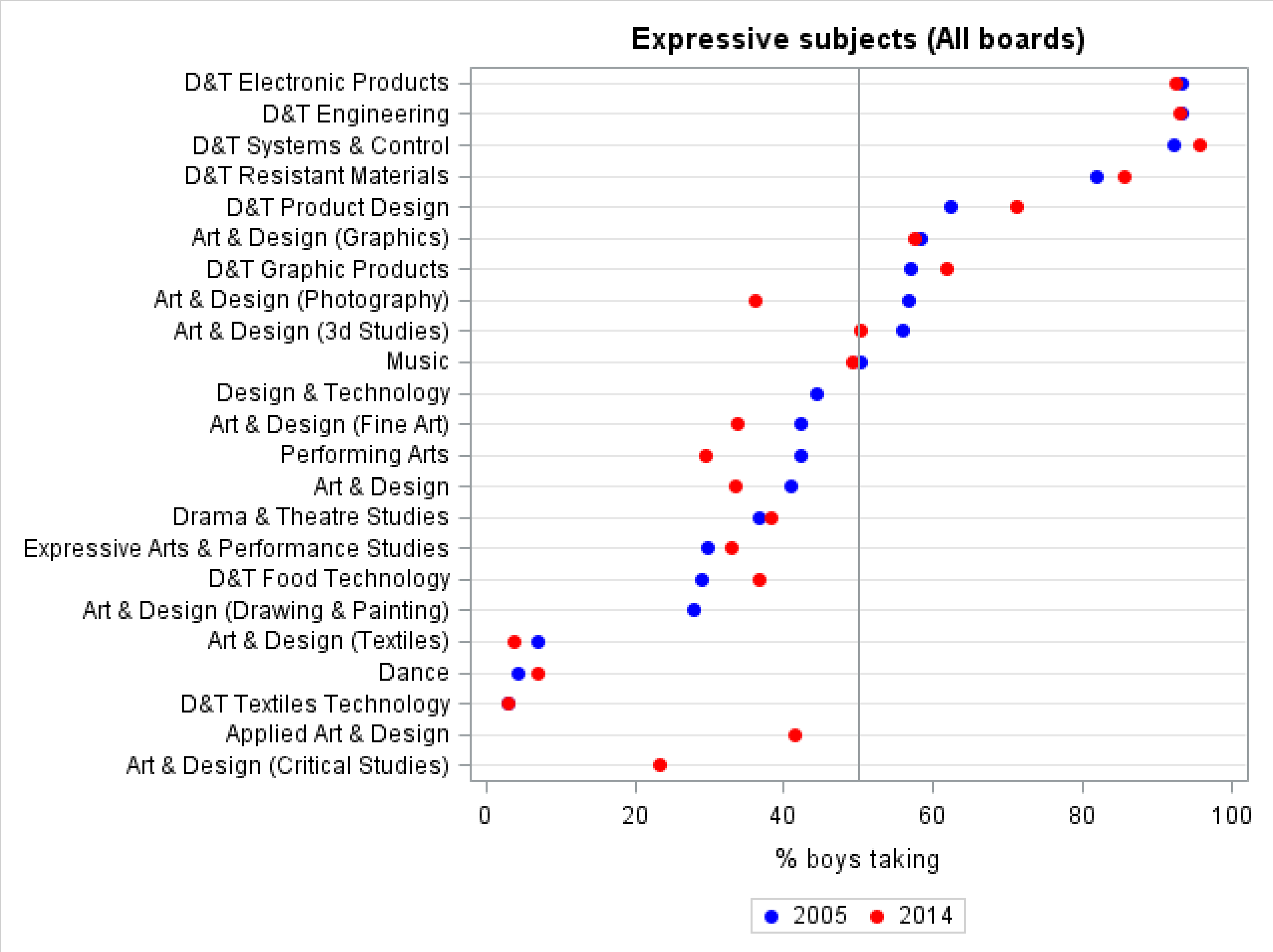


Figure 1.4: Percentage of exam entry that were boys in Expressive subjects at GCSE in 2005 and 2014.

Figure 1.4 shows that, amongst the Expressive subjects, there were big differences along the stereotypical lines. For example, subjects such as D&T (in particular, Electronic Products, Engineering and Systems & Control) were taken mostly by boys, whilst subjects such as Dance or those related to Textiles were mostly taken by girls. The biggest change in proportion of boys between 2005 and 2014 was in Photography. Here there was a large increase in the overall entry: the number of girls increased dramatically from ~1300 to ~11,700 while the number of boys increased less (but still substantially) from ~1700 to ~6,600.

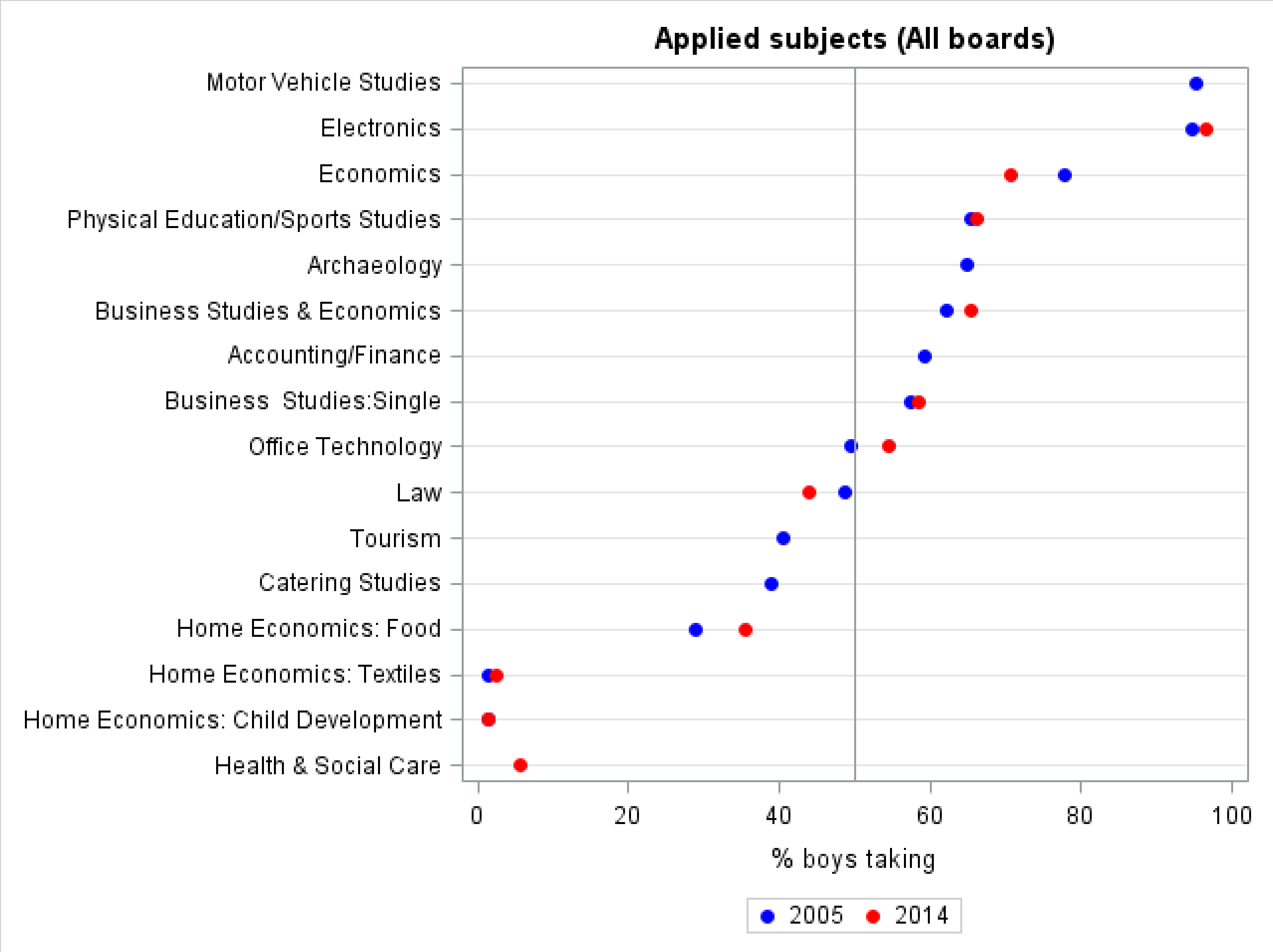


Figure 1.5: Percentage of exam entry that were boys in Applied subjects at GCSE in 2005 and 2014.

As for the Expressive subjects, Figure 1.5 shows that amongst the Applied subjects there were also big differences along stereotypical lines. For example, subjects such Motor Vehicle Studies or Electronics were taken mostly by boys, whilst subjects such as Home Economics or Health and Social Care were mostly taken by girls.

2. Subject outcomes (grades) at GCSE

Figures 2.1 to 2.5 are the counterparts of Figures 1.1 to 1.5, showing the same subjects in the same order (i.e. vertically ordered by the proportion of boys taking the subject in 2005). Tables 2.1 and 2.2 summarise the information in the graphs. The graphs show the difference in the percentage (boys minus girls) gaining a grade C or above (upper graph) or A* (lower graph) in 2005 and 2014. That is, if in subject X 12% of the boys got a grade C or above and 10% of the girls got a grade C or above, the dot for that subject would be at a value of +2 percentage points. The vertical line at 0 thus represents subjects where the same proportion of boys and girls achieved at or above the grade in question. Subjects to the right of the line are those where the 'gender gap' was in favour of boys; those to the left of the line where the 'gender gap' was in favour of girls.

The graphs show that:

- Girls tended to do better than boys in all GCSEs, regardless of whether it was a subject where the entry was predominantly from boys or girls;
- The difference (gender gap) in percentage points was greater at grade C and above (around 10.5) than at grade A* (around 3.0);
- The gender gap was generally smaller in STEM and Language subjects (around 5 percentage points at grade C) and greater in Applied, Expressive and Humanities subjects (around 14 percentage points at grade C);
- In most subjects the gap tended to be slightly wider in 2014 than it was in 2005 (noting the caveat mentioned earlier about interpreting changes in gaps with this metric), but this varied within and between categories.
- The only subjects in 2014 where there was a higher percentage of boys than girls at both grade C and grade A* were 'Applications of Mathematics' and Arabic, taken by ~11,600 and ~1,700 candidates respectively.

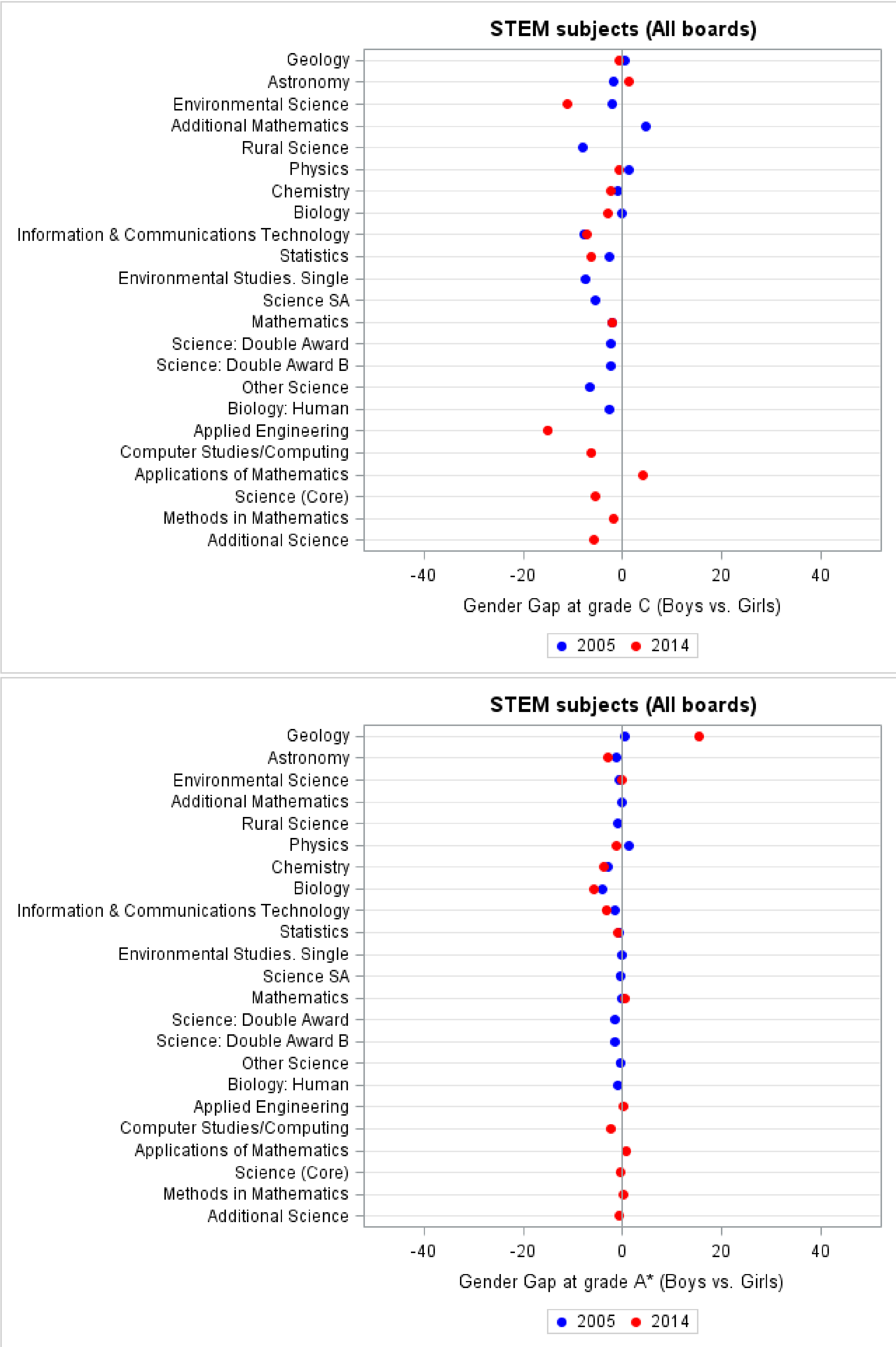


Figure 2.1: Difference in percentage (boys minus girls) gaining grade C or above (upper graph) or A* (lower graph) in 2005 and 2014, STEM subjects.

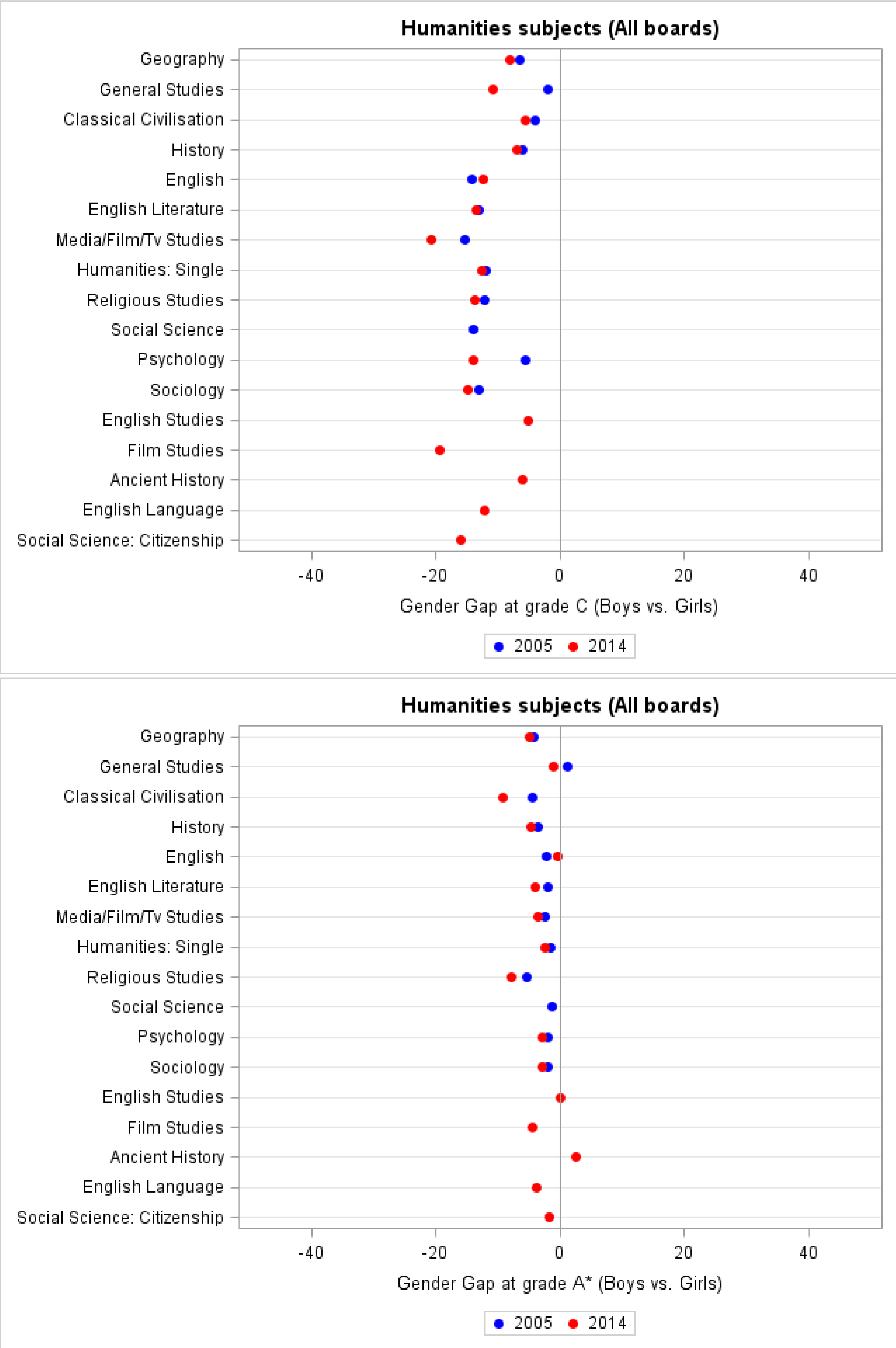
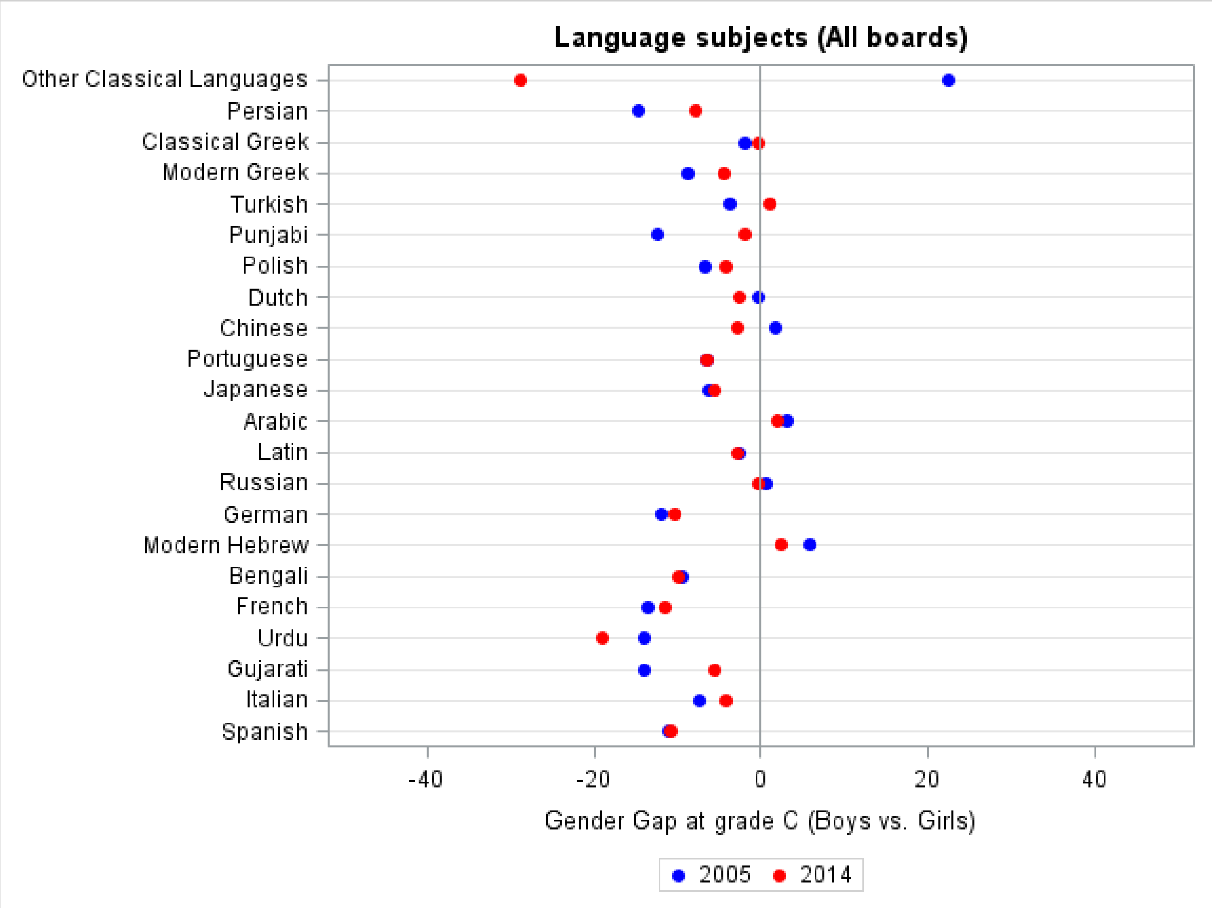


Figure 2.2: Difference in percentage (boys minus girls) gaining grade C or above (upper graph) or A* (lower graph) in 2005 and 2014, Humanities subjects.



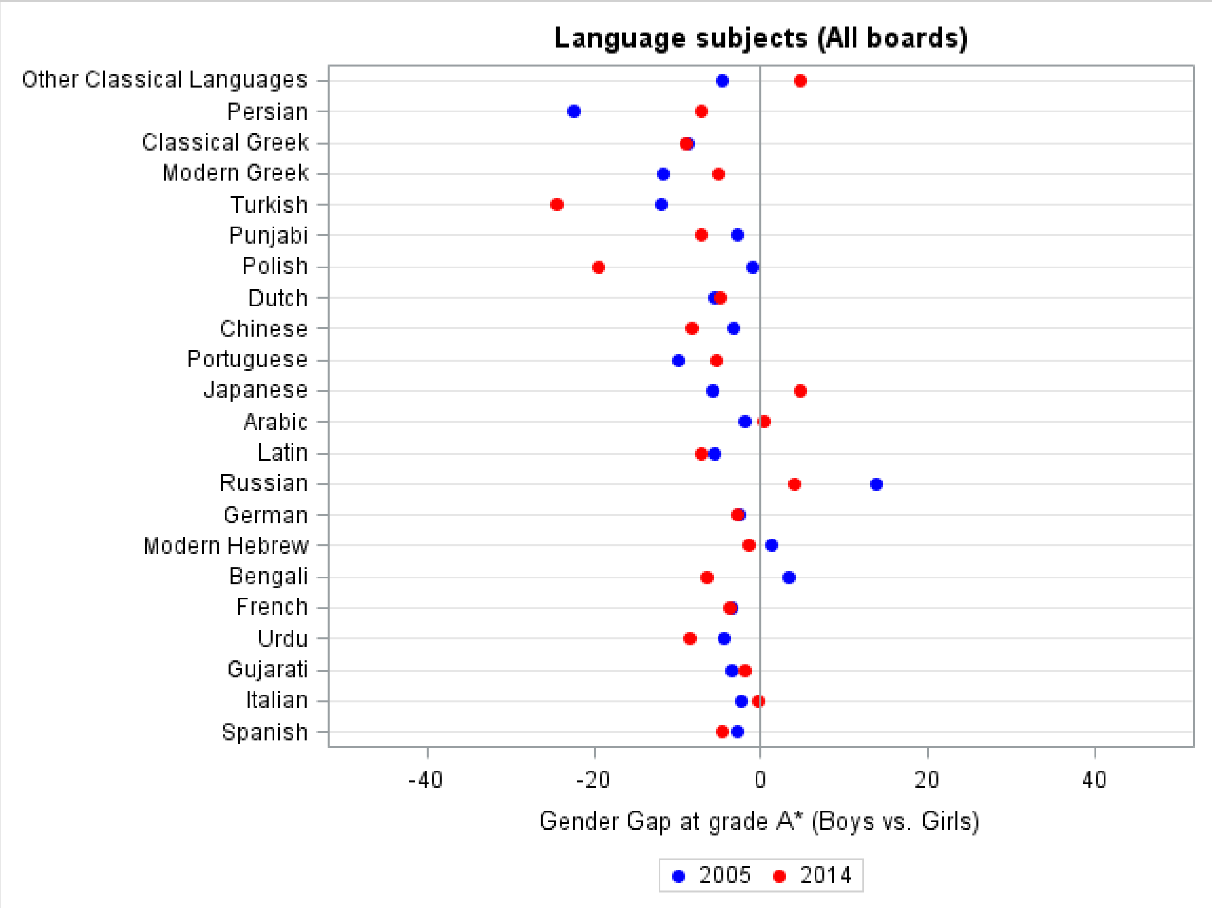
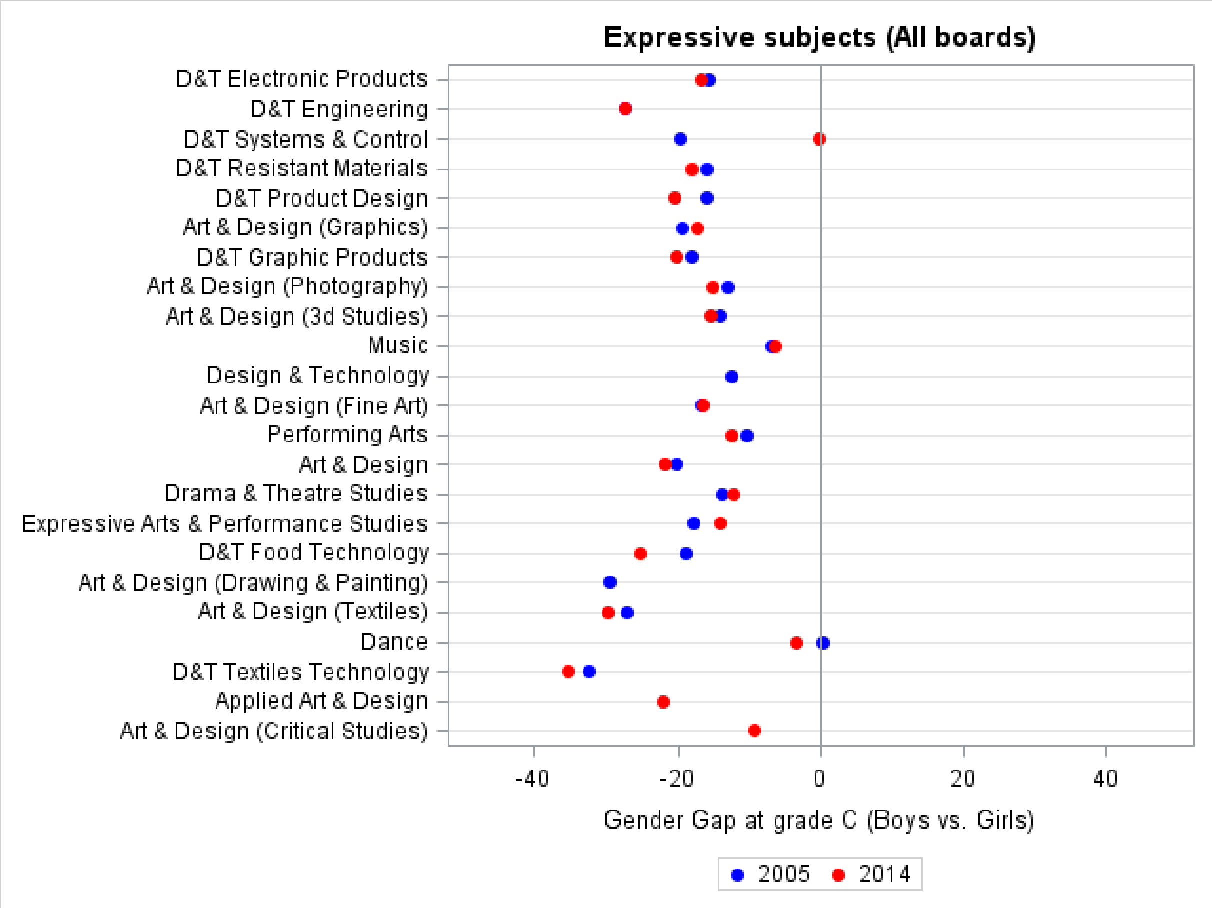


Figure 2.3: Difference in percentage (boys minus girls) gaining grade C or above (upper graph) or A* (lower graph) in 2005 and 2014, Language subjects.



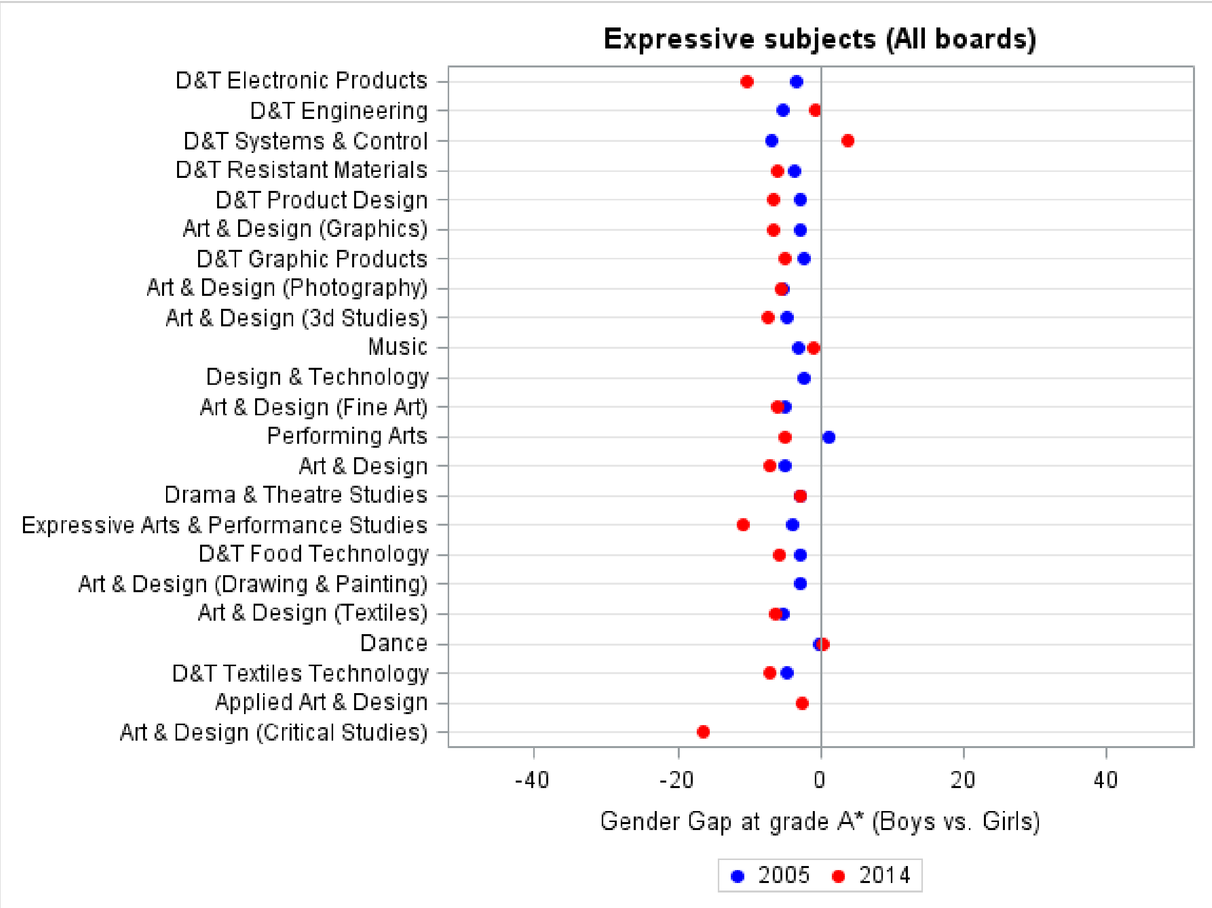


Figure 2.4: Difference in percentage (boys minus girls) gaining grade C or above (upper graph) or A* (lower graph) in 2005 and 2014, Expressive subjects.

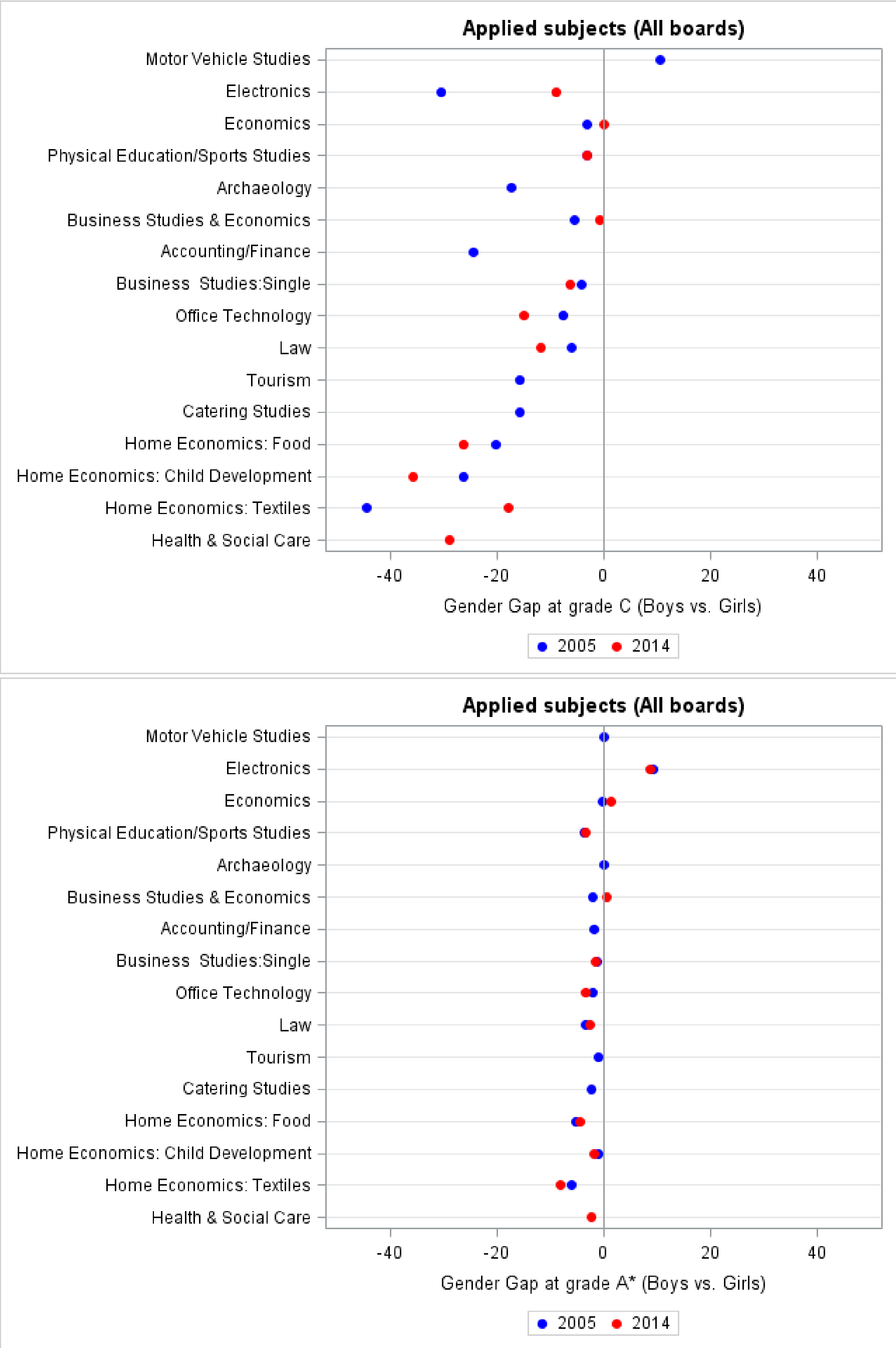


Figure 2.5: Difference in percentage (boys minus girls) gaining grade C or above (upper graph) or A* (lower graph) in 2005 and 2014, Applied subjects.

Table 2.1: Average gender gap at grade C and above (percentage points) in subjects with an entry of 500 or more[4].

Category	Year	N	Mean	SD	Minimum	Maximum
Applied	2005	11	-12.56	9.75	-30.42	-3.15
	2014	10	-13.66	12.57	-35.69	-0.07
Expressive	2005	19	-17.09	7.21	-32.31	0.44
	2014	19	-16.95	8.46	-35.41	-0.11
Humanities	2005	12	-9.83	4.65	-15.34	-1.90
	2014	15	-12.50	4.48	-20.76	-5.72
Languages	2005	14	-6.34	5.89	-13.96	3.03
	2014	15	-5.65	5.72	-19.04	1.87
STEM	2005	12	-3.28	3.06	-8.08	1.30
	2014	15	-4.13	4.87	-15.20	4.02
All	2005	68	-10.43	8.12	-32.31	3.03
	2014	74	-10.71	8.83	-35.69	4.02

Table 2.2: Average gender gap at grade A* (percentage points) in subjects with an entry of 500 or more.

Category	Year	N	Mean	SD	Minimum	Maximum
Applied	2005	11	-1.16	3.78	-5.32	9.35
	2014	10	-0.89	3.79	-4.38	8.66
Expressive	2005	19	-3.82	1.52	-6.74	-0.14
	2014	19	-5.17	3.48	-10.94	3.74
Humanities	2005	12	-2.54	1.74	-5.41	1.09
	2014	15	-3.42	2.87	-9.28	2.60
Languages	2005	14	-2.75	5.90	-11.82	13.85
	2014	15	-6.09	7.78	-24.49	4.73
STEM	2005	12	-1.13	1.38	-4.16	1.26
	2014	15	-0.28	4.71	-5.70	15.40
All	2005	68	-2.47	3.38	-11.82	13.85
	2014	74	-3.43	5.23	-24.49	15.40

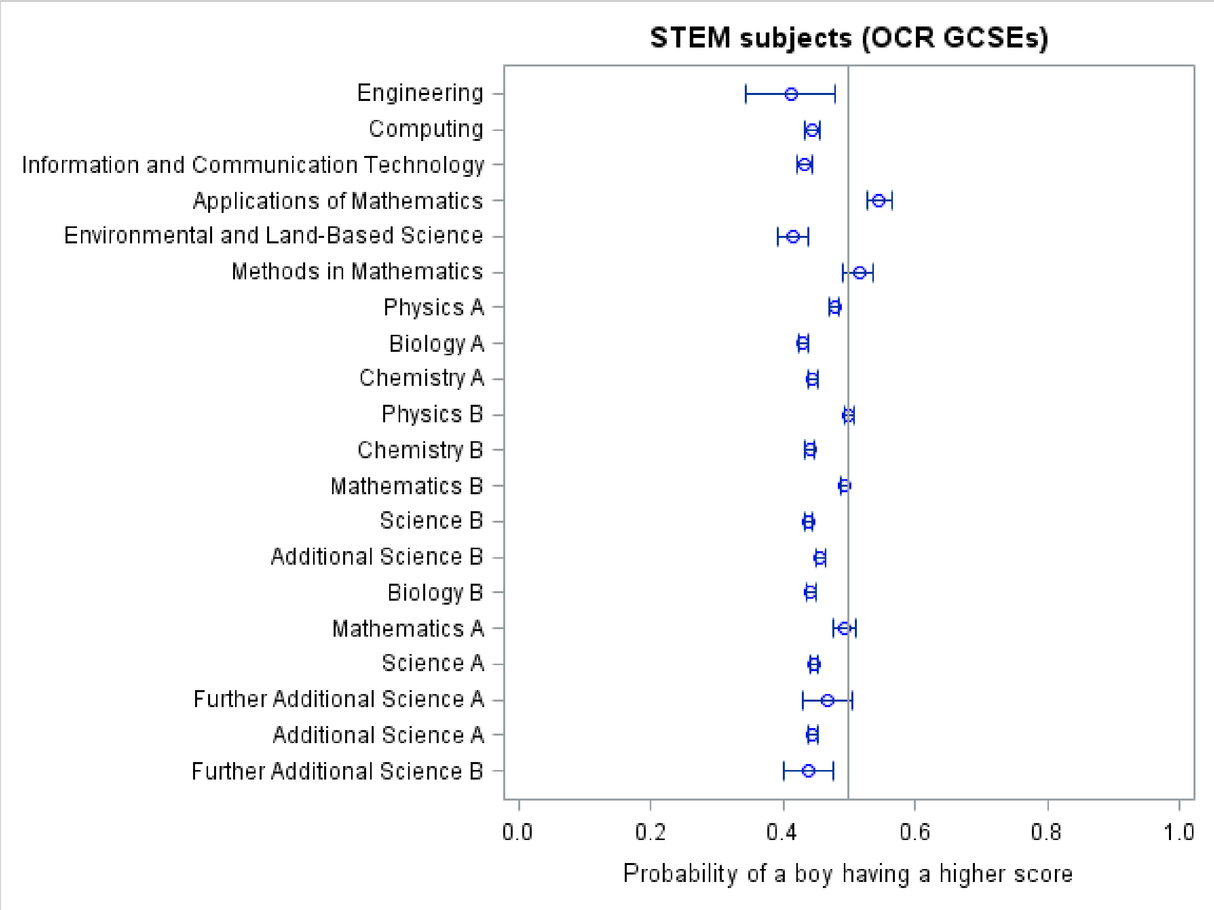
[4] Figures 2.1 to 2.5 include subjects with fewer than 500 entries. The restriction was applied here for consistency with Section 3, and to avoid the values in Tables 2.1 and 2.2 being distorted too much by outliers from small-entry subjects.

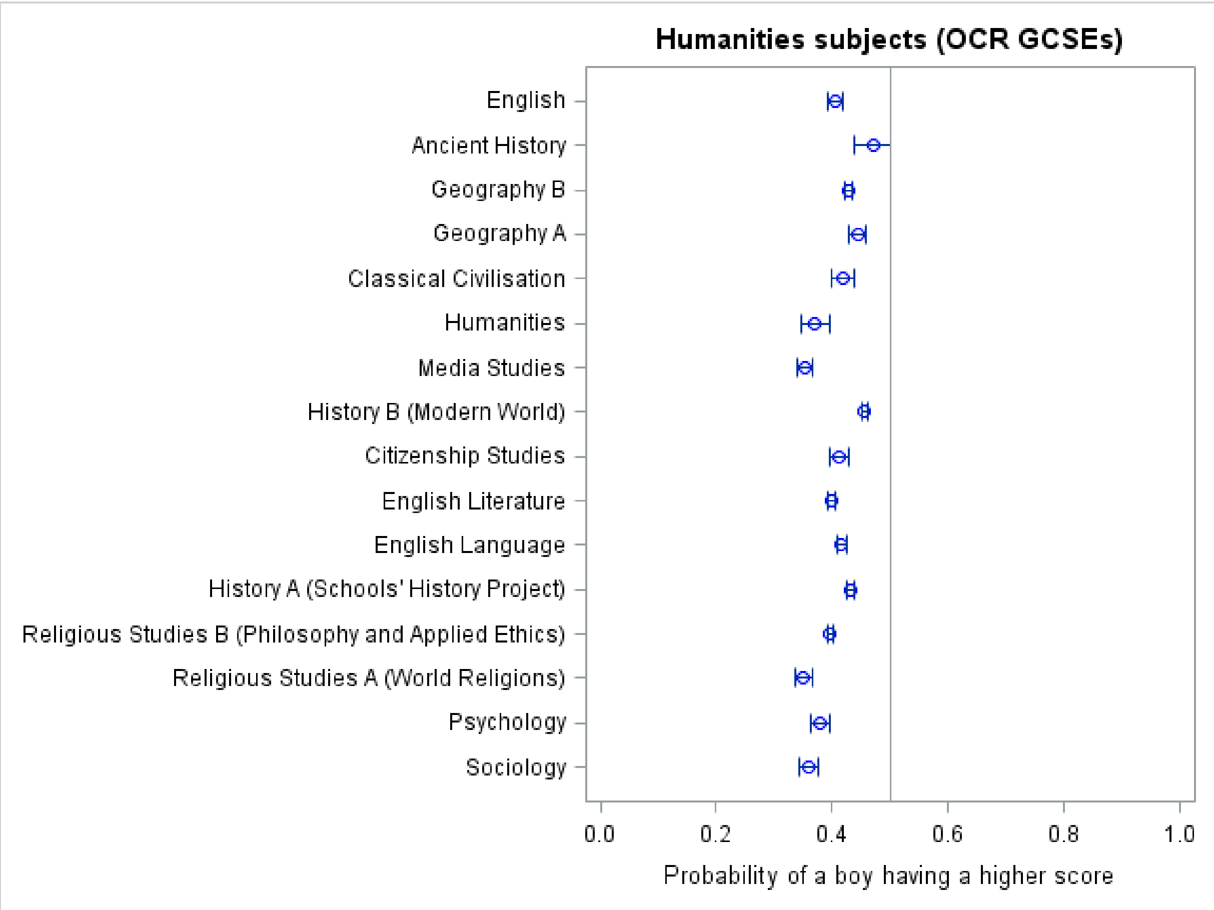
3. Subject outcomes (scores) at GCSE (OCR specifications with more than 500 entries)

As noted above, grades are not always the best metric for analysing gender differences. Figures 3.1 to 3.5 and Table 3.1 show the probability of superiority p(sup) for boys in 2014 in OCR specifications with an entry of more than 500. The graphs are vertically ordered by the proportion of boys in the entry, with the specification with the highest proportion of boys at the top and the one with the lowest proportion of boys at the bottom. If the confidence bars do not overlap the vertical reference line at 50% then the value is 'statistically significant' in the sense that if the exam scores were a random sample from a population of scores where p(sup) for boys was 50% there would be a probability of less than 5% of obtaining a result as far from 50% as the one observed. This is arguably not relevant since the data represent the entire population taking the exam and not a random sample. However, the confidence bars are longer where the entry size was smaller so are perhaps useful aids to interpretation (for example if entries from different years are conceived as samples from a hypothetical population). The underlying score scale from which the p(sup) was calculated was either the Uniform Mark Scale (UMS) for exams with a 'modular' assessment structure, or the weighted aggregate mark for exams with a 'linear' assessment structure[5].

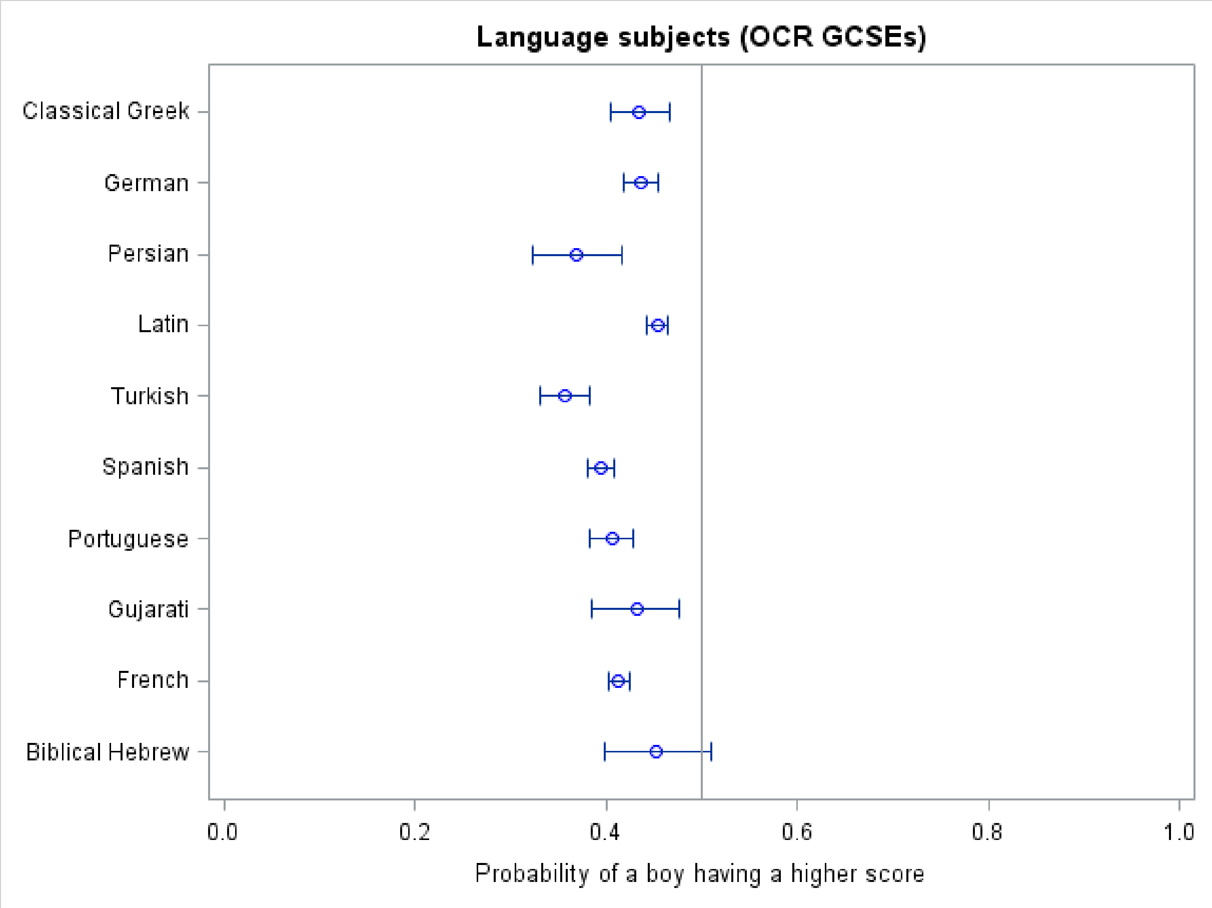
Similarly to the results presented in Section 2, Figures 3.1 to 3.5 and Table 3.1 show that girls tended to do better than boys in all subjects (the only two exceptions were Applications of Mathematics and Methods in Mathematics which had entries of ~3,000 and ~2,500 respectively). Also, in STEM subjects the probability of superiority at 0.46 on average was closer to 0.5 than in other types of subjects (which would imply that there was less difference between the performance of boys and girls). The greatest difference between boys and girls was in Expressive subjects, where the average p(sup) was 0.35. The ordering of p(sup) across the five categories is the same as the order of the gender gap in percentage points at grade C and above using the full NPD data.

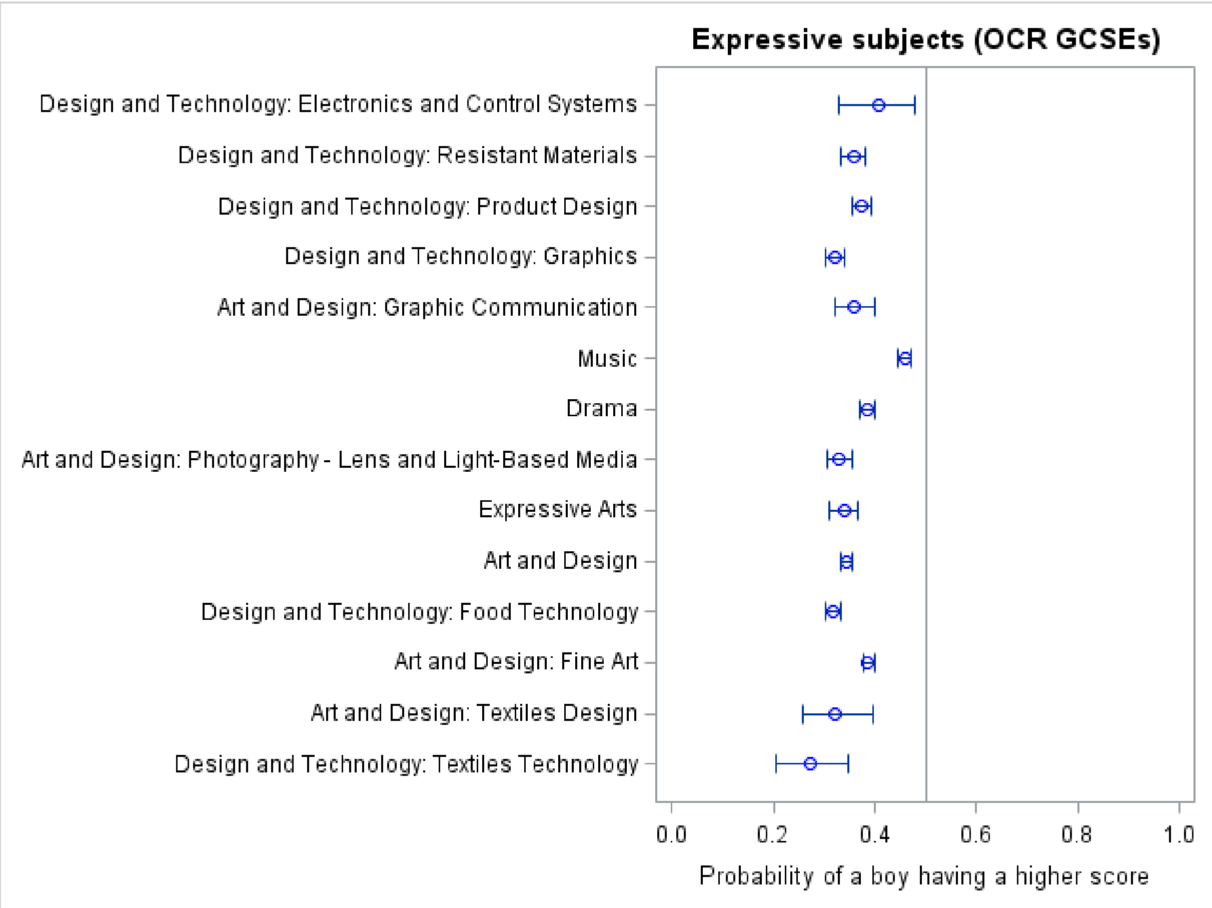
[5] For more information about how UMS scores are calculated, see AQA (2013). In modular assessments, modules (units) can be taken throughout the course, and the UMS result 'banked'. In linear assessments all the examination components are usually taken at the end of the course.





Figures 3.1 & 3.2: P(boy scoring higher than girl) in a STEM or Humanities GCSE subject.





Figures 3.3 & 3.4: P(boy scoring higher than girl) in a Language or Expressive GCSE subject.

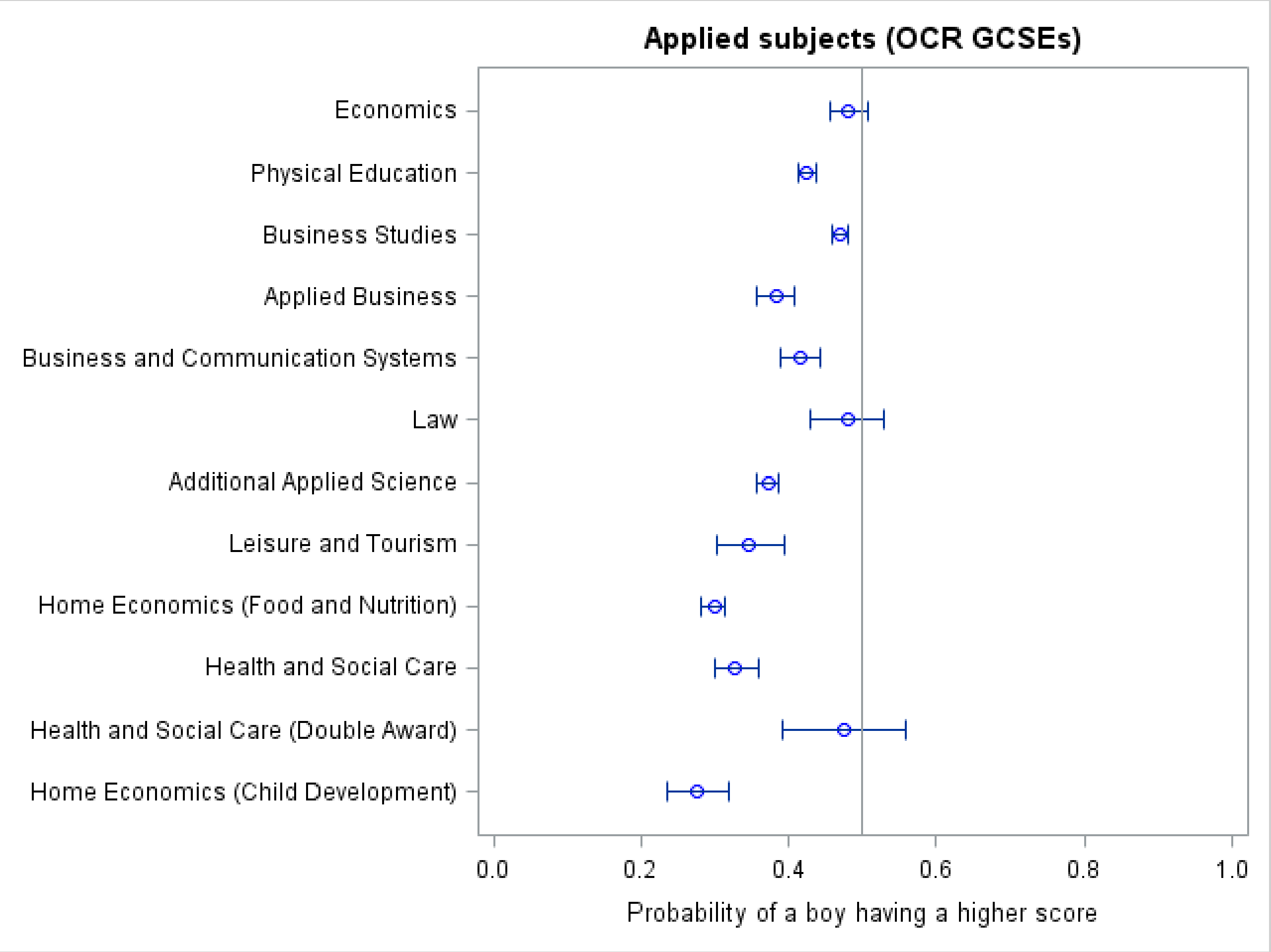


Figure 3.5: P(boy scoring higher than girl) in an Applied GCSE subject.

Table 3.1: Average p(boy scoring higher than girl) by category.

Category	N	Mean	SD	Minimum	Maximum
Applied	12	0.40	0.07	0.27	0.48
Expressive	14	0.35	0.05	0.27	0.46
Humanities	17	0.41	0.04	0.35	0.50
Languages	10	0.42	0.03	0.36	0.45
STEM	20	0.46	0.03	0.41	0.55
All	73	0.41	0.06	0.27	0.55

Contextualising the effect size of the gender difference in examination scores

As mentioned previously, one advantage of the p(sup) statistic is that it is scale-free, allowing comparison with differences on other metrics. In order to provide a comparator for the p(sup) values shown in Figures 3.1 to 3.5, we downloaded data from the World Health Organisation (WHO) website on the heights of children by age in months[6]. We first verified that approximating height distributions by assuming normality with the given mean and standard deviation (SD) did not materially affect calculation of p(sup) compared to using more detailed information about the centiles of the distribution. We then calculated p(sup) for different differences in age or gender for comparison with effects from examination scores.

The probability of a randomly sampled boy aged 16 years and 3 months being taller than a randomly sampled girl of the same age is 0.86, (and hence the probability of being shorter is 0.14). This is clearly a much bigger gender difference than in examination scores, where the average across all 73 OCR specifications with an entry of 500+ was 0.41. In terms of height, a p(sup) of 0.41 corresponds to the difference in height between boys in Year 11 who differ in age by around 9 months[7] – 2.5 cm. It is therefore not a particularly large difference in the sense of likelihood of being visible to the naked eye.

Age differences within the school year are also related to academic achievement, with the disadvantage of 'summer borns' the usual focus of the debate (see for example Sykes et al., 2009; Crawford et al., 2013). For comparison purposes we divided our OCR GCSE data into two groups: those born in the first six months of the academic year (i.e. September to February) and those born in the last six months (i.e. March to August). Including only those students who were in Year 11 at the time of taking their GCSEs we again calculated p(sup) for those born in the last six months. The graphs in Appendix B show a consistent but small effect of month of birth. Across 68 specifications with an entry of 500+ the average p(sup) for those born in the second half of the academic year was 0.48. This corresponds to the difference in height between boys in Year 11 who differ in age by two months (0.5 cm) – an effect that definitely would not be visible to the naked eye.

Gender differences in variability of scores

As noted in the background section, it has often been found that the variability of male scores on cognitive tests is greater than that of female scores.

Table 3.2: Relative size of mean and SD of boys' and girls' scores (OCR GCSEs June 2014, specifications with an entry of 500+).

	STEM	Humanities	Languages	Expressive	Applied	All
Boys higher mean boys higher SD	2	0	0	0	0	2
Boys higher mean girls higher SD	0	1	0	0	0	1
Girls higher mean boys higher SD	15	14	8	10	5	52
Girls higher mean girls higher SD	3	2	2	4	7	18
Girls higher mean	18	16	10	14	12	70
Boys higher SD	17	14	8	10	5	54
All	20	17	10	14	12	73

[6] http://www.who.int/growthref/who2007_height_for_age/en/
[7] Specifically, the difference in height between boys aged 16 years and 3 months, and those aged 15 years and 6 months.

Table 3.2 shows that boys' scores had a higher SD than girls' scores in 54 out of 73 specifications (80.0%), and that girls' scores had a higher mean than boys' scores in 70 out of 73 specifications (95.9%). The combination of higher mean for girls and higher SD for boys was found in 52 out of 73 specifications (71.2%).

Does this mean that boys are 'over-represented' at both extremes of the distribution? For example, this has recently been claimed for A-level[8]. To investigate this at GCSE, we looked at the 'gender gap' defined as before as the percentage of boys minus the percentage of girls in the top 5% and bottom 5% of scores overall. Analysis was restricted to specifications with at least 2,000 entries in order to ensure at least 100 people in the top/bottom 5% of scores. Figures 3.6 to 3.10 clearly show that while boys were certainly over-represented in the bottom 5% of scores, they were not over-represented in the top 5%: far from it – in only 4 of the 53 specifications was this the case. All four were STEM subjects, and it is interesting to note that in two of them (Mathematics and Physics) OCR offered two specifications, and in the other specification there were relatively more girls in the top 5%.

This suggests that at GCSE, the lower mean and higher SD for boys can mainly be attributed to a higher proportion of low scores. There is a higher proportion of girls than boys at the extreme top end of the score distribution in the vast majority of cases.

[8] http://www.independent.co.uk/news/education/education-news/boys-tend-to-either-get-top-marks-or-fail-in-exams-says-new-research-10435842.html

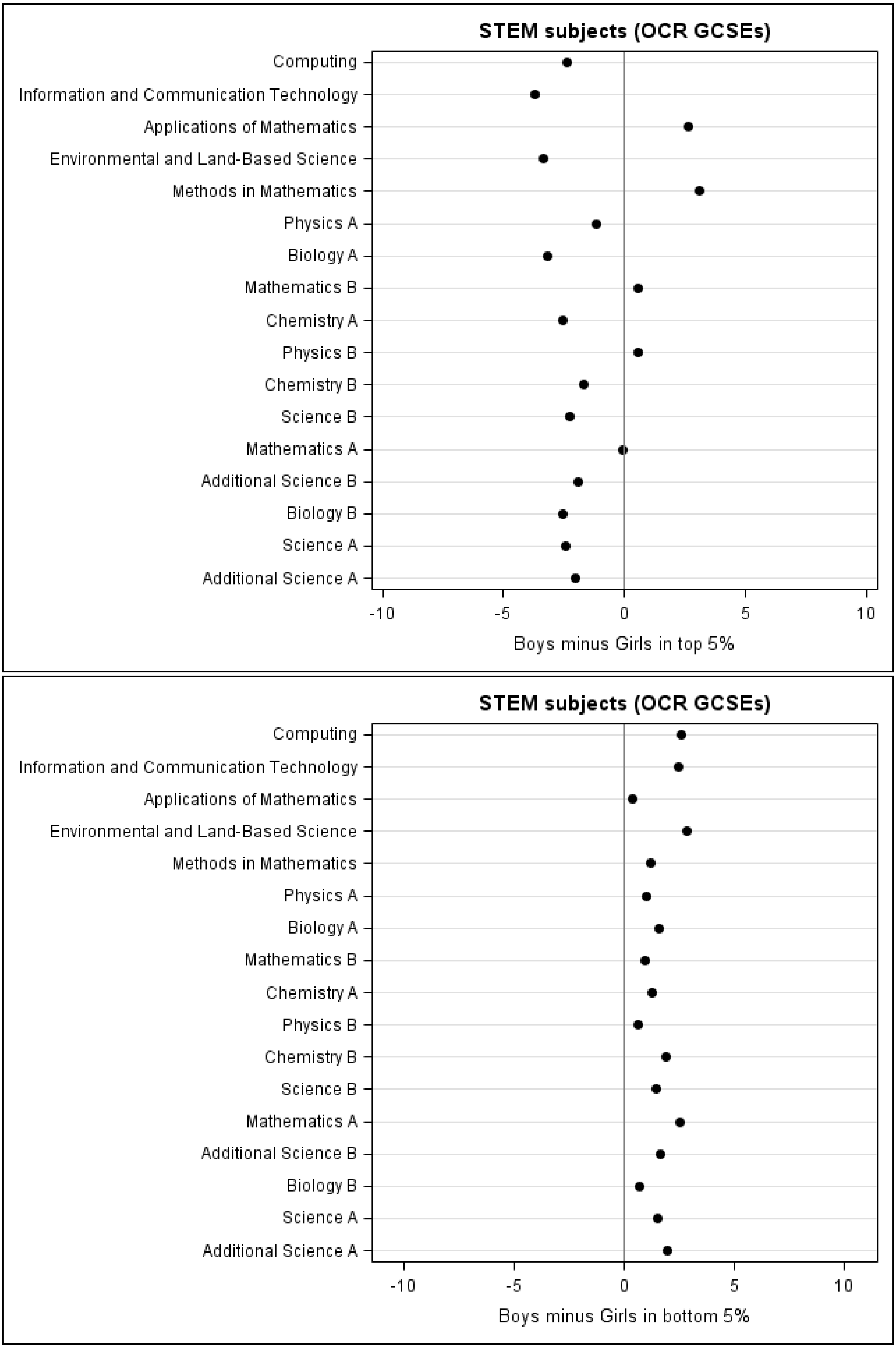
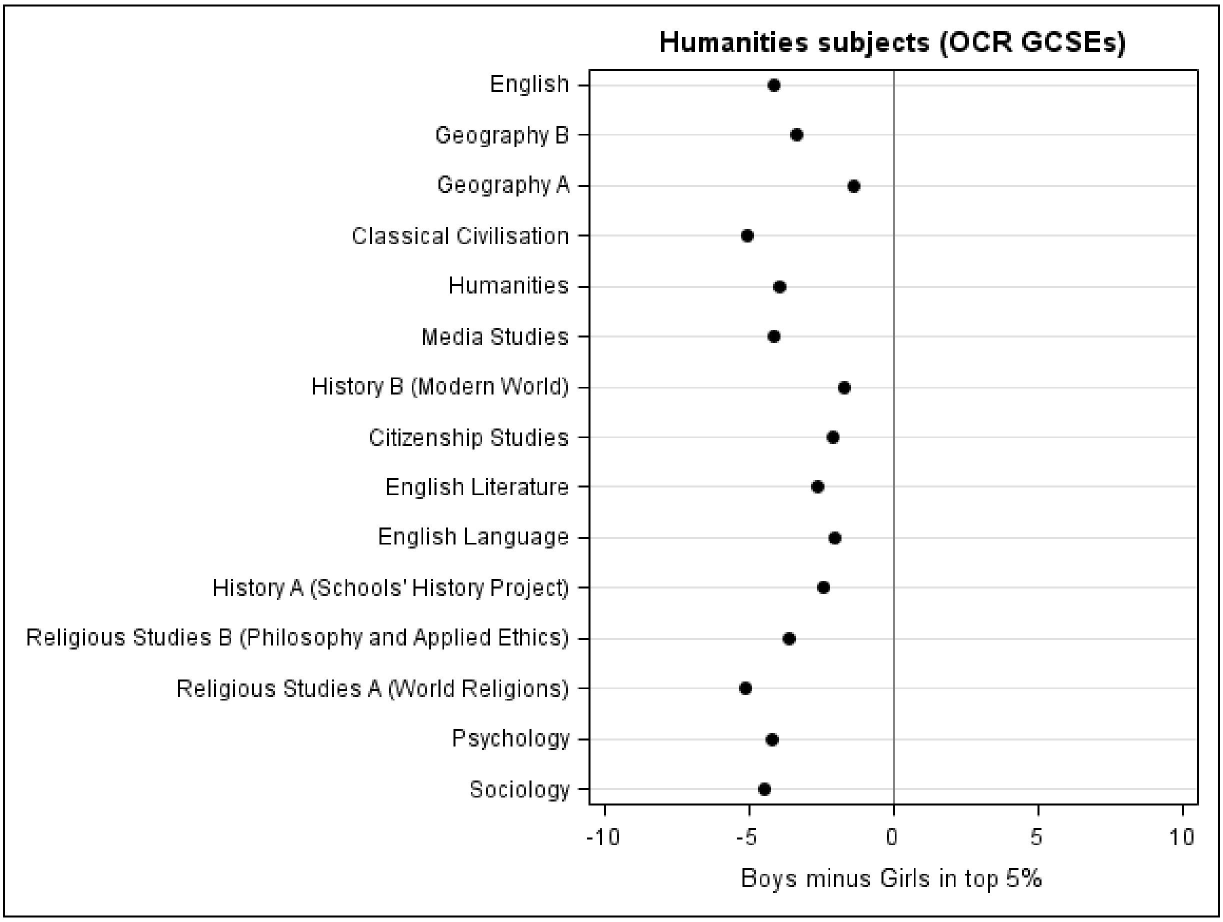


Figure 3.6: Difference in the percentage of boys and girls in the top 5% (upper graph) and bottom 5% (lower graph) of scores, STEM subjects.



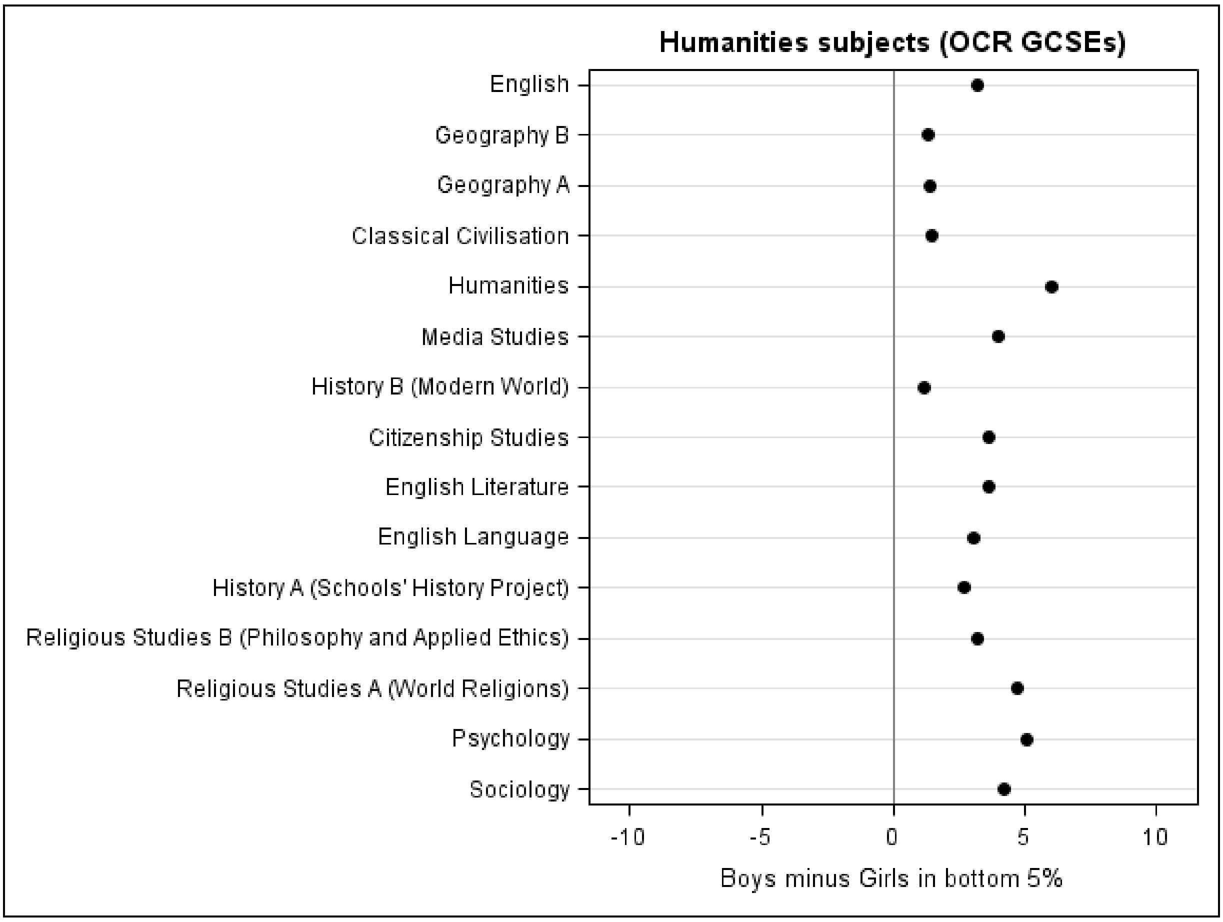
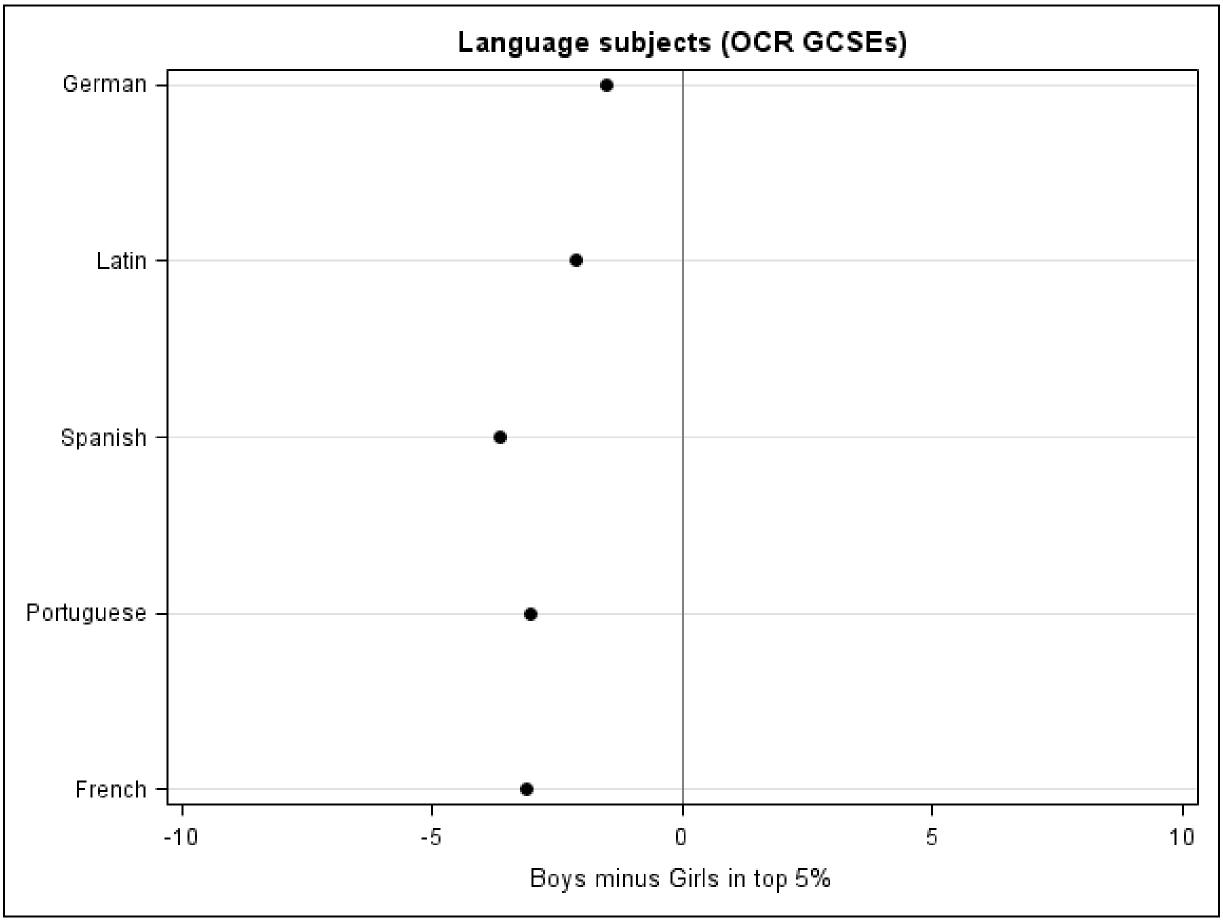


Figure 3.7: Difference in the percentage of boys and girls in the top 5% (upper graph) and bottom 5% (lower graph) of scores, Humanities subjects.



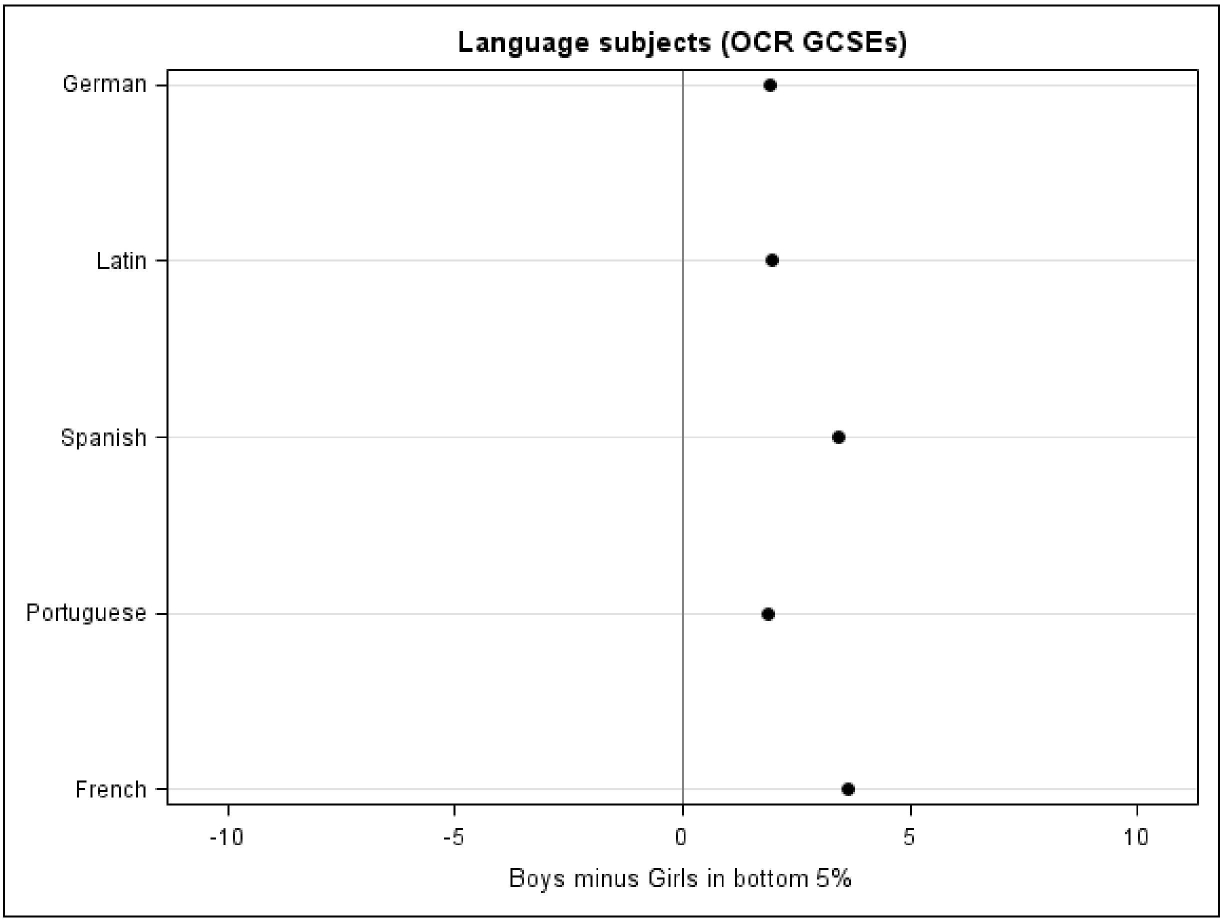
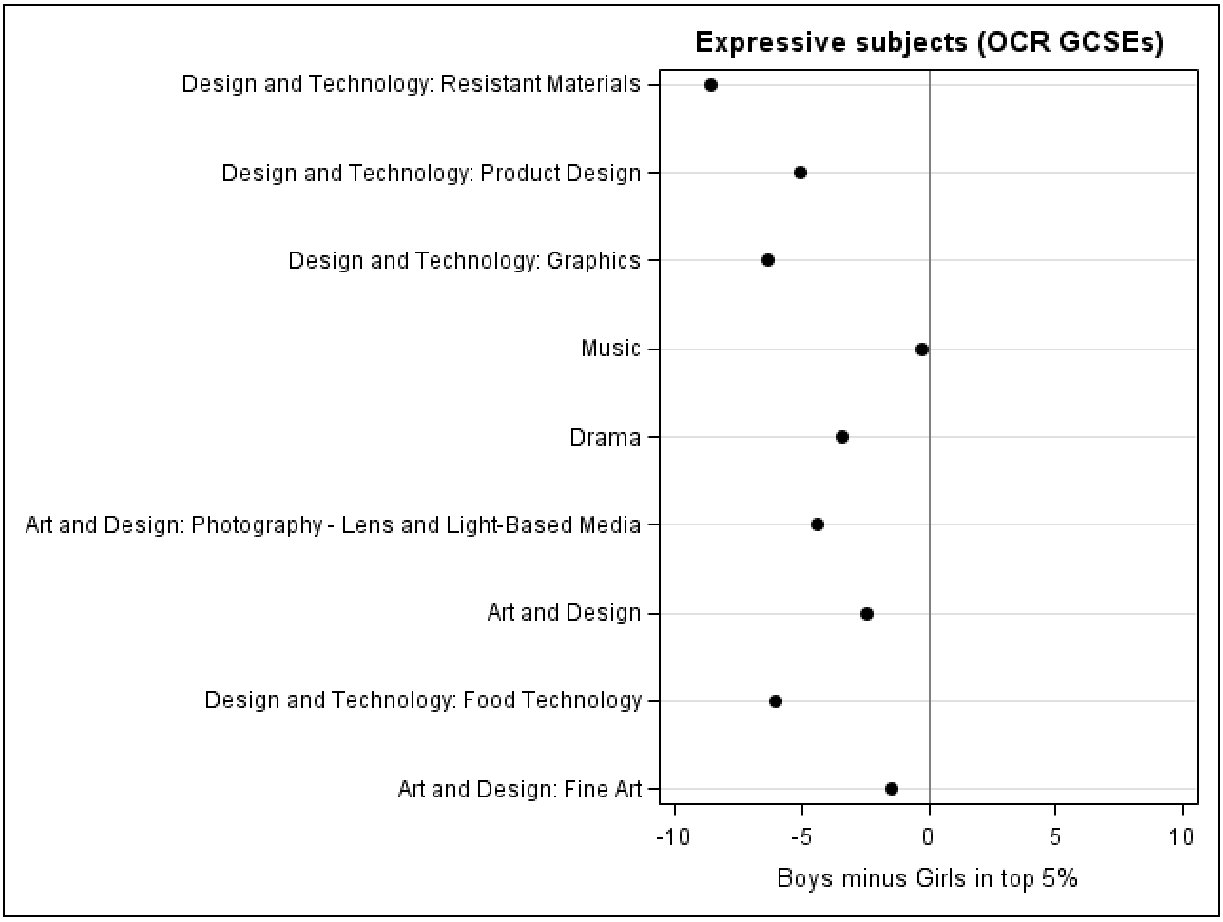


Figure 3.8: Difference in the percentage of boys and girls in the top 5% (upper graph) and bottom 5% (lower graph) of scores, Language subjects.



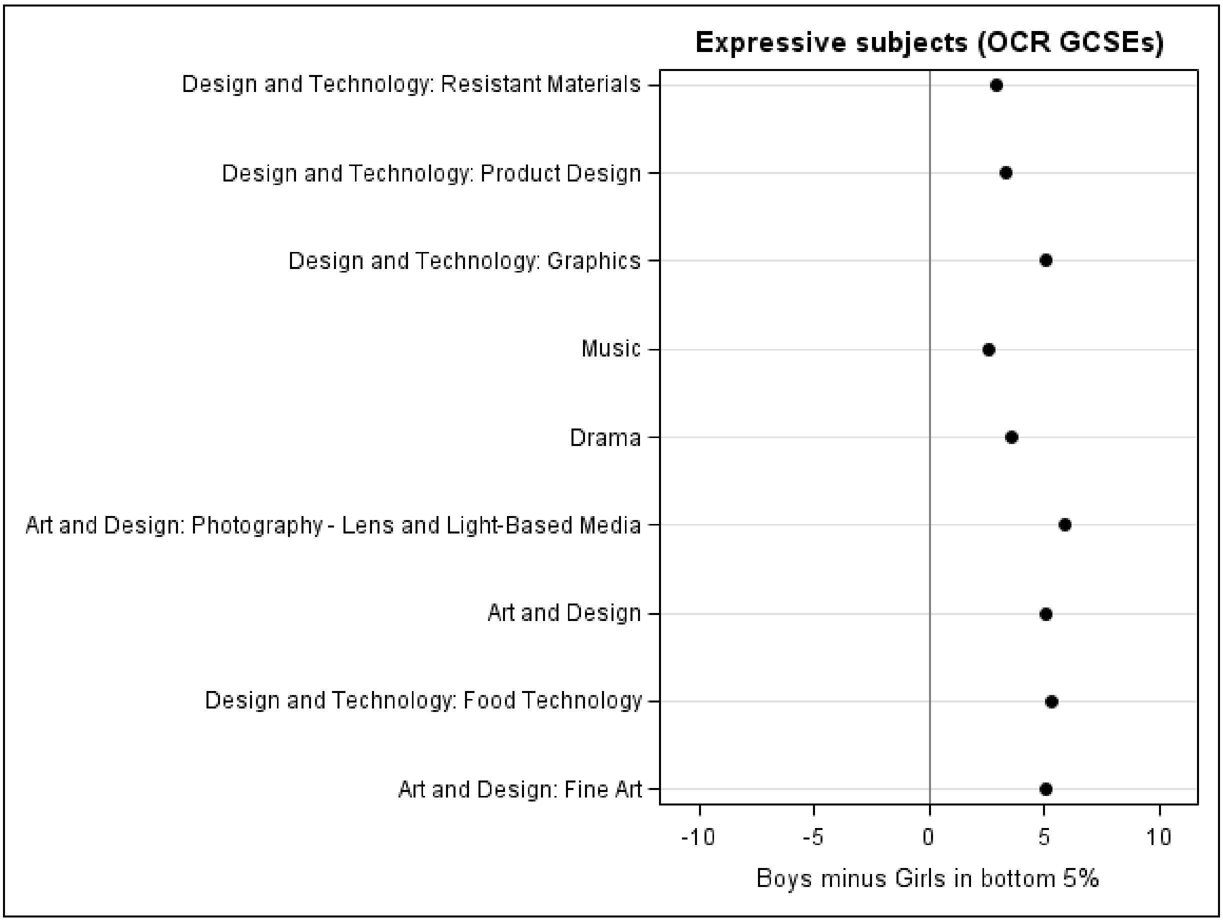
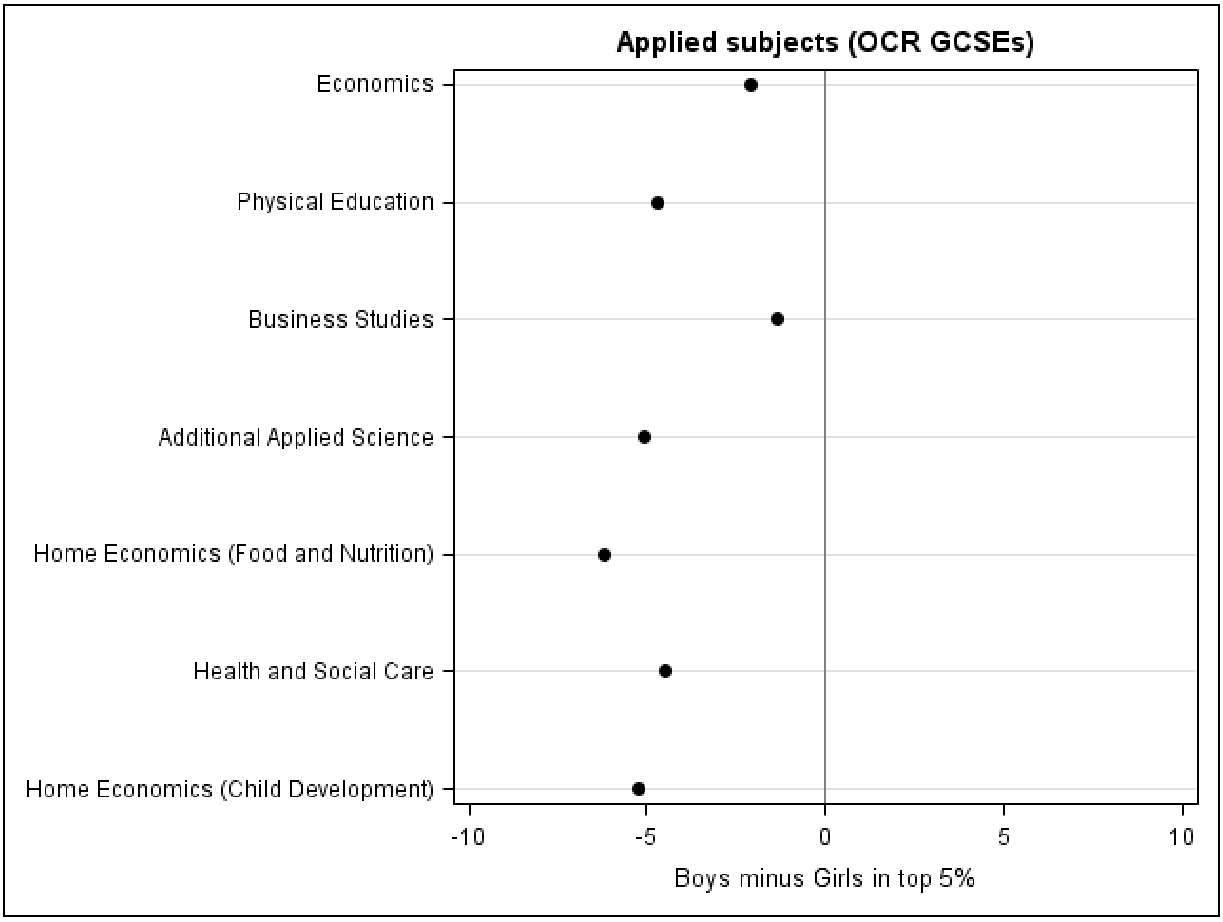


Figure 3.9: Difference in the percentage of boys and girls in the top 5% (upper graph) and bottom 5% (lower graph) of scores, Expressive subjects.



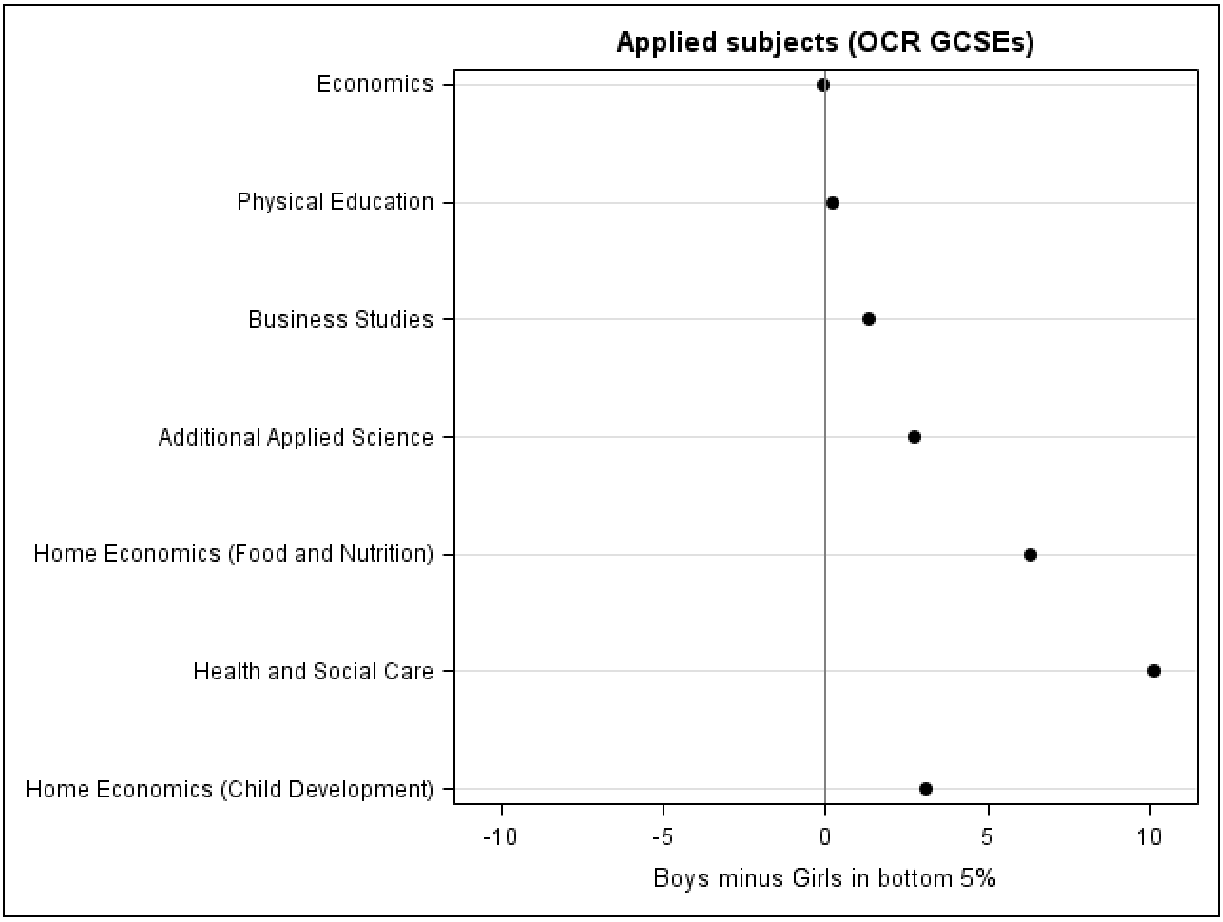


Figure 3.10: Difference in the percentage of boys and girls in the top 5% (upper graph) and bottom 5% (lower graph) of scores, Applied subjects.

4. Gender differences relating to type of assessment

GCSE grades are usually determined by performance in written examinations (in recent years, exams could have either been terminal exams at the end of Year 11, a series of modular examinations taken throughout the course, or a combination of the two). However, GCSEs also allow students to complete coursework (or controlled assessment[9]) during their two years of study. In such cases, students complete a number of assessed pieces of work which will count towards their final examination grade. Controlled assessment can contribute to anything from 10–60% of a pupil's final grade, with some subjects, such as design and technology, art or English often having a heavier controlled assessment element.

Research has suggested that girls tend to perform better in coursework assessments (e.g., Oates, 2007), which are based over a prolonged period and do not depend on performance on a single day, whereas boys do better in written examinations. However, one should be careful to generalise about the strengths of boys and girls in such a way, as there are many boys who do well in coursework assessments.

In this section, component/unit level data from OCR specifications was obtained. Components were categorised into coursework (which includes assessment types that measure subject-specific skills that cannot be tested by written exam papers, such as practicals, portfolios, performances or controlled assessments) and written examinations. Table 4.1 below shows the numbers of each type of component in GCSE examinations offered in June 2014, together with the relative size of mean and standard deviation of boys' and girls' scores in each type of assessment.

Table 4.1: Relative size of mean and SD of boys' and girls' scores (OCR GCSEs June 2014, unit/components with an entry of 500+), by type of assessment.

	Coursework	Written assessment	All
Boys higher mean boys higher SD	5	18	23
Boys higher mean girls higher SD	4	15	19
Girls higher mean boys higher SD	100	117	217
Girls higher mean girls higher SD	26	59	85
Girls higher mean	126	176	302
Boys higher SD	105	135	240
All	135	209	344

Table 4.1 shows that boys' and girls' scores (both their mean and standard deviation) differed by the type of assessment, supporting the hypothesis that girls tend to perform better in coursework assessments than boys. In particular, in 126 out of 135 coursework components (93.3%), girls' scores had a higher mean than boys'. However, in written components, 176 out of 209 components (84.2%), girls' scores had a higher mean than boys'. The combination of higher mean for girls and higher standard deviation for boys was found in 74.1% and 56.0% of coursework and written assessment components, respectively.

In written examinations, students are faced with different types of questions, depending on the subject. For example, some units/components comprise multiple choice questions, others short-

[9] Controlled assessment is a form of coursework where control levels for each stage of the process (task setting, task taking and task marking) have been strictly defined by the qualifications regulator.

answer questions or longer essays. Within the coursework or controlled assessments, as mentioned above, there were also differences by subject, for example, there were science practicals, art portfolios, artistic performances, etc. The following graphs show, for a selection of components/units, the probability of superiority for boys in different types of assessments. In these figures, the graphs are vertically ordered by the probability of superiority statistic. As before, the underlying score scale from which the probability of superiority was calculated was either the UMS for exams with a 'modular' assessment structure, or the weighted aggregate mark for exams with a 'linear' assessment structure

Figure 4.1 includes a couple of IGCSE and GCE A-level components, in order to show examples for multiple choice components (MC). Components comprising mostly short-answer questions (S) and components comprising mostly longer essays (L) were also included. This figure shows that boys performed quite similarly to girls in components that comprised mostly short-answer questions. However, in all subjects considered in Figure 4.1, girls performed better than boys in those components with long or essay questions.

Figure 4.2, which presents the probability of superiority for boys in a selection of controlled assessment components (CA) and portfolios (P), reflects the general result from Table 4.1, that is, girls performed better in those types of components than boys. Note that in the OCR data used in this section it was not possible to identify different types of controlled assessments other than portfolios.

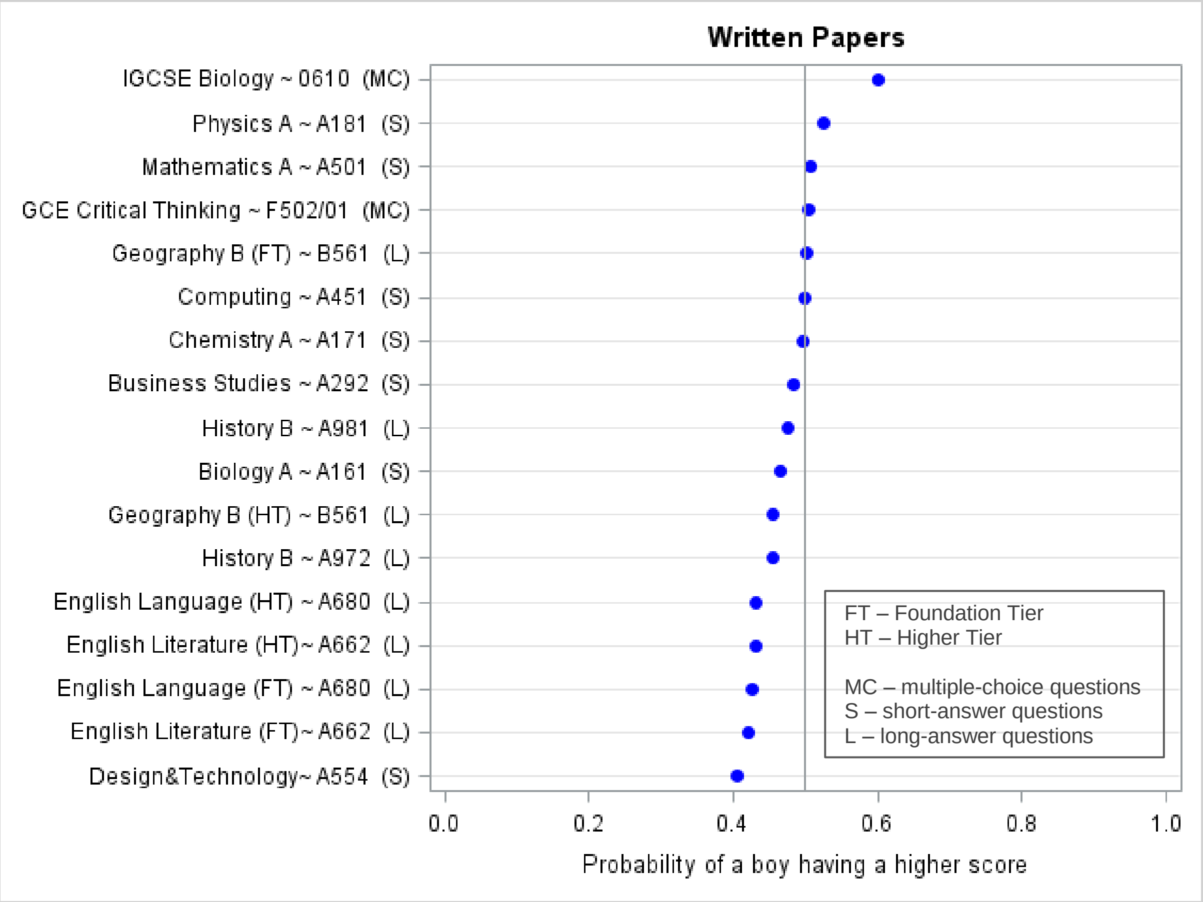


Figure 4.1: Probability of a boy having a higher score than a girl in written papers, with different types of questions.

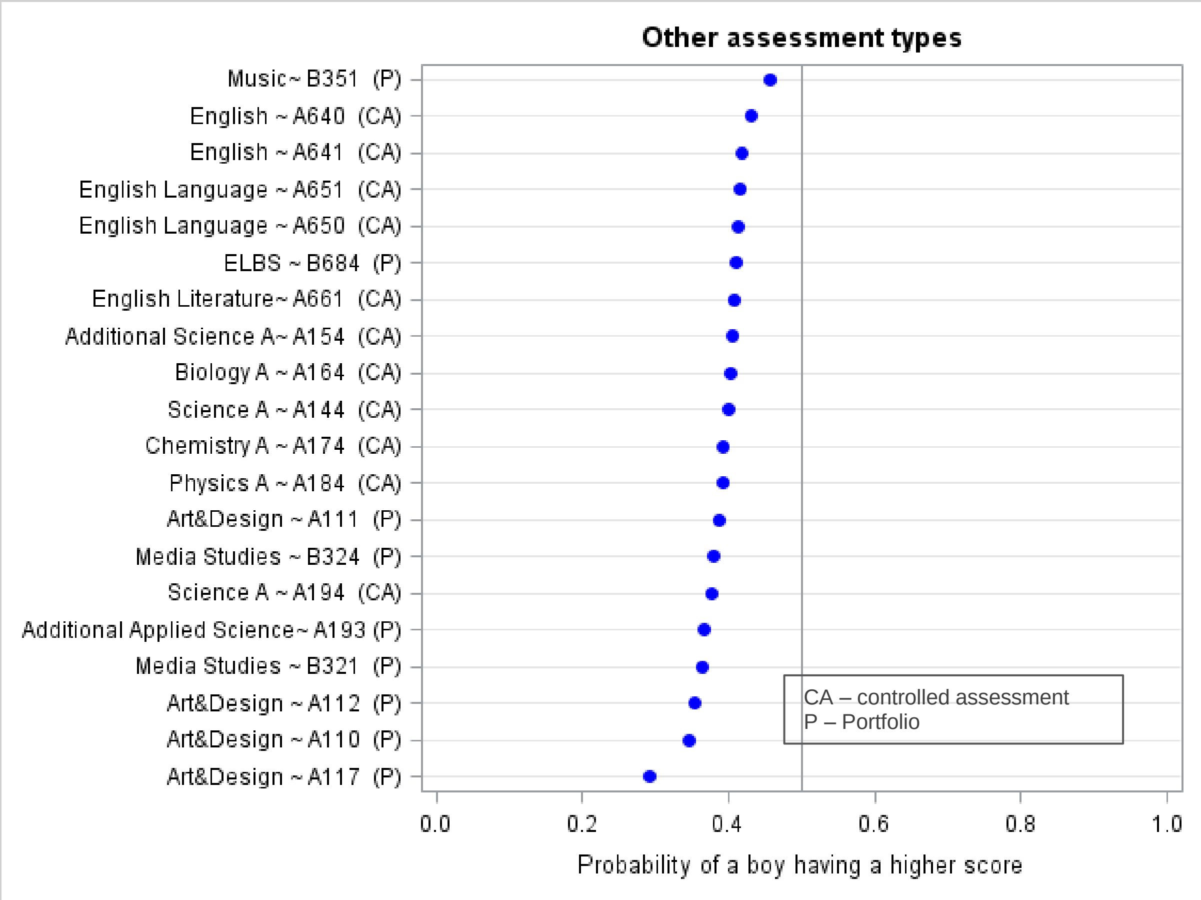


Figure 4.2: Probability of a boy having a higher score than a girl in controlled assessment and portfolio components.

A final example of gender differences related to type of assessments in presented in Figure 4.3 below. In this figure, the probability of a boy having a higher score than a girl in GCSE/IGCSE[10] Biology units/components is displayed[11].

The units/components in these Biology qualifications comprise different types of questions, including multiple choice questions, short-answer questions, coursework and practical assessments. Figure 4.3 shows that boys performed worse than girls in the controlled assessment and coursework components. However, it is interesting to note that boys did better than girls (in terms of their probability of superiority) in the IGCSE Biology qualification than in the GCSE one. This could be due to the types of students that are entered for each qualification (for example, in the IGCSE, a high percentage of the entries comes from independent schools) or to the different structure of the qualification (IGCSE is linear, whilst the GCSE is modular[12]). Very similar results, although not presented here, were obtained for GCSE/IGCSE in chemistry and physics.

[10] The IGCSE Biology qualification considered here is offered by Cambridge International Examinations in countries all over the world. However, the analysis carried out here was restricted to schools in England.
[11] Only higher tier (HT) papers were included in the graph.
[12] From September 2012, all GCSE examinations units had to be taken at the end of the two-year course. Therefore those taking the GCSE in June 2014 took the assessment linearly, although the structure of the course was modular.

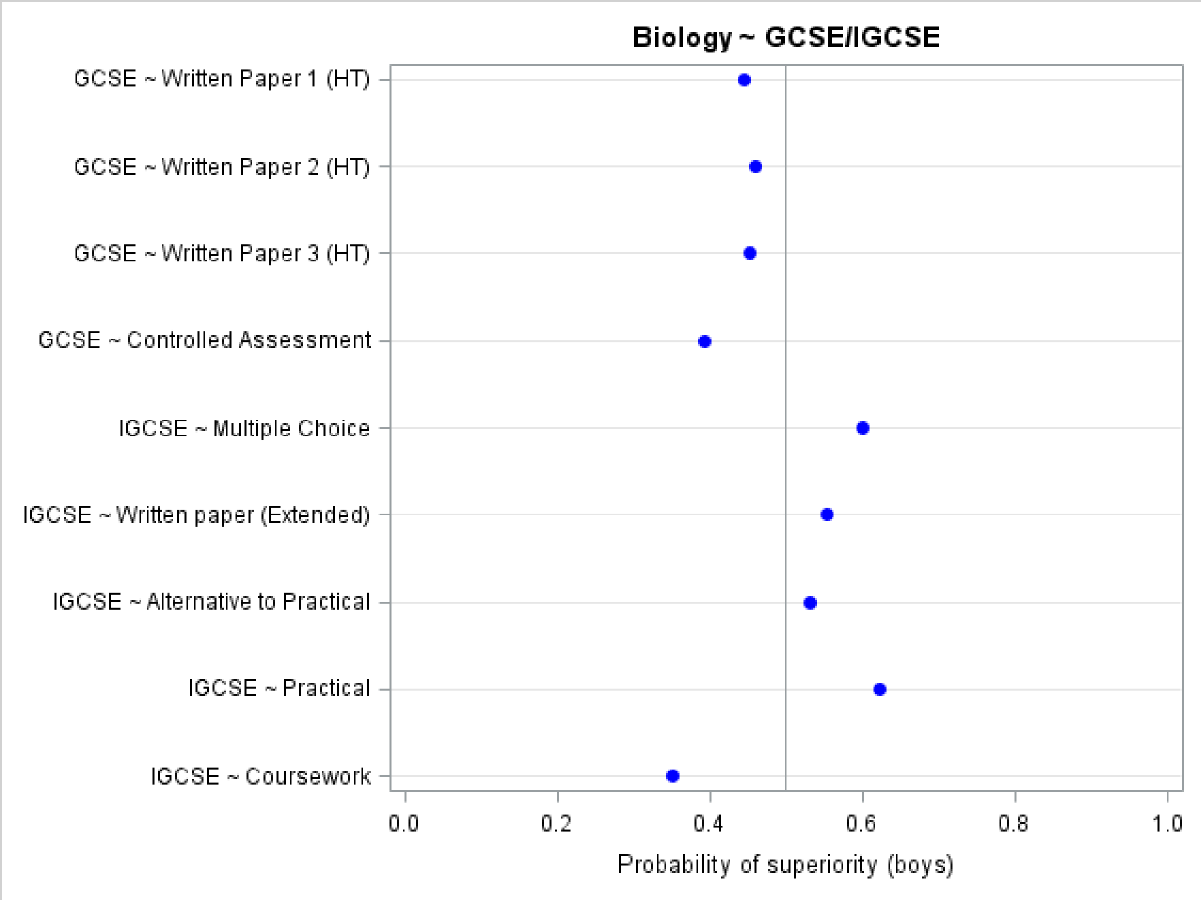


Figure 4.3: Probability of a boy having a higher score than a girl in IGCSE/GCSE biology components (June 2014)

Summary and discussion

In this paper we analysed differences between boys and girls in their choice of GCSE subject and achievement in the examination. For presentation purposes we grouped the subjects into five categories: STEM, Humanities, Languages, Expressive and Applied. The main findings are summarised below.

Subject choice

Using data from the National Pupil Database in 2005 and 2014 (which covers children in all schools in England, whichever exam board they chose) we found that:

- Boys formed the greater proportion of the GCSE examination entry in nearly all STEM subjects in both 2005 and 2014.
- In 2014 the proportion of boys and girls in the separate sciences (Physics, Chemistry, Biology) was almost equal (i.e. 50% of each) whereas in 2005 the proportion of boys in the separate sciences was around 55-59%.
- The proportion of boys and girls in most Humanities subjects was fairly close to 50%, with the exception of Psychology and Sociology where nearly 70% of the entry was from girls. For the majority of subjects the proportions of boys and girls were slightly more similar in 2014 than in 2005.
- Some language GCSEs were taken by more boys than girls and others were taken by more girls than boys. There were fewer boys than girls in the largest-entry language GCSEs (French, Spanish, German).
- The biggest gender differences in proportion of the entry were in the Expressive and Applied categories, and these were invariably along stereotypical lines. For example, D&T Electronic Products and D&T Engineering comprised ~90% boys, whereas D&T Textiles and Health & Social Care comprised ~90% girls.

Subject outcomes (grades)

The main findings, again using data from the National Pupil Database in 2005 and 2014, were that:

- Girls tended to do better than boys in all GCSEs, regardless of whether it was a subject where the entry was predominantly from boys or girls.
- The difference (gender gap) in percentage points was greater at grade C and above (around 10.5) than at grade A* (around 3.0).
- The gender gap was generally smaller in STEM and Language subjects (around 5 percentage points at grade C) and greater in Applied, Expressive and Humanities subjects (around 14 percentage points at grade C).
- In most subjects the gap tended to be slightly wider in 2014 than it was in 2005, but this varied within and between subject categories. Interpreting changes in gaps using a percentage point metric can be problematic given the dependence of this measure on the shape of the distribution and the location of the grade boundaries.
- The only subjects in 2014 where there was a higher percentage of boys than girls at both grade C and grade A* were ‘Applications of Mathematics’ and Arabic, taken by ~11,600 and ~1,700 candidates respectively.

Subject outcomes (scores)
Using data from the exam board OCR we were able to obtain the underlying scores from which the grades were based and thus carry out some more fine-grained analyses. First of all we considered the probability that a randomly sampled boy would have a higher score than a randomly sampled girl – the 'probability of superiority' p(sup). This statistic has the advantage of being 'scale-free' in both the sense that examinations with mark scales of different lengths can be compared and also in that effect sizes can be compared with those found in completely different attributes, such as height.

As expected from the analysis of grades using data from all boards, we found that p(sup) for boys was generally lower than 0.50 showing that in all subjects girls were likely to do better than boys. The overall average across all subjects was 0.41, being highest in STEM subjects (0.46 on average) and lowest in Expressive subjects (0.35 on average). To put this in context, the p(sup) for 16 year old boys vs. girls in terms of height is 0.85. A p(sup) of 0.41 corresponds to the difference in height between Year 11 boys who are 9 months apart in age, so is not a particularly large difference in terms of being visible 'to the naked eye'. However, it is bigger than the effect of month of birth on exam scores where we found the average p(sup) to be 0.48 for those born in the last 6 months of the academic year compared with those born in the first 6 months.

The data also confirmed the general finding in the research literature that the scores of boys on cognitive tests are more spread out than those of girls: boys' scores had a higher standard deviation (SD) than girls' scores in 54 out of 73 specifications (80.0%). The combination of higher mean for girls and higher SD for boys was found in 52 out of 73 specifications (71.2%). However, it is also often claimed that the higher variability of boys' scores means that they are over-represented at both extremes of the score distribution. We did not find this in the OCR GCSE data – only 4 of 53 specifications had relatively more boys than girls in the top 5% of scores whereas 52 out of 53 specifications had relatively more boys than girls in the bottom 5% of scores. (The one exception was Economics, where the proportions were practically the same). This suggests that at GCSE, the lower mean and higher SD for boys can mainly be attributed to a higher proportion of low scores for boys.

Assessment type
Most GCSEs are made up of assessed components of different types. Within the OCR data we were able to distinguish between coursework (which includes practicals, portfolios, performances and controlled assessments) and written examinations. In 126 out of 135 coursework components (93.3%), girls' scores had a higher mean than boys', compared to 176 out of 209 written examination components (84.2%). This supports the hypothesis that girls tend to perform better in coursework assessments than boys.

Within a selection of the written examination components we looked for gender differences between those comprising mainly long-answer or short-answer questions. Boys performed quite similarly to girls in components that comprised mostly short-answer questions, but girls performed better than boys in those components with long-answer or essay questions. It is not straightforward to interpret this kind of finding because subjects differ in the proportion of long and short answer questions in their assessment components.

Conclusion

The findings in this report are generally consistent with what has been found in previous research. At GCSE, gender differences in subject choice are generally more dramatic than differences in achievement, with some subjects being chosen by many more boys than girls, and vice versa. Differences in achievement consistently favour girls, across all subject areas and regardless of whether we consider the percentage achieving grade C or above, grade A*, mean scores or probability of superiority. The gender gap is narrower in STEM subjects and languages. In terms of the size of the boy-girl difference, it is on average roughly comparable to 9 months growth in height for Year 11 boys. It is thus not a particularly large effect (as Benton (2015) has noted, two randomly selected boys or girls will differ more from each other than the average girl differs from the average boy), and as many other authors have noted there are larger and arguably more concerning differences between groupings based on other demographic variables such as ethnicity or social class. However, the average boy-girl difference in GCSE outcomes is notably larger than the average difference between those born in the first six months of the academic year and those born in the last six months of the academic year.

Future work could extend the analysis to A-levels, where subject choice is more influential. It would also be interesting to explore further the contributions of subject content, assessment structure and question type to gender differences in examination scores.

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Appendix A

Table A1: GCSE Entries in 2005 and 2014 (source: National Pupil Database).

Category	Subject	2005				2014			
		Boys		Girls		Boys		Girls	
		N	%	N	%	N	%	N	%
STEM	Geology	307	74.7	104	25.3	533	76.8	161	23.2
	Astronomy	140	69.7	61	30.3	856	63.7	487	36.3
	Environmental Science	249	64.5	137	35.5	1568	54.6	1302	45.4
	Additional Mathematics	171	63.3	99	36.7	.	.	.	.
	Rural Science	601	61.8	372	38.2	.	.	.	.
	Physics	26935	59.3	18490	40.7	62808	50.6	61222	49.4
	Chemistry	26729	58.2	19177	41.8	61935	50.8	59974	49.2
	Biology	27096	57.4	20150	42.6	61703	50.7	59909	49.3
	Information & Communications Technology	47093	56.8	35808	43.2	44161	57.2	33027	42.8
	Statistics	16469	53.9	14093	46.1	18123	53.5	15747	46.5
	Environmental Studies. Single	28	50.9	27	49.1	.	.	.	.
	Science SA	32464	50.3	32014	49.7	.	.	.	.
	Mathematics	296202	50.1	295058	49.9	258592	50.6	252516	49.4
	Science: Double Award	222441	49.4	227407	50.6	.	.	.	.
	Science: Double Award B	222441	49.4	227407	50.6	.	.	.	.
	Other Science	2055	43.7	2646	56.3	.	.	.	.
	Biology: Human	419	43.5	544	56.5	.	.	.	.
	Applied Engineering	.	.	.	.	3822	94.8	211	5.2
	Computer Studies/Computing	.	.	.	.	13105	84.9	2334	15.1
	Applications of Mathematics	.	.	.	.	6031	52.1	5553	47.9
	Science (Core)	.	.	.	.	76054	52.1	70063	48.0
	Methods in Mathematics	.	.	.	.	4348	50.7	4220	49.3
	Additional Science	.	.	.	.	130236	48.5	138181	51.5
Humanities	Geography	105524	56.3	82064	43.7	107426	53.7	92522	46.3
	General Studies	1871	54.0	1596	46.0	4156	50.6	4061	49.4
	Classical Civilisation	2203	53.6	1908	46.4	2048	52.1	1884	47.9
	History	102689	50.5	100762	49.5	110389	48.5	117262	51.5
	English Language & Literature	295220	49.9	296480	50.1	58640	60.0	39170	40.0
	English Literature	251286	48.3	268901	51.7	188032	47.4	208324	52.6
	Media/Film/Tv Studies	18953	48.0	20556	52.0	23171	51.7	21620	48.3
	Humanities: Single	6811	47.1	7655	52.9	3600	51.1	3444	48.9
	Religious Studies	54418	42.9	72425	57.1	110680	46.6	126965	53.4
	Social Science	471	36.8	810	63.2	.	.	.	.
	Psychology	514	27.6	1349	72.4	4404	32.8	9017	67.2
	Sociology	3944	26.7	10805	73.3	5789	29.4	13885	70.6
	English Studies	.	.	.	.	199	65.5	105	34.5
	Film Studies	.	.	.	.	3424	58.1	2465	41.9
	Ancient History	.	.	.	.	580	57.4	430	42.6
	English Language	.	.	.	.	131035	47.4	145638	52.6
	Social Science: Citizenship	.	.	.	.	8250	45.0	10068	55.0

Table A1 (continued): GCSE Entries in 2005 and 2014.

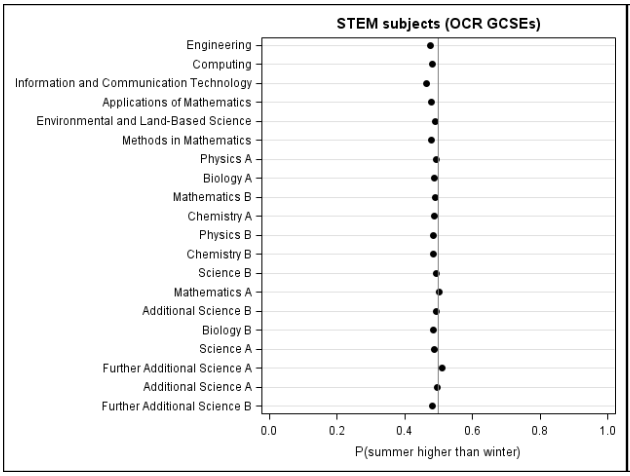
Category	Subject	2005				2014			
		Boys		Girls		Boys		Girls	
		N	%	N	%	N	%	N	%
Languages	Other Classical Languages	57	85.1	10	14.9	31	60.8	20	39.2
	Persian	136	69.0	61	31.0	126	57.0	95	43.0
	Classical Greek	561	61.4	353	38.6	676	59.8	455	40.2
	Modern Greek	64	59.3	44	40.7	59	51.3	56	48.7
	Turkish	317	56.7	242	43.3	287	52.0	265	48.0
	Punjabi	384	56.3	298	43.7	186	47.9	202	52.1
	Polish	51	54.3	43	45.7	709	51.8	660	48.2
	Dutch	66	53.2	58	46.8	62	44.3	78	55.7
	Chinese	669	51.3	636	48.7	1022	54.8	844	45.2
	Portuguese	158	49.7	160	50.3	374	46.9	424	53.1
	Japanese	354	49.5	361	50.5	257	44.4	322	55.6
	Arabic	460	48.9	480	51.1	790	47.5	873	52.5
	Latin	4089	48.9	4269	51.1	4033	48.0	4367	52.0
	Russian	599	48.4	638	51.6	723	54.2	610	45.8
	German	46929	48.1	50638	51.9	26277	48.1	28301	51.9
	Modern Hebrew	97	47.3	108	52.7	102	39.4	157	60.6
	Bengali	722	46.6	826	53.4	366	50.3	362	49.7
	French	107550	45.2	130533	54.8	63122	43.1	83224	56.9
	Urdu	2243	44.8	2766	55.2	1209	40.1	1809	59.9
	Gujarati	142	42.6	191	57.4	105	48.2	113	51.8
	Italian	1139	41.9	1577	58.1	1370	42.4	1858	57.6
	Spanish	20673	40.8	30030	59.2	35502	43.7	45800	56.3
Expressive	D&T Electronic Products	15782	93.4	1110	6.6	7285	92.4	595	7.6
	D&T Engineering	1231	93.3	88	6.7	282	93.1	21	6.9
	D&T Systems & Control	10910	92.4	900	7.6	2981	95.8	131	4.2
	D&T Resistant Materials	79289	81.8	17615	18.2	42918	85.5	7287	14.5
	D&T Product Design	9849	62.3	5960	37.7	23858	71.1	9689	28.9
	Art & Design (Graphics)	2581	58.3	1849	41.7	4203	57.5	3112	42.5
	D&T Graphic Products	48294	56.9	36581	43.1	19964	61.8	12326	38.2
	Art & Design (Photography)	1656	56.6	1270	43.4	6602	36.2	11656	63.8
	Art & Design (3d Studies)	1978	56.0	1556	44.0	885	50.3	873	49.7
	Music	25823	50.3	25536	49.7	20006	49.3	20579	50.7
	Design & Technology	1871	44.3	2349	55.7	.	.	.	.
	Art & Design (Fine Art)	21120	42.4	28711	57.6	16739	33.7	32989	66.3
	Performing Arts	27	42.2	37	57.8	1006	29.4	2414	70.6
	Art & Design	49263	40.9	71200	59.1	27255	33.5	54208	66.5
	Drama & Theatre Studies	33795	36.7	58357	63.3	26250	38.4	42173	61.6
	Expressive Arts & Performance Studies	2321	29.9	5454	70.1	715	32.9	1455	67.1
	D&T Food Technology	26909	29.0	65977	71.0	14022	36.8	24083	63.2
	Art & Design (Drawing & Painting)	28	28.0	72	72.0	.	.	.	.
	Art & Design (Textiles)	454	7.1	5940	92.9	297	3.9	7407	96.1
	Dance	608	4.3	13595	95.7	762	7.0	10153	93.0
	D&T Textiles Technology	1513	3.2	46151	96.8	767	3.2	23393	96.8
	Applied Art & Design	.	.	.	.	386	41.5	544	58.5
	Art & Design (Critical Studies)	.	.	.	.	15	23.4	49	76.6

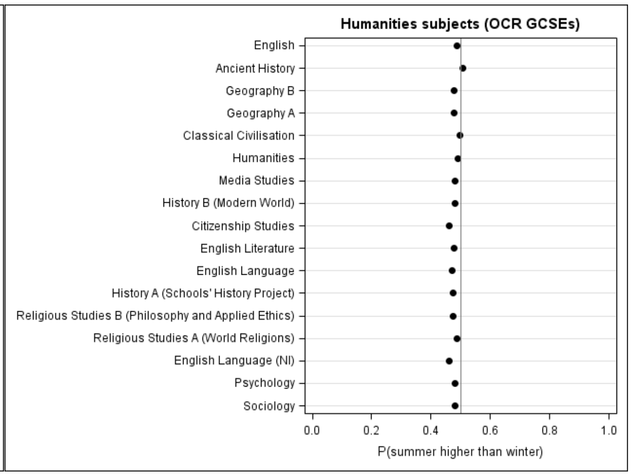
Table A1 (continued): GCSE Entries in 2005 and 2014.

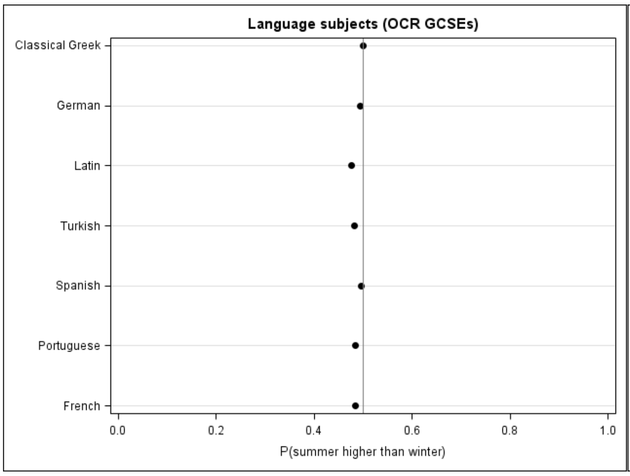
Category	Subject	2005				2014			
		Boys		Girls		Boys		Girls	
		N	%	N	%	N	%	N	%
Applied	Motor Vehicle Studies	137	95.1	7	4.9	.	.	.	.
	Electronics	631	94.7	35	5.3	525	96.5	19	3.5
	Economics	2116	77.7	607	22.3	3402	70.7	1408	29.3
	Physical Education/Sports Studies	84807	65.3	45094	34.7	65146	66.3	33161	33.7
	Archaeology	48	64.9	26	35.1	.	.	.	.
	Business Studies & Economics	2533	62.2	1540	37.8	2564	65.4	1356	34.6
	Accounting/Finance	148	59.2	102	40.8	.	.	.	.
	Business Studies: Single	42272	57.3	31475	42.7	39967	58.6	28281	41.4
	Office Technology	14190	49.6	14433	50.4	6917	54.7	5740	45.4
	Law	404	48.7	426	51.3	840	44.0	1069	56.0
	Tourism	554	40.5	815	59.5	.	.	.	.
	Catering Studies	1165	39.0	1824	61.0	.	.	.	.
	Home Economics: Food	1452	28.9	3573	71.1	3163	35.6	5725	64.4
	Home Economics: Child Development	380	1.3	28863	98.7	258	1.5	17367	98.5
	Home Economics: Textiles	4	1.3	304	98.7	5	2.5	199	97.5
	Health & Social Care	.	.	.	.	301	5.7	4971	94.3

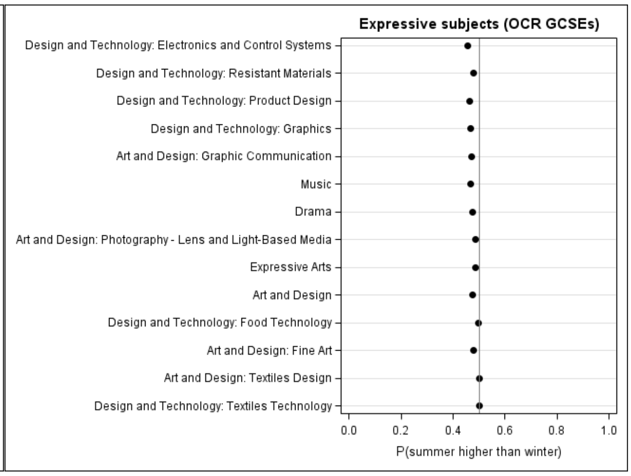
Appendix B

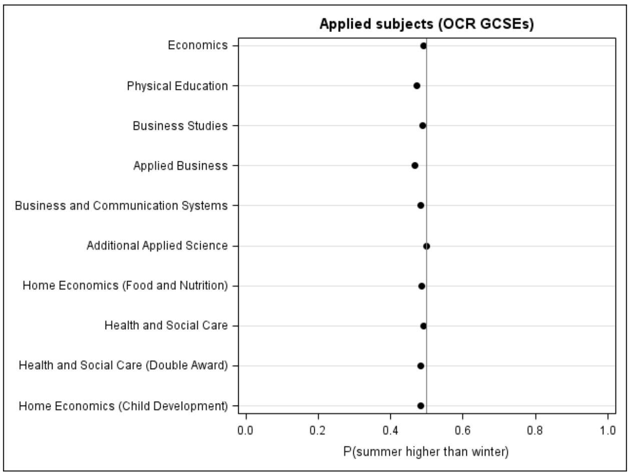
The graphs below show the probability of superiority in OCR GCSEs taken in June 2014 for Year 11 students who were born in the summer months[13] (March to August) compared to the winter months (September to February).











[13] The term 'summer-borns' in other research often refers only to students born in June, July and August.