GLOBAL GAPS

Comparing socio-economic gaps in the performance of highly able UK pupils internationally

Dr John Jerrim
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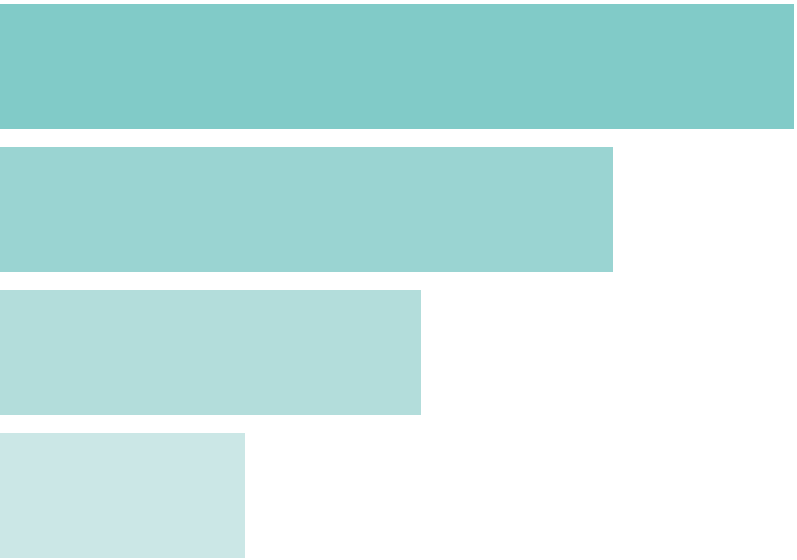

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FOREWORD

For 20 years, the Sutton Trust has worked to improve opportunities for young people, particularly those of high ability from low and middle income backgrounds. But we have also been acutely aware during that time that highly able young people from less advantaged backgrounds too often lag far behind their better-off peers.

That's why it matters so much that socio-economic gaps of two to three years remain for highly able pupils at the age of 15 in reading, mathematics and science. With the last OECD PISA survey we found particularly worrying gaps in maths and reading. Those gaps remain large, though they are lower in Scotland and particularly Wales.

We have often documented the poor performance of working class boys. Interestingly, here the gaps are bigger for girls in science and reading than they are for boys. It is true that this reflects a particularly good performance for better-off girls, but it is unsatisfactory to accept that bright but poor girls should not perform just as well. This gap is then reflected – for both genders – in the university access gap three years later.

Tackling the needs of the highly able must be a priority for government. We advocate a three pronged approach: ensuring that every comprehensive can provide properly for its ablest students with a new 'highly able fund' to spur improvements; much better access to the existing grammar schools for less advantaged able students; and opening up our best independent day schools based on ability rather than ability to pay.

There are also important lessons for Wales and Scotland, who are each embarking on their own approaches to education reform. They have real university access problems too, so the poor performance of Wales and declines in maths in Scotland are particularly concerning.

The Sutton Trust plays its part, supporting over 3,000 young people a year on our summer school and Pathways programmes, along with 600 12-15 year-olds through Sutton Scholars. However, we also need government to implement the three pronged approach we advocate.

I am very grateful to Dr John Jerrim for this important new research.

Sir Peter Lampl, Founder and Chairman, the Sutton Trust

Chairman, Education Endowment Foundation

Science

- England has some of the best young scientists anywhere in the world. Finland and Japan are the only OECD countries where the most able pupils achieve significantly higher science scores than in England.
- Able children from poor backgrounds in England also perform comparatively well on the PISA science test; in only Finland and Estonia do the highest-achieving poor children perform significantly better in science than in England.
- However, bright but poor pupils in England and Scotland (in the top 10% of achievement nationally, but the lowest quarter socio-economically) are substantially behind bright well-off pupils – a gap of around 2 years and 8 months, around the OECD average.
- The gap is particularly big for girls: bright but poor girls lag 3 years behind bright but better-off girls in science in England. This is 8 months greater than the equivalent gap for boys.
- The socio-economic gap is smaller in Northern Ireland and Wales. However, this reflects the comparatively weak performance amongst the top socio-economic group, particularly in Wales, rather than any outstanding level of achievement amongst academically able pupils from low socio-economic status homes.
- While the scores of England's highest achieving pupils in science have remained stagnant since 2006, there have been large declines in Northern Ireland, Scotland and Wales. This, however, is being driven by a fall in the performance of able children from more advantaged socio-economic groups, rather than those from disadvantaged backgrounds.

Mathematics

- England's highest achievers in mathematics are around the level of the highest achievers in the median OECD country, and significantly outperform their counterparts in the rest of the UK. However, they perform significantly behind their peers in countries including Canada, Estonia, Switzerland and the Netherlands.
- Wales compares particularly poorly in this respect, with only three OECD countries (Chile, Turkey and Mexico) performing significantly worse in terms of the attainment of the most able pupils in mathematics. Able students in Scotland and Northern Ireland also perform worse than in most other industrialised countries.
- There is, however, no significant difference across the four UK countries in terms of the mathematics skills of the highest-achieving pupils from disadvantaged social backgrounds. Nevertheless, bright but poorer pupils still lag well behind their better off peers - by two or more years.
- The gap between the highest-performing children from advantaged and disadvantaged homes is similar in England and Scotland to the OECD average in mathematics – around 2 years and 8 months of schooling. The socio-economic gap in Wales is smaller than in any other industrialised country (2 years of schooling) though this reflects the weak performance of better-off Welsh students rather than any strong performance by poorer students.

- The mathematics skills of the most able pupils across the UK, including those from low socio-economic backgrounds, have shown no improvement over the last decade, with signs of a decline in Scotland since 2009.

Reading

- England's highest achievers in reading are around the OECD median. While Northern Ireland and Scotland perform slightly below the OECD median, bright students in Wales fare particularly poorly. In only three industrialised countries (Chile, Turkey and Mexico) are the reading skills of the highest-achievers lower than in Wales.
- Similar findings for England, Northern Ireland and Scotland hold for high-achieving pupils from low socio-economic backgrounds. There are only three OECD countries (Norway, Finland and Canada) where the highest-achieving 10 percent of pupils have significantly higher reading skills than their counterparts in England.
- PISA shows that there are big gaps between the reading skills of the highest-achieving pupils from advantaged and disadvantaged backgrounds in most industrialised countries. In England the gap is 2 years and 8 months, and although this is slightly above the average across industrialised countries (80 points versus 73 points) it is not statistically significant. The gap is 2 years and 2 months in Scotland, and around 2 years in Northern Ireland and Wales.
- The socio-economic gap in reading for bright girls in England is 3 years of schooling, 9 months greater than that for boys.
- In England, there has been some improvement in the reading skills of high-achieving pupils from low socio-economic backgrounds between 2009 and 2015. Across the rest of the UK, the reading skills of academically able pupils (including those from disadvantaged homes) have not improved or declined over the last decade.

	England	Northern Ireland	Scotland	Wales	OECD median
All high-achieving pupils					
Science	642	618	619	602	620
Mathematics	613	592	601	578	610
Reading	625	605	608	588	617
High-achieving better-off pupils					
Science	680	648	659	629	657
Mathematics	649	623	633	607	645
Reading	665	637	639	614	649
High-achieving poor pupils					
Science	598	582	581	576	575
Mathematics	567	556	556	551	565
Reading	585	578	574	562	576
Gap between high-achieving better-off and poor					
Science	33 months	26 months	31 months	21 months	33 months
Mathematics	33 months	27 months	31 months	22 months	32 months
Reading	32 months	24 months	26 months	21 months	29 months

Notes: Figures refer to PISA points score.

RECOMMENDATIONS

- The government should establish a highly able fund to support the prospects of high attainers in comprehensive schools, where high potential children from low and middle income backgrounds are identified at the start of compulsory education and receive sustained interventions throughout their time at school. An effective national programme for highly able state school pupils, with ring-fenced funding to support evidence-based activities and tracking of pupils' progress would do much to improve social mobility, maximising the attainment of the majority of highly able students, widening entry to top universities, and improving their economic prospects in the long term.

- All schools must be made accountable for the progress of their most able pupils. These pupils should have access to triple sciences and a broad traditional curriculum, including a language and humanity, which widens their future educational opportunities. The Government should report the (3-year average) Progress 8 figures for highly able girls and boys in performance tables.

- Schools where highly able pupils currently underperform should be supported through the designation of another local exemplar school. In the small number of areas where there is no exemplary good practice, a one-off centralised support mechanism should be set-up.

- Exemplar schools already successfully catering for highly able pupils that are located in areas of underperformance should be invited to consider whether they are able to deliver a programme of extra-curricular support to raise horizons and aspirations for children living in the wider area.

1. INTRODUCTION

1.1 Background

Much academic and public policy research in education focuses upon the outcomes of the 'average' pupil, or the proportion of children failing to meet a basic floor target (such as the C grade in GCSEs). Less attention is paid to achievement at the top: how the best and brightest young people in the UK are doing at school, and whether this is better or worse than young people in other industrialised countries. Yet this is something that is critical for the future of the economy. Having a plentiful supply of young people with high-level skills is vital for the sustainability of certain professions (like doctors or scientists) and to continue the research and development that puts the UK at the forefront of technological innovation. Moreover, ensuring academically able young people from poor backgrounds maximise their potential is vital for stimulating greater levels of social mobility; if we want more people from disadvantaged backgrounds to be entering the top jobs, then we need to ensure that they have the skills they need to succeed.

Previous research on the outcomes of able children from lower socio-economic backgrounds in the UK has highlighted some concerning findings. For a long time it was believed that high-achieving children from poor backgrounds were overtaken by low-achieving better-off children by around age five (Feinstein 2003)[1], though this has since been shown to not be the case (Jerrim and Vignoles 2013).[2] Nevertheless, recent work by Crawford, Macmillan and Vignoles (2016) indicates that initially high-achieving poor children do lose some academic ground to their more socio-economically advantaged peers between the ages of seven and 16.[3] Furthermore, previous research, based upon PISA 2009 data, found that the gap in reading skills between high-achieving poor children and high-achieving better-off children was greater in England and Scotland than the average industrialised country (Jerrim 2012; Sutton Trust 2013).[4]

I develop this work within this report using the recently released PISA 2015 dataset. As well as providing an update to previous international comparative evidence on this matter, a series of other changes have also been made. These include:

- Results presented for each of the three core PISA domains (science, mathematics and reading).
- All estimates presented separately for England, Northern Ireland, Scotland and Wales.
- Consideration of absolute levels of performance amongst the highest-achieving children from poor backgrounds across the UK.

[1] Feinstein, L. (2003). Inequality in the early cognitive development of children in the early 1970 cohort. Economica, 70, 73–97.
[2] Jerrim, J., and Vignoles, A. (2013). Social mobility, regression to the mean and the cognitive development of high ability children from disadvantaged homes. Journal of the Royal Statistical Society: Series A (Statistics in Society), 176: 887–906.
[3] Crawford, C.; Macmillan, L. and Vignoles, A. (2016). When and why do initially high-achieving poor children fall behind? Oxford Review of Education http://dx.doi.org/10.1080/03054985.2016.1240672
[4] Jerrim, J. (2012). 'The socio-economic gradient in teenagers' literacy skills: how does England compare to other countries?' *Fiscal Studies* 33(2):159–84.

- Whether any progress has been made in increasing the skills of the UK's most able pupils over the last decade – including those from lower socio-economic backgrounds.

In doing so, this report attempts to provide a comprehensive overview of what PISA can tell us about the achievement of academically able pupils from across the UK, and how this compares to other countries.

The report proceeds as follows: Section 2 provides a brief overview of the empirical methodology with supplementary details provided in the Appendix. Sections 3, 4 and 5 then present the results for high-achieving pupils in science, reading and mathematics. Each of these sections begins by documenting the absolute performance of high-achieving pupils across OECD countries, before turning to differences between socio-economic groups, and how performance of the highest-achievers has changed over time. Conclusions follow in section 6.

2. Methodology

The data are drawn from the 2015 round of the Programme for International Student Assessment (PISA); a study of 15 year-olds' achievement conducted every three years by the Organisation for Economic Co-Operation and Development (OECD). In 2015, PISA was conducted in November, when children were in their final year of compulsory schooling and just six months away from taking their GCSEs. The PISA consortia state that the test measures children's 'functional ability' (how well they can use the concepts examined in 'real life' situations) in three domains (reading, mathematics and science). In 2015, science was assigned as the major domain. This report focuses upon the highest-achieving pupils in the United Kingdom, particularly those from low socio-economic backgrounds. If readers are interested in taking sample questions from the PISA test, they can follow the link provided here: https://www.oecd.org/pisa/pisaproducts/pisa-test-questions.htm

Throughout this report, we define 'high-achievement' as the 90th percentile of the PISA test score distribution within each country. The 90th percentile refers to the score that a child would need to achieve to make it into the top 10 percent of children within that country. This statistic will be compared across countries (using the PISA 2015 data) and, for the four UK countries, over time (using all PISA waves since 2006).

When investigating socio-economic differences amongst high-achieving pupils, the report focuses upon two particular groups of children: (i) those from 'advantaged' family backgrounds (ii) those from disadvantaged family backgrounds. Family background refers to the Economic, Social and Cultural Status (ESCS) index in the PISA dataset. This is a continuous measure, which combines information on (a) parental education; (b) parental occupation and (c) household possessions (a common proxy used in international survey to capture family wealth). Within each country, children are divided into quartiles (four equal groups, with each group containing 25% of the 15 year old population). PISA test scores are then compared between the top quartile (most advantaged 25% of the population) and the bottom quartile (least advantaged 25% of the population). Put simply, results refer to the difference in test scores between children who have parents with high levels of education working in occupations like managers, doctors, lawyers and engineers and those whose parents have a low level of education and work in unskilled or semi-skilled jobs such as cleaners, waiters / waitresses or labourers.

Further methodological details, including changes to the methodology implemented since the Sutton Trust *Reading Gap* report using PISA 2009 data, can be found in the Appendix.

3. Science

3.1 The performance of the highest-achieving pupils in science across countries

Table 3.1 illustrates the absolute performance of the highest-achieving pupils in science across OECD countries. England fares particularly well compared to other industrialised nations. There are only two OECD countries (Japan and Finland) with a significantly higher score. The higher scores in Estonia, New Zealand and Canada are not statistically significant. All other parts of the UK countries are at least 20 points (two terms of schooling) behind England, with the difference statistically significant. Whereas Scotland and Northern Ireland are around the median OECD country, Wales is in the bottom quarter of the table. Indeed, the performance of the highest-achieving Welsh pupils in science is similar to the situation in countries like Israel, Hungary and Latvia. Thus, while England has some of the world's highest-performing pupils in science, Wales fares particularly poorly. Scotland and Northern Ireland are close to the average.

Table 3.1. Science scores of the highest achieving 10% of pupils across OECD countries

Country	90th percentile	Country	90th percentile
Japan	**655***	**Scotland**	**619***
Finland	**651***	**Poland**	**619***
Estonia	648	**Northern Ireland**	**618***
New Zealand	647	**Czech Republic**	**618***
Canada	644	**Ireland**	**618***
England	642	**Denmark**	**617***
Australia	639	**Luxembourg**	**615***
Netherlands	638	**Israel**	**606***
Slovenia	636	**Spain**	**605***
Germany	636	**Wales**	**602***
South Korea	636	**Hungary**	**601***
Switzerland	632	**Italy**	**599***
Belgium	**629***	**Latvia**	**596***
United States	**626***	**Iceland**	**593***
Sweden	**625***	**Slovakia**	**588***
France	**623***	**Greece**	**575***
Norway	**622***	**Chile**	**560***
Austria	**621***	**Turkey**	**532***
Portugal	**620***	**Mexico**	**510***

Notes: Jerrim and Shure (2016: Table 2.5). Bold with * indicates significantly different from England at the 5% level. Portugal is the median OECD country with a score of 620 points.

3.2 The science performance of the highest-achieving pupils from low socio-economic backgrounds

Table 3.2 provides an international comparison focusing on the performance of the highest-achieving pupils from a low socio-economic background. This again appears to be a strength in England; only Finland and Estonia have superior science achievement amongst this group. While the table suggests that Japan, Canada and South Korea also perform better, the difference is not statistically significant given the sample size. England is again the best performing country within the UK, though because of the reduced sample size, is not statistically significantly

different to either Scotland or Northern Ireland. Interestingly, Wales actually sits around the OECD median, and is similar to countries like Germany, Sweden, Ireland and the United States. Overall, Table 3.2 suggests a reasonably strong comparative performance for high-achieving disadvantaged pupils in science across the UK compared with other industrialised countries.

Table 3.2. The PISA science scores of the highest achieving 10% of pupils from low socio-economic backgrounds across OECD countries

Country	90th percentile	Country	90th percentile
Finland	**617***	**United States**	**574***
Estonia	**615***	**Sweden**	**574***
Japan	612	**Ireland**	**573***
Canada	607	**France**	**571***
South Korea	598	**Poland**	**570***
England	598	**Spain**	**567***
Australia	597	**Iceland**	**567***
Netherlands	591	**Austria**	**566***
Slovenia	590	**Italy**	**560***
New Zealand	589	**Latvia**	**557***
Norway	587	**Czech Republic**	**557***
Germany	583	**Luxembourg**	**544***
Switzerland	582	**Slovak Republic**	**539***
Northern Ireland	582	**Israel**	**537***
Scotland	581	**Hungary**	**534***
Belgium	**576***	**Greece**	**532***
Wales	**576***	**Chile**	**505***
Portugal	**575***	**Turkey**	**499***
Denmark	**575***	**Mexico**	**472***

Notes: Author's calculations using the PISA 2015 database. Figures refer to the 90th percentile of science scores for children in the bottom ESCS quartile. First generation immigrants have been excluded. Denmark is the median OECD country with a score of 575 points.

3.3 The gap in science performance between the highest-achieving pupils from advantaged and disadvantaged backgrounds

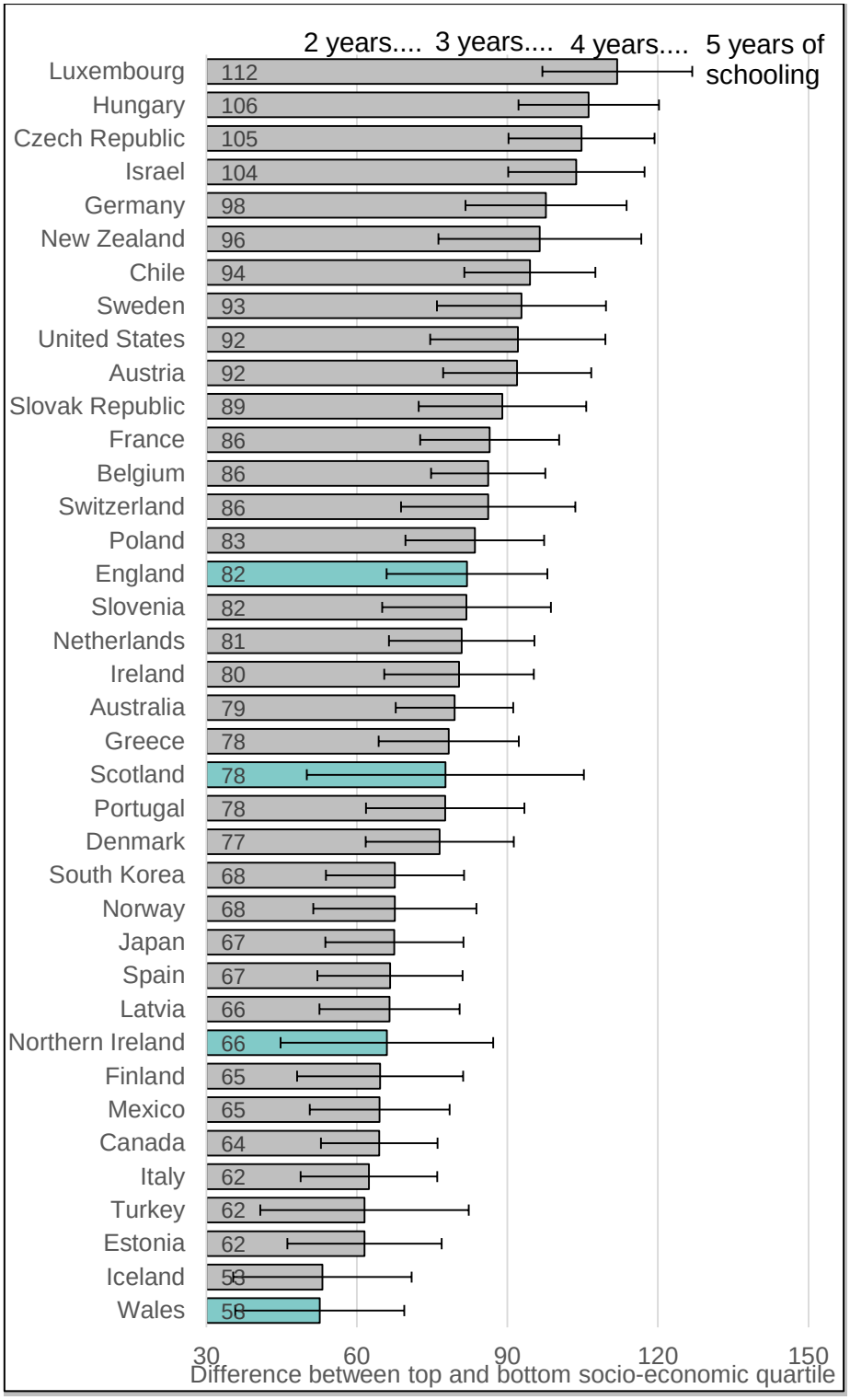
Figure 3.1 turns to the magnitude of the gap in PISA science scores between the top-performing pupils from low and high socio-economic backgrounds within each OECD country. England and Scotland are around the OECD average, with a gap of around two years and eight months of schooling. On this measure, only Wales and Iceland have a significantly smaller gap amongst high-achievers than England, and in only Israel, Hungary, Luxembourg and the Czech Republic is the gap significantly bigger.

It is interesting to note that Northern Ireland and Wales have amongst the smallest gap out of any of the OECD countries, standing at around two years of schooling. This is not as positive a finding as it seems. As noted by Jerrim and Shure (2016), a major contributing factor to what appears to be a comparatively small socio-economic difference in Wales is the under-performance of children from the most advantaged socio-economic backgrounds.[5] Indeed,

[5] Jerrim, J and Shure, N. 2016. PISA 2015 national report for Wales.

although Wales is around the OECD average in Table 3.2, bright pupils from high socio-economic backgrounds in Wales perform poorly relative to their peers in other industrialised countries.

Figure 3.1 The socio-economic gap in children's science skills *amongst the highest-achievers* – A comparison across OECD countries



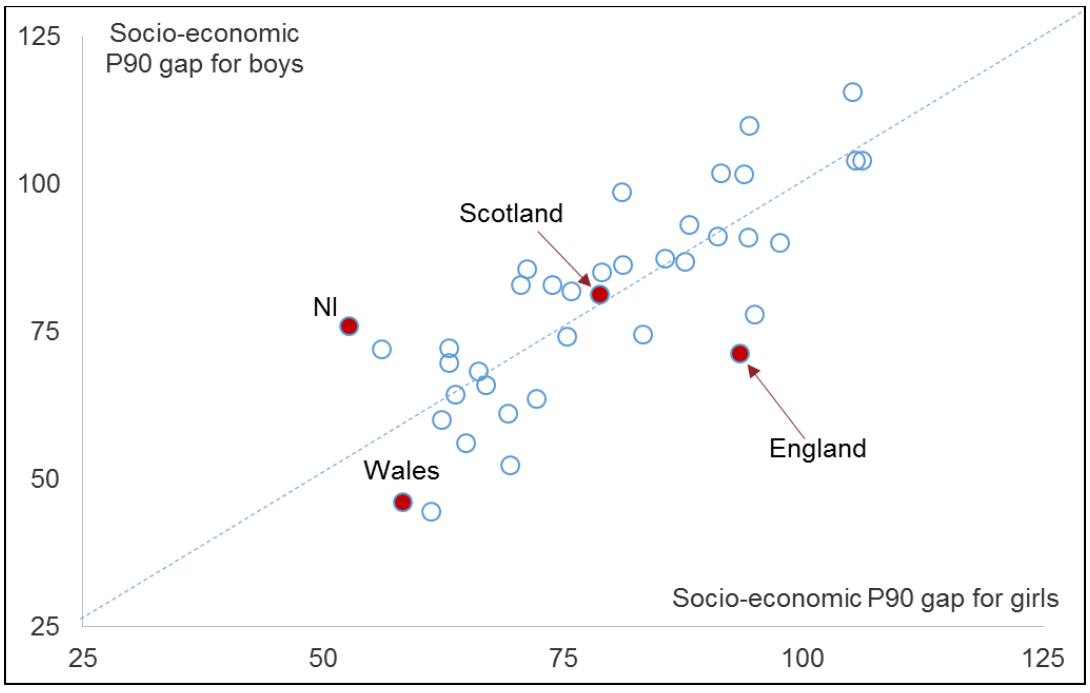
Notes: Thin black lines refer to estimated 95% confidence intervals. 'High achieving' refers to the 90th percentile. First generation immigrants have been excluded.

3.4 Gender differences in the socio-economic science gap

Figure 3.2 compares the socio-economic gap for the highest achieving boys and girls. Countries to the right of the graph are where the socio-economic gap in girls test scores is particularly large. Similarly, countries towards the top of the graph are those where the socio-economic gap for boys test scores is particularly large. The further a country is away from the dashed line, the greater the difference in the socio-economic gap between boys and girls.

England is somewhat of an outlier, and is one of the countries furthest below the dashed 45 degree line. This highlights how the socio-economic gap for girls is particularly pronounced (3 years of schooling), and greater than the analogous gap for boys (2 years and 4 months of schooling). It is particularly interesting to compare England and Northern Ireland in this respect; in both countries the socio-economic gap for boys is reasonably similar (71 points in England and 76 in Northern Ireland) but is very different for girls (93 versus 53 test points). Indeed, whereas the gap for English boys is quite favourable compared to other countries, the same is not true for girls (there is no country where the gap for girls is significantly bigger). However this result is being driven by the exceptionally strong performance of academically able high socio-economic status girls in England, rather than weak performance amongst those from low socio-economic backgrounds.[6]

Figure 3.2. The socio-economic gap in *high achieving* children's science skills– a comparison between boys and girls



Notes: First generation immigrants have been excluded.

[6] There are seven OECD countries where academically able low socio-economic status girls achieve higher science scores than in England, though only one of these differences (Finland) is statistically significant. On the other hand, there is no OECD country where academically able high socio-economic status girls do better than England – this is an area where England leads the industrialised world.

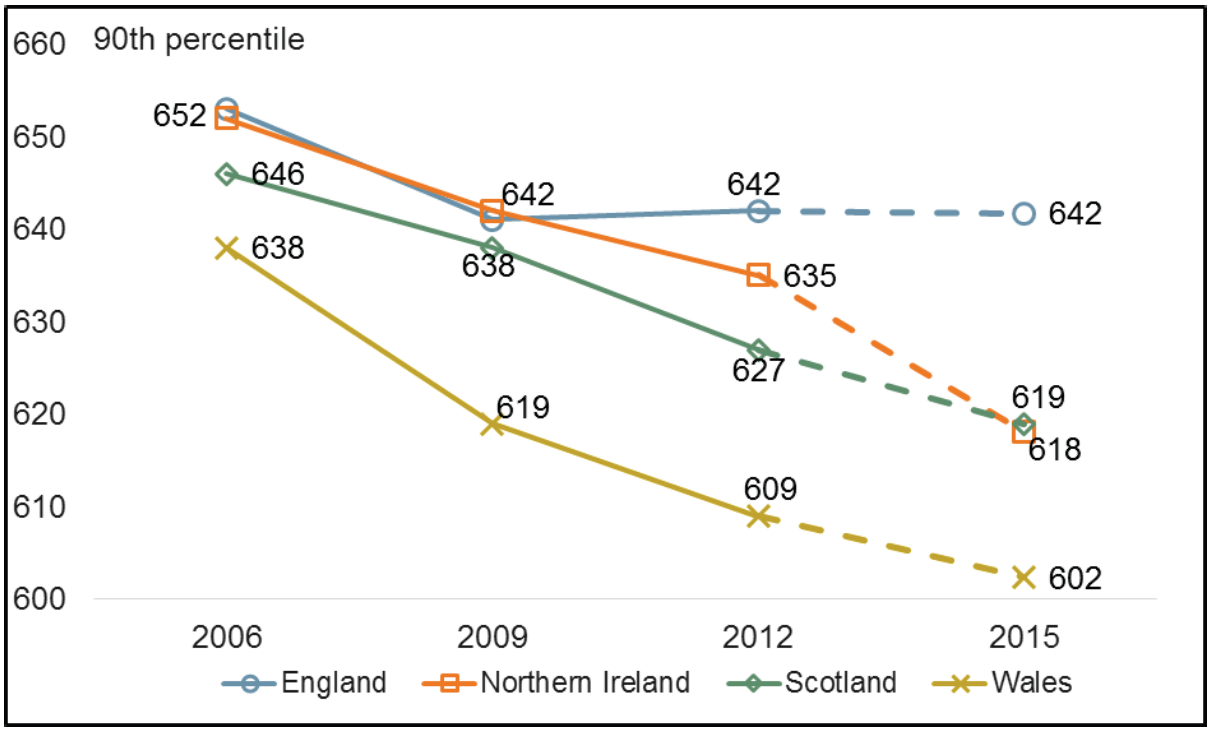
3.5 Changes in the science performance of the UK's highest performing children over time

Next, we turn to how the science performance of the UK's highest-achieving pupils has changed over the last decade. Figure 3.3 provides the results for high-achieving pupils amongst (a) all pupils and (b) pupils from low socio-economic backgrounds only. Starting with panel (a), although the science scores of England's highest-achieving pupils has remained broadly stable since 2006, there have been some sharp declines in the rest of the UK. For instance, there has been a drop in performance of around a year of schooling in each of Northern Ireland, Scotland and Wales. Indeed, while Scotland and Northern Ireland were broadly comparable to England in 2006, their fall has meant they were significantly behind England in 2015. This is a concerning trend, and one which needs to be reversed.

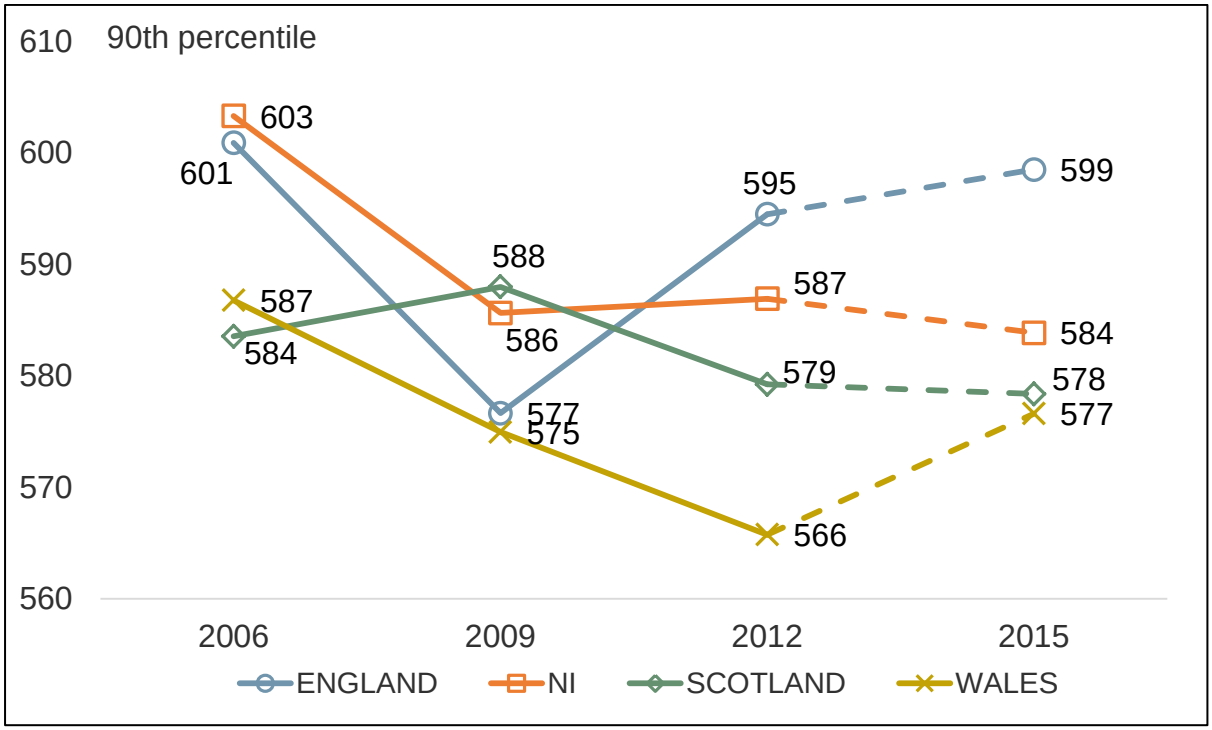
Panel (b) turns to the equivalent results when focusing upon pupils from low socio-economic backgrounds. Interestingly, results for this group have held up somewhat better. For instance, in Scotland, there is now no evidence of a fall in scores over time. Likewise, any evidence of a trend emerging in Northern Ireland and Wales is less pronounced. What this therefore means is that the pattern being observed in panel (a) is *not* being driven by a fall in the performance of able pupils from disadvantaged socio-economic backgrounds. Rather, it is primarily due to a fall in performance of the highest-achieving pupils from higher socio-economic status families.

Figure 3.3 Changes in the science performance of the UK's most able pupils since 2006

(a) All pupils



(b) Low socio-economic status pupils



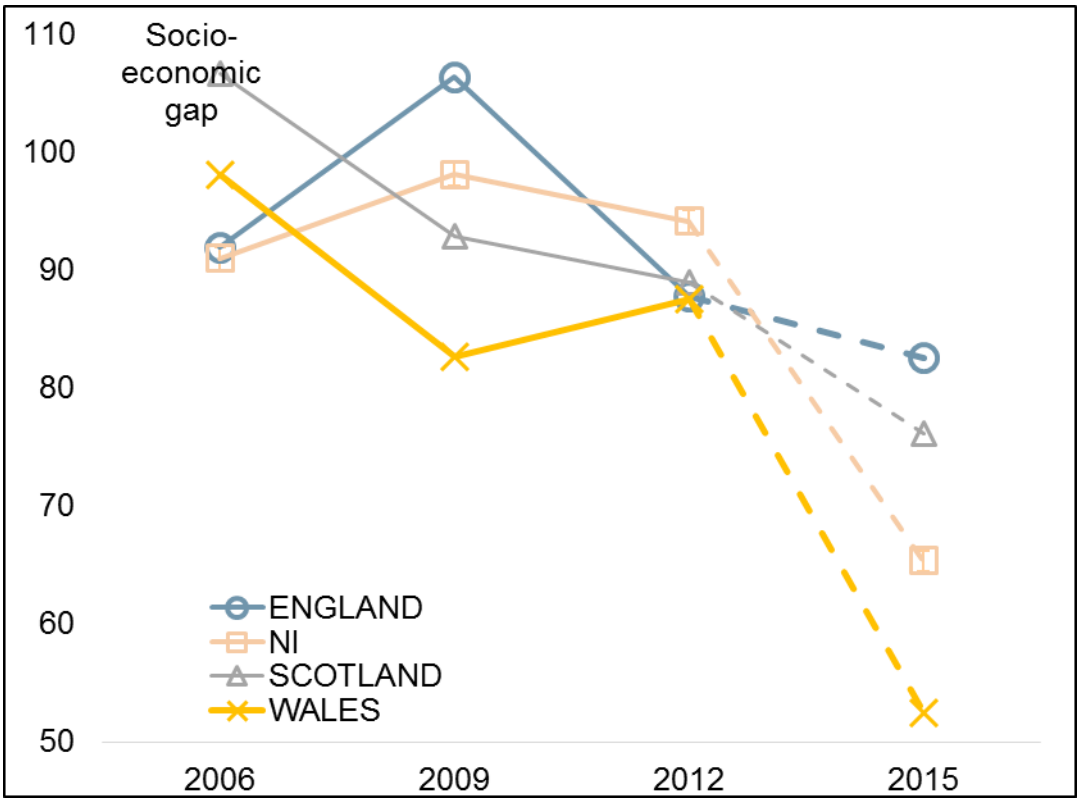
Notes: 2015 figures calculated using first five plausible values only[7]. Values may therefore differ slightly from Tables 3.1 and 3.2. First generation immigrants have been excluded in panel (b). Panel (a) includes first generation immigrants for consistency with Jerrim and Shure (2016).

3.6 Changes in the socio-economic gap in high science performance since 2006

Figure 3.4 considers how the socio-economic gap in science skills amongst high-achieving pupils has changed across the UK over time. In England, the difference reached its peak in 2009, standing at 3 years and six months of schooling (106 test points). The gap has subsequently declined to around 88 test points in 2012 and 82 points in 2015. Again, sharper declines in socio-economic inequality have occurred in other parts of the UK between 2012 and 2015, with the gap between high-achieving advantaged and disadvantaged 15-year-olds in Wales almost falling by half (from 3 years and 4 months of schooling in 2006 to 1 year and 10 months in 2015). However, as indicated by Figure 3.3 (panel b), these apparent declines in socio-economic inequality in Northern Ireland, Scotland and Wales are *not* being driven by a substantial increase in the science performance of bright pupils from lower socio-economic backgrounds. Rather, the fall in socio-economic inequality visible in Figure 3.4 is primarily due to a decline in the performance amongst the most able pupils from more affluent backgrounds.

[7] Plausible values are possible PISA scores each child might achieve. There were five plausible values in PISA 2006, 2009 and 2012, and ten plausible values in 2015. I use the first five plausible values from 2015 for consistency with previous PISA waves, and for simplicity.

Figure 3.5 The socio-economic gap in high-achieving children's science skills. Trends between 2006 and 2015



Notes: 2015 figures calculated using first five plausible values only. Values may therefore differ slightly from Tables 3.1 and 3.2. First generation immigrants have been excluded.

4. Mathematics

4.1 The performance of the highest-achieving pupils in mathematics across countries

England's high-achieving pupils in mathematics obtain a score of 613 points, which is around the OECD median (610 points). Fifteen out of the 37 comparator OECD countries achieve a higher score than England, but in only seven is the difference statistically significant, including Canada, Estonia, Switzerland and the Netherlands. In contrast, there are 21 OECD countries where pupils do worse than England. In 11 of those countries the difference is statistically significant, including all other nations within the United Kingdom. Scotland and Northern Ireland are again below the OECD median, while Wales is in the bottom quarter of the table. Indeed, there are only three OECD countries (Chile, Turkey and Mexico) where the mathematics skills of the most able pupils are significantly lower than in Wales.

Table 4.1. The mathematics scores of the highest achieving 10% of pupils across OECD countries

Country	90th percentile	Country	90th percentile
South Korea	**649***	Italy	610
Japan	**643***	Sweden	609
Switzerland	**641***	Czech Republic	608
Belgium	**630***	Iceland	608
Canada	**627***	Luxembourg	607
Netherlands	**627***	Ireland	606
Estonia	**623***	Israel	601
Slovenia	622	**Scotland**	**601***
Germany	620	**Hungary**	**598***
Austria	618	**Slovakia**	**596***
Poland	617	**Spain**	**593***
Finland	614	**Northern Ireland**	**592***
Denmark	614	**United States**	**585***
Portugal	614	**Latvia**	**582***
Australia	613	**Wales**	**578***
England	613	**Greece**	**570***
New Zealand	613	**Chile**	**534***
France	613	**Turkey**	**529***
Norway	610	**Mexico**	**505***

Notes: Jerrim and Shure (2016: Table 4.5). Bold with * indicates significantly different from England at the 5% level. First generation immigrants have been included for consistency with Jerrim and Shure (2016). Norway is the median OECD country with a score of 610 points.

4.2 The maths performance of the highest-achieving pupils from low SES backgrounds

The focus in Table 4.2 turns to the highest-achieving pupils amongst those from a disadvantaged socio-economic background. There is no statistically significant difference between the four UK countries, which are all reasonably similar to the OECD median (565 points). There are 17 countries above England, and in six of those countries the difference is statistically significant, including Switzerland, Netherlands and Canada. Meanwhile, there are 20 OECD countries where the score is lower, and significantly lower in 10 of those countries.

Table 4.2. The PISA mathematics scores of the highest achieving 10% of pupils from low socio-economic backgrounds across OECD countries

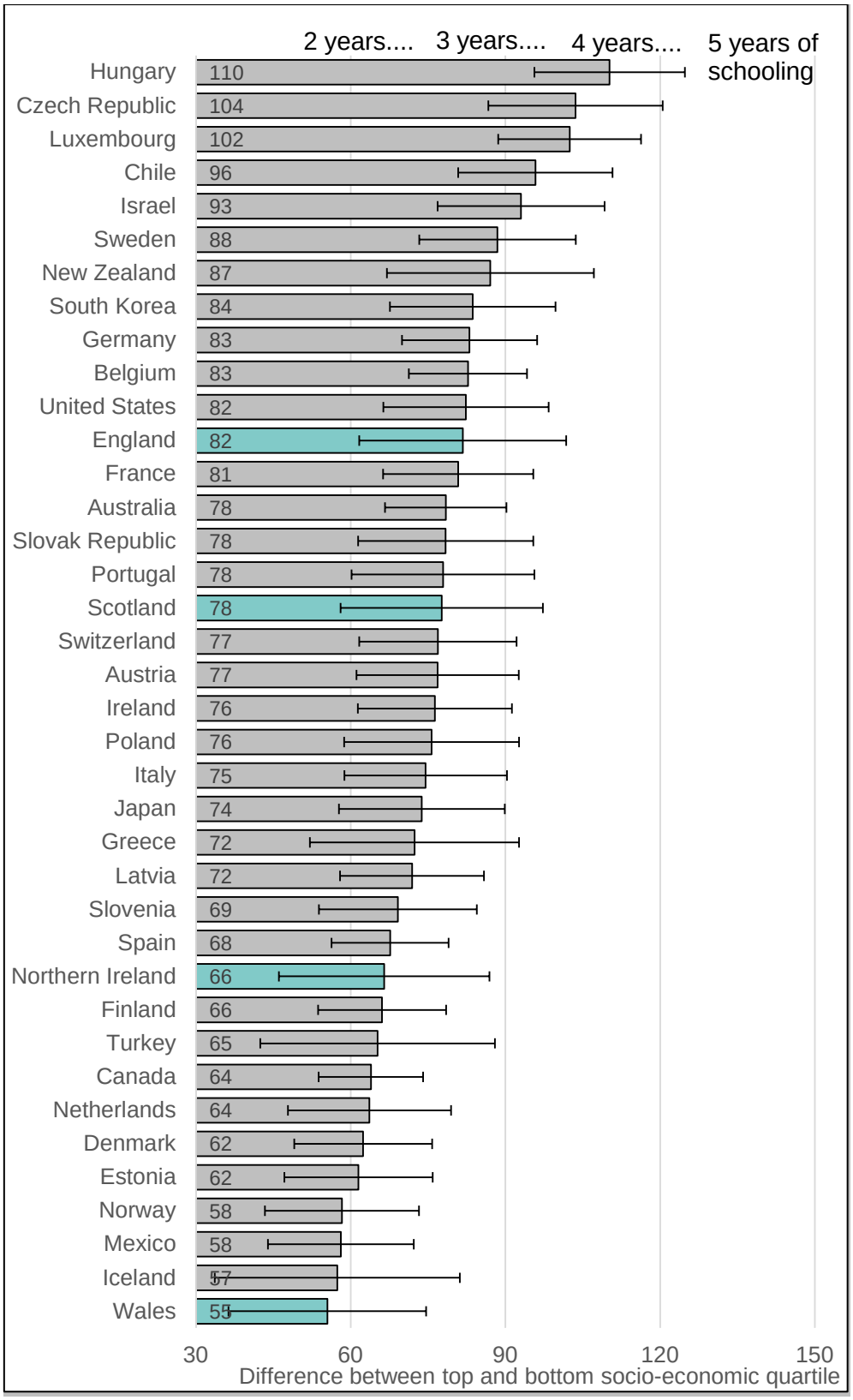
Country	90th percentile	Country	90th percentile
South Korea	**602***	France	564
Switzerland	**598***	Ireland	562
Japan	**598***	New Zealand	560
Netherlands	**594***	Sweden	559
Canada	**589***	Northern Ireland	556
Estonia	**588***	Scotland	556
Slovenia	583	Spain	556
Belgium	580	Wales	551
Iceland	579	Slovak Republic	551
Norway	579	**Czech Republic**	**547***
Denmark	578	**Luxembourg**	**545***
Finland	578	**Israel**	**540***
Poland	575	**United States**	**539***
Germany	575	**Latvia**	**539***
Austria	573	**Greece**	**530***
Portugal	572	**Hungary**	**528***
Australia	570	**Turkey**	**496***
England	567	**Chile**	**481***
Italy	565	**Mexico**	**473***

Notes: Bold with * indicates significantly different from England at the 5% level. First generation immigrants have been excluded. Italy is the median OECD country with a score of 565 points.

4.3 The gap in mathematics performance between the highest-achieving pupils from advantaged and disadvantaged backgrounds

High achieving pupils from the most advantaged backgrounds in England and Scotland are 2 years and 8 months ahead of their counterparts in the least advantaged households (see Figure 4.1). Both of these countries are around the OECD median. On this measure, no country has a significantly smaller gap than England, while in only Hungary is the gap significantly bigger. Wales, on the other hand, has the smallest gap anywhere in the developed world. However, as suggested by Tables 4.1 and 4.2, this result is being driven by the comparatively weak mathematics performance of high socio-economic status pupils in Wales, rather than any exceptional performance amongst its lowest socio-economic group.

Figure 4.1 The socio-economic gap in children's mathematics skills *amongst the highest-achievers* – A comparison across OECD countries

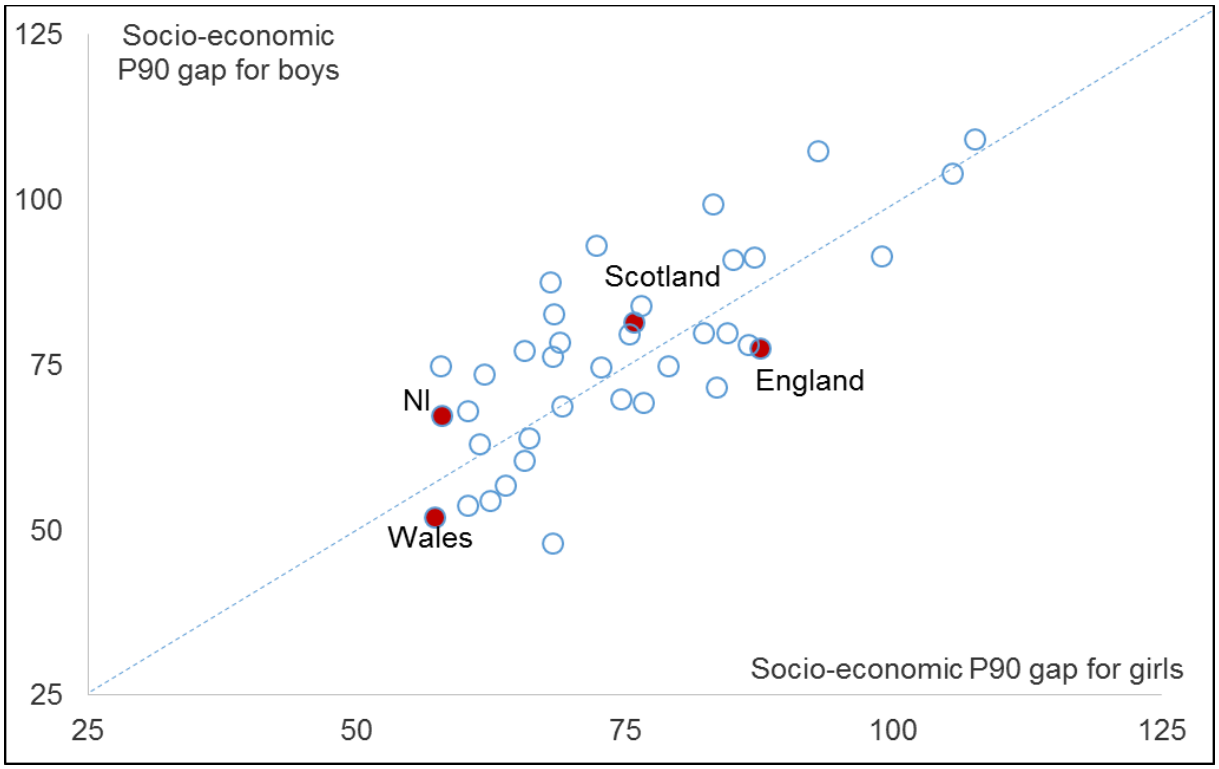


Notes: Thin black lines refer to estimated 95% confidence intervals. 'High achieving' refers to the 90th percentile. First generation immigrants have been excluded.

4.4 Gender differences in the socio-economic mathematics gap

Figure 4.2 compares the socio-economic gap for the highest achieving boys and girls. Once again, countries to the right of the graph are those where the socio-economic gap in girls test scores is particularly large. Similarly, countries towards the top of the graph are those where the socio-economic gap for boys test scores is particularly large. The further a country is away from the dashed line, the greater the difference in the socio-economic gap between boys and girls. All four UK countries sit reasonably close to the 45 degree line, with no evidence that any are outliers. (This is in contrast to the results for science – see Figure 3.3 for further details). Overall, the socio-economic achievement gap is quite similar for both boys and girls.

Figure 4.2 The socio-economic gap in *high achieving* children's mathematics skills– a comparison between boys and girls



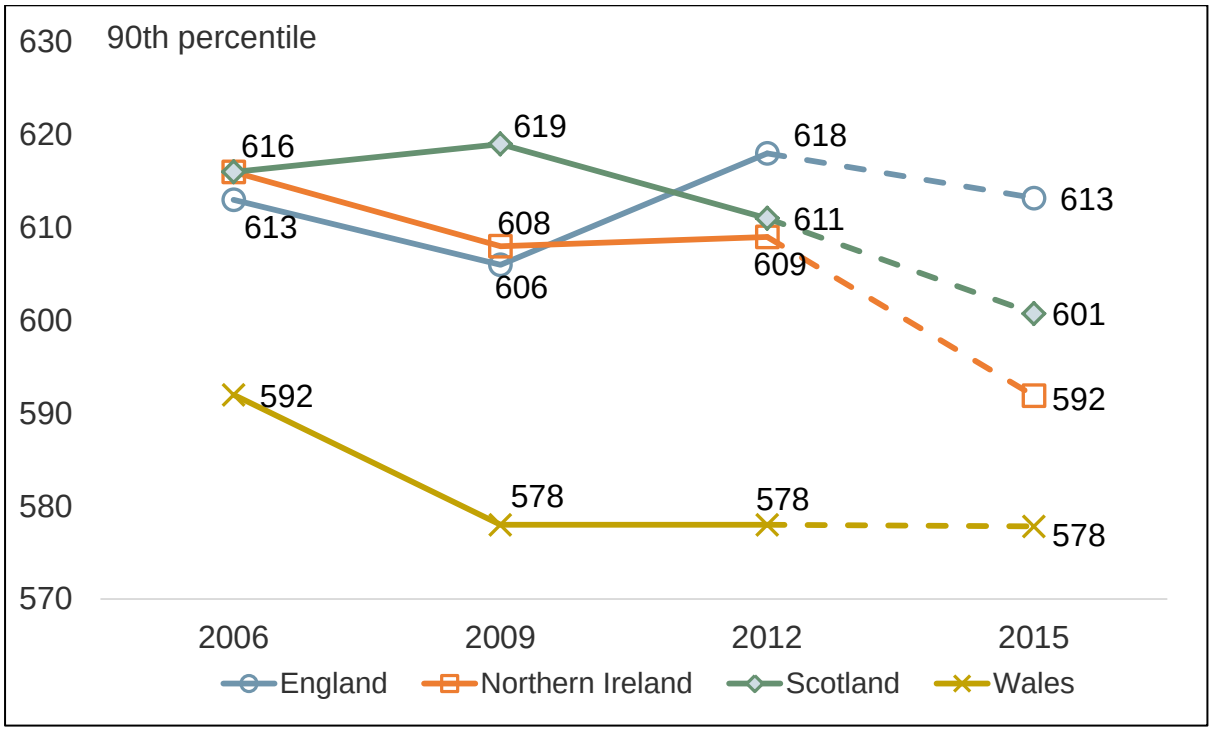
Notes: First generation immigrants have been excluded.

4.5 Changes in the performance of the UK's highest performing children in mathematics over time

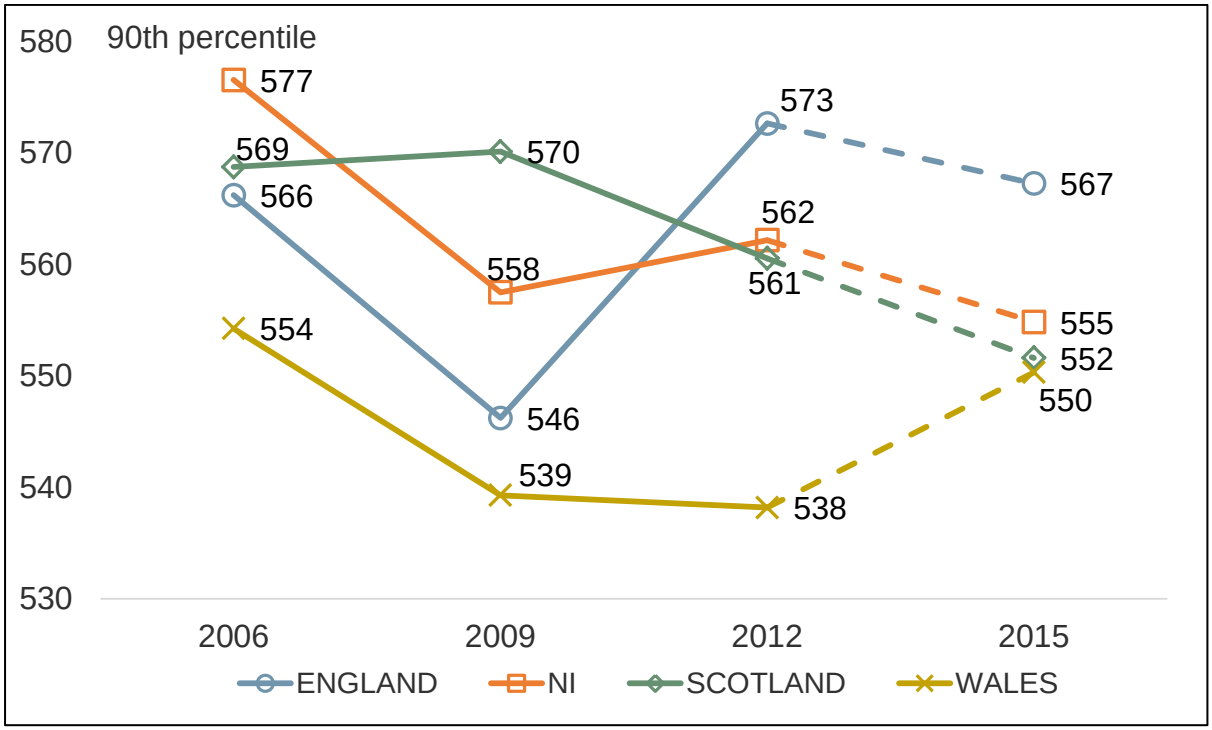
Figure 4.3 turns to how the mathematics performance of England's highest achieving pupils has changed since 2006. Panel (a) refers to all pupils and panel (b) to pupils from low socio-economic backgrounds. In England, there is no evidence that scores have changed over time; in both panels (a) and (b) there is no clear evidence of improvement or decline, with the trend line being broadly stable (though with some fluctuations between individual PISA cycles). In contrast, there is some suggestion of a decline in Scotland. For instance, the 90th percentile of mathematics scores in Scotland has fallen from around 620 in 2009 to around 600 in 2015 (two-terms of schooling difference). This includes a fall in the performance of able pupils from low socio-economic status homes. There has also been a fall in Northern Ireland, which was around the same level as England in 2006, but is now below England in 2015. For Wales, there is no clear evidence of a sustained upward or downward trend over time.

Figure 4.3 Changes in the maths performance of the UK's most able pupils since 2006

(a) All pupils



(b) Low socio-economic status pupils



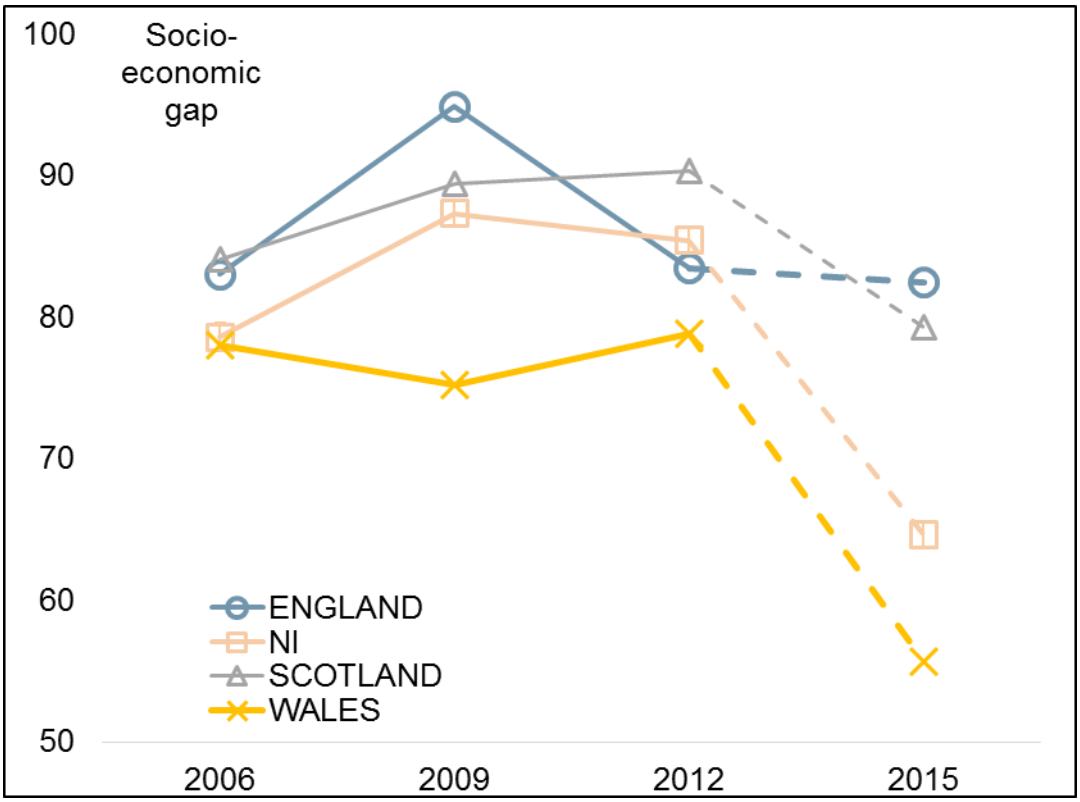
Notes: 2015 figures calculated using first five plausible values only. Values may therefore differ slightly from Tables 4.1 and 4.2. First generation immigrants have been excluded in panel (b). Panel (a) includes first generation immigrants for consistency with Jerrim and Shure (2016).

4.6 Changes in the socio-economic gap in high mathematics performance since 2006

Figure 4.4 considers how the socio-economic gap in mathematics skills amongst high-achieving pupils has changed across the UK over time. In England, the difference reached its peak in 2009, standing at 3 years and 2 months of schooling (95 test points). In all other years, the gap has been between 80 and 85 test points.

However, striking declines in socio-economic inequality have occurred in other parts of the UK between 2012 and 2015, with the gap in Wales falling from around 80 points (2 years and 8 months of schooling) in 2006, 2009 and 2012 down to 57 points (around 2 years of schooling) in 2015. There has been a striking reduction in educational inequality in Northern Ireland as well. These results should, however, be interpreted in the context of Table 4.1; absolute performance in mathematics amongst high-achieving pupils in these countries is comparatively low relative to other industrialised nations.

Figure 4.4 The socio-economic gap in high-achieving children's mathematics skills. Trends between 2006 and 2015



Notes: First generation immigrants have been excluded.

5. READING

5.1 The performance of the highest-achieving pupils in reading across countries

The reading skills of England's highest achieving pupils are above the OECD median (625 versus 617). Out of the 37 comparator OECD countries, 13 perform better than England on this metric but only six (New Zealand, Canada, Finland, South Korea, France and Norway) perform significantly better, as we can see in Table 5.1. England also performs above the rest of the UK when it comes to the highest achievers' reading performance, with Scotland and Northern Ireland just below the OECD median. Wales again sits towards the bottom of the table, with only three members of the OECD scoring significantly lower (Chile, Turkey and Mexico).

Table 5.1. The reading scores of the highest achieving 10% of pupils across OECD countries

Country	90th percentile	Country	90th percentile
New Zealand	**643***	Luxembourg	616
Canada	**642***	**Czech Republic**	**614***
Finland	**640***	**Switzerland**	**614***
South Korea	**637***	**Portugal**	**614***
France	**637***	**Austria**	**611***
Norway	**636***	**Denmark**	**608***
Germany	634	**Scotland**	**608***
Australia	631	**Iceland**	**607***
Estonia	630	**Northern Ireland**	**605***
Netherlands	630	**Spain**	**603***
Japan	629	**Italy**	**602***
Ireland	629	**Latvia**	**595***
Sweden	625	**Hungary**	**593***
England	625	**Greece**	**590***
United States	624	**Wales**	**588***
Belgium	623	**Slovakia**	**583***
Israel	621	**Chile**	**572***
Slovenia	621	**Turkey**	**535***
Poland	617	**Mexico**	**523***

Notes: Jerrim and Shure (2016: Table 5.5). Bold with * indicates significantly different from England at the 5% level. First generation immigrants have been included for consistency with Jerrim and Shure (2016). Poland is the median OECD country with a score of 617 points.

5.2 The reading skills of high-achieving pupils from low socio-economic backgrounds

The PISA reading scores of high-achieving pupils from low socio-economic backgrounds are similar across England, Northern Ireland and Scotland, and not substantially different from the median OECD country (576). On this metric, Wales (562) scores significantly lower than England (585) and is similar to countries like Latvia and Israel. Otherwise, the UK is comparable to most other industrialised nations. These results are presented in Table 5.2. While 13 countries scored higher than England, only six had statistically significant differences.

Table 5.2. The PISA reading scores of the highest achieving 10% of pupils from low socio-economic backgrounds across OECD countries

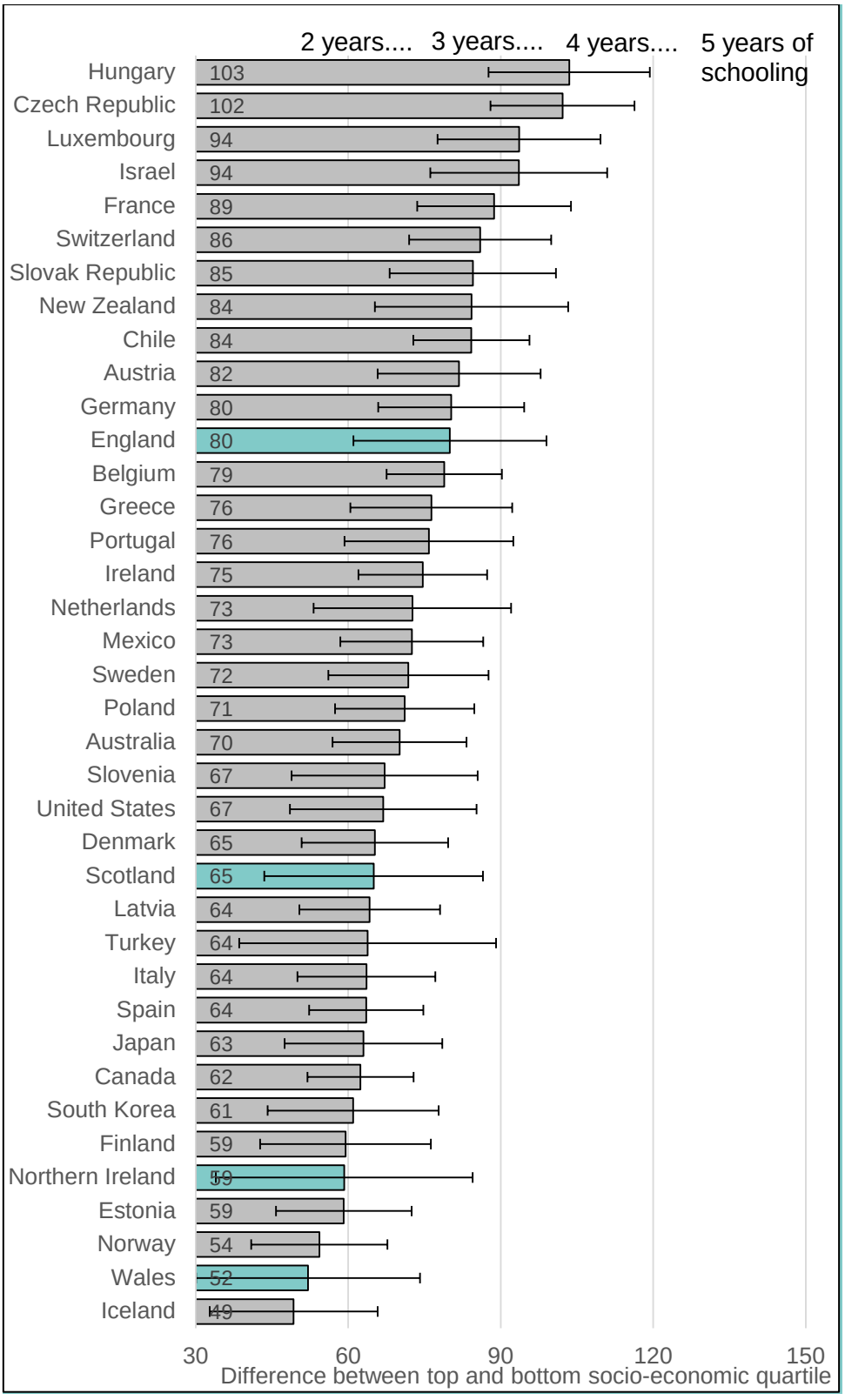
Country	90th percentile	Country	90th percentile
Norway	**609***	Belgium	576
Finland	**608***	Scotland	574
Canada	**605***	Denmark	573
South Korea	604	Portugal	569
Estonia	598	**Spain**	**568***
Australia	593	**Austria**	**565***
Germany	592	**Switzerland**	**563***
New Zealand	592	**Italy**	**563***
Netherlands	590	**Wales**	**562***
Japan	590	**Israel**	**559***
Ireland	589	**Latvia**	**558***
Sweden	588	**Luxembourg**	**557***
United States	587	**Czech Republic**	**551***
England	585	**Greece**	**547***
France	584	**Slovak Republic**	**534***
Slovenia	582	**Hungary**	**525***
Iceland	582	**Chile**	**521***
Northern Ireland	578	**Turkey**	**503***
Poland	576	**Mexico**	**481***

Notes: Bold font with a star indicates significantly different to England at the five percent level. First generation immigrants excluded. Poland is the median OECD country with a score of 576 points.

5.3 The gap in reading performance between the highest-achieving pupils from advantaged and disadvantaged socio-economic backgrounds

High-achieving pupils from the most advantaged backgrounds in England are two years and eight months (80 points) ahead of their counterparts in the least advantaged households. (See Figure 5.1) On this measure, England is slightly above the OECD average (73 points), though the difference is not statistically significant. Only Spain, Canada, Estonia, Wales, Norway and Iceland have a significantly smaller gap than in England, while in only Hungary and the Czech Republic is the gap significantly bigger. While Scotland sits just below the median OECD country, Northern Ireland and Wales have smaller gaps at two years of schooling (60 test points) or less. However it should be remembered that, in absolute terms, the reading skills of the most able disadvantaged Welsh pupils' remains comparatively low by international standards (recall Table 5.2).

Figure 5.1 The socio-economic gap in children's reading skills ***amongst the highest-achievers*** – A comparison across OECD countries

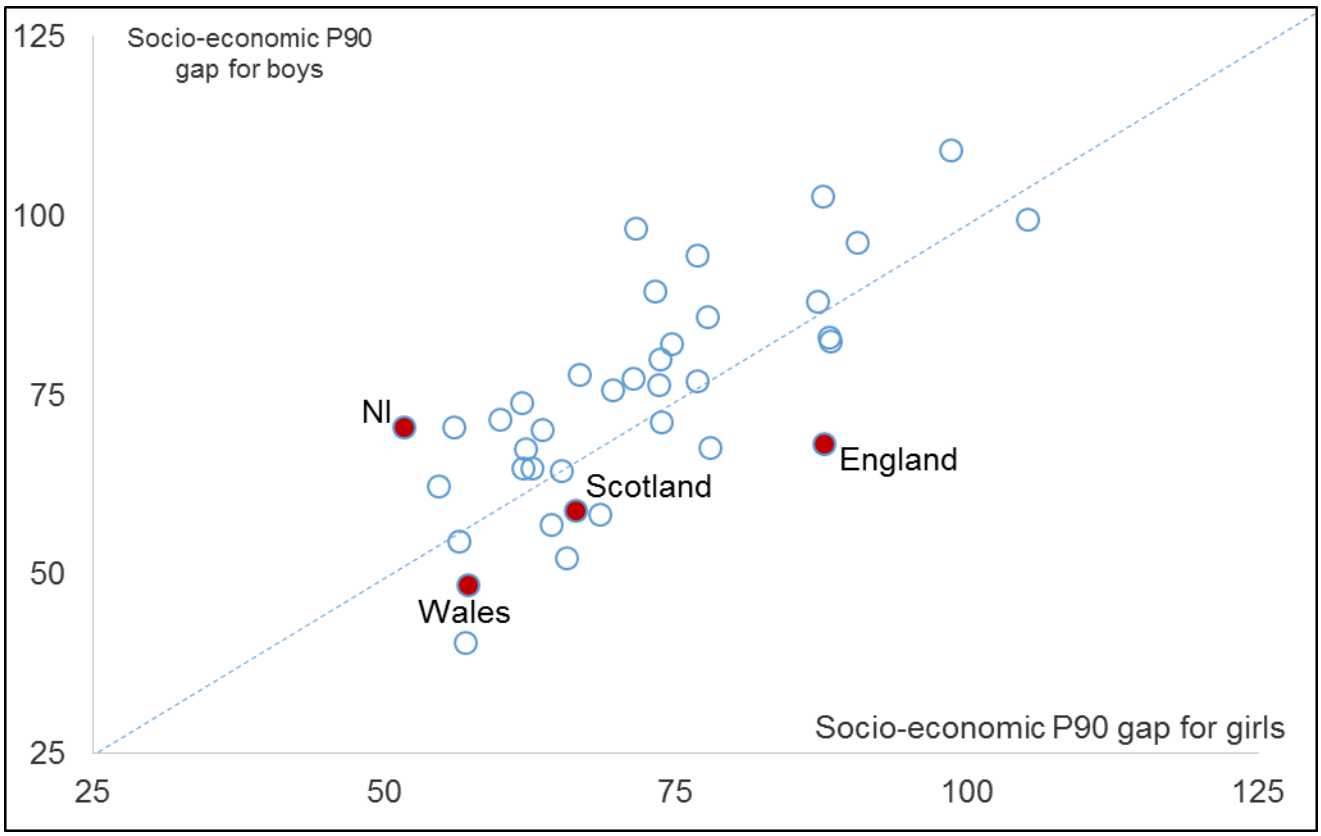


Notes: Thin black lines refer to estimated 95% confidence intervals. 'High achieving' refers to the 90th percentile. First generation immigrants excluded from the sample.

5.4 Gender differences in the socio-economic reading gap

Figure 5.2 compares the socio-economic gap in reading for high-achieving boys and girls. England is somewhat of an outlier, and is one of the countries furthest below the dashed 45 degree line. This highlights how the socio-economic gap for girls is particularly pronounced (3 years of school), and greater than the gap for boys (2 years and 3 months of schooling). It is particularly interesting to compare England and Northern Ireland in this respect; in both countries the socio-economic gap for boys is very similar (around 70 test points) but is very different for girls (51 points in Northern Ireland versus 87 points in England). Indeed, whereas the gap for English boys is quite favourable compared to other countries, the same is not true for girls (there is no country where the gap for girls is significantly bigger). In contrast, Scotland and Wales are both close to the 45 degree line, with no evidence of a gender difference.

Figure 5.2 The socio-economic gap in *high achieving* children's reading skills– a comparison between boys and girls



Notes: First generation immigrants excluded from the sample.

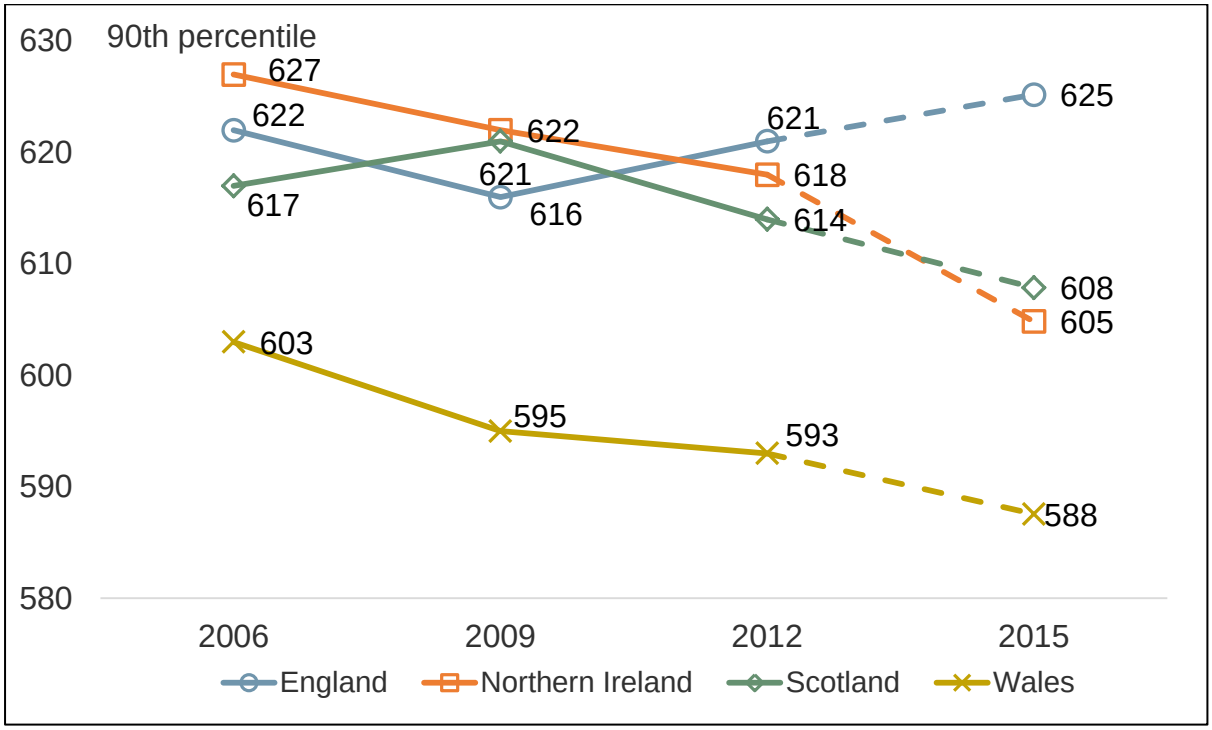
5.5 Changes in the performance of the UK's highest performing children in reading over time

Figure 5.3 turns to trends in the reading skills of England's most able pupils over the last decade. Panel (a) refers to the highest-achievers amongst all pupils, while panel (b) focuses upon the most able pupils from low socio-economic backgrounds. For England, the results in panel (a) are broadly stable. In panel (b), for high-achieving disadvantaged children, there was a downward blip in England between 2006 and 2009, followed by strong improvement from 2009 to 2015. Hence, since 2009, there is some evidence that in England the reading skills of high-achieving children from disadvantaged backgrounds may have improved.

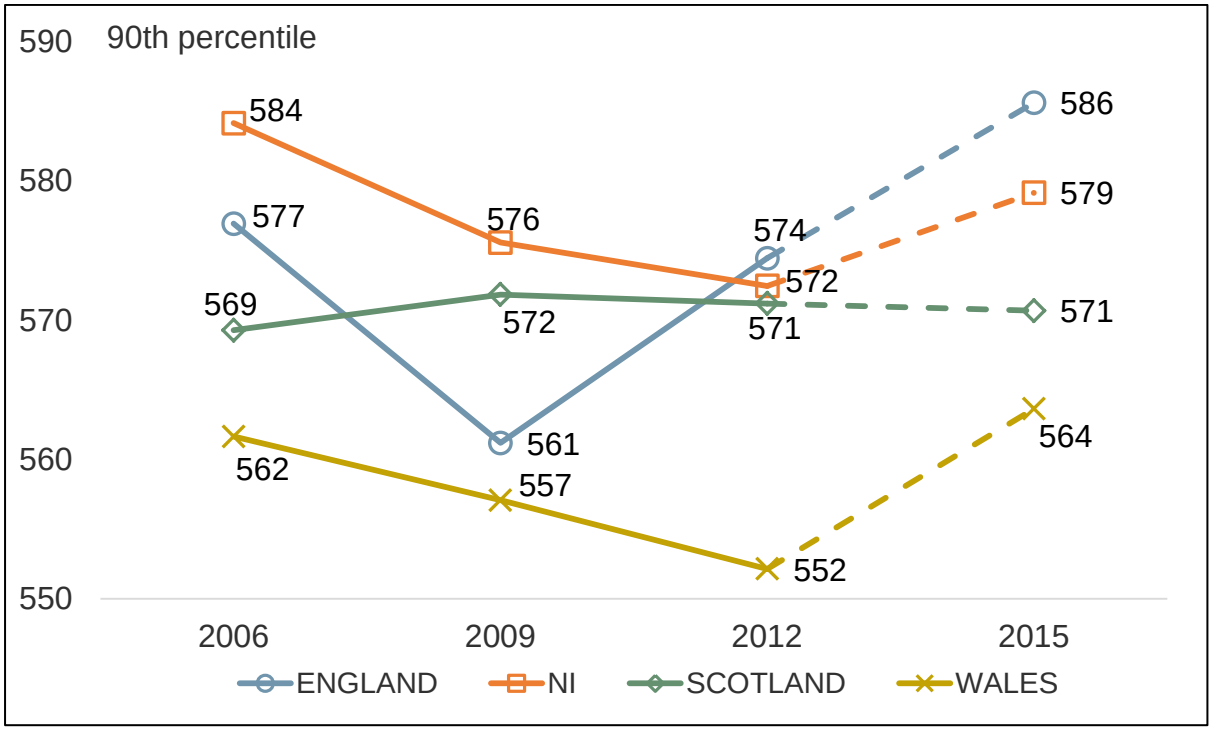
Turning to the rest of the UK, panel (a) indicates that there has been a marked decline in the reading skills of the most able pupils in Northern Ireland and Wales. However, panel (b) also indicates how the trend in reading skills for high-achieving disadvantaged pupils has remained broadly stable, with no clear evidence of sustained improvement or decline. Together, this suggests that it is the declining performance amongst the most able pupils within higher socio-economic groups that is responsible for the downward trajectory observed for Northern Ireland and Wales in panel (a).

Figure 5.3 Changes in the reading performance of the UK's most able pupils since 2006

(a) All pupils



(b) Low socio-economic status pupils

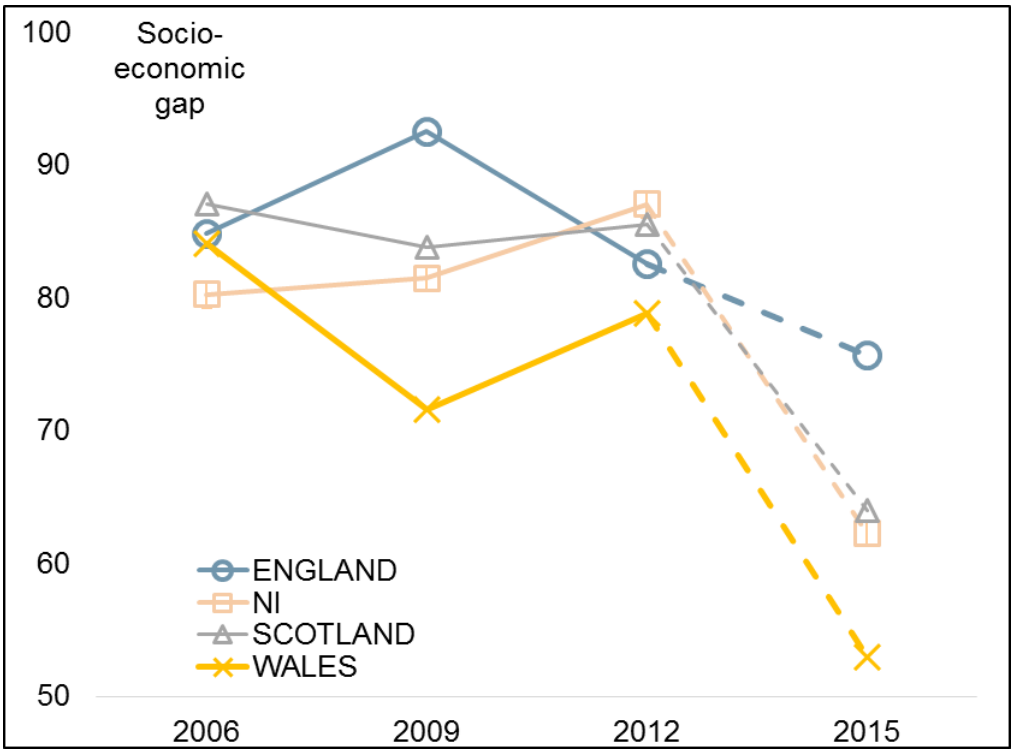


Notes: 2015 figures calculated using first five plausible values only. Values may therefore differ slightly from Tables 5.1 and 5.2. First generation immigrants have been excluded in panel (b). Panel (a) includes first generation immigrants for consistency with Jerrim and Shure (2016).

5.6 Changes in the socio-economic gap in high reading performance since 2006

Figure 5.4 considers how the socio-economic gap in reading skills amongst high-achieving pupils has changed across the UK over time. In England, the difference reached its peak in 2009 (the data used in the original Sutton Trust *Reading Gap* report) standing at just over 3 years of schooling (93 test points). The gap has subsequently declined to around 80 test points in 2012 and 2015. Again, a lot sharper declines in socio-economic inequality have occurred in other parts of the UK between 2012 and 2015, with falls of 8 months of schooling (20 test points) or more in Northern Ireland, Scotland and Wales. However, in Scotland and Northern Ireland in particular, this is being driven by a sharp fall in the performance of the highest-achievers within higher socio-economic groups, rather than improving performance amongst disadvantaged pupils.

Figure 5.4 The socio-economic gap in high-achieving children's reading skills. Trends between 2006 and 2015



Notes: 2015 figures calculated using first five plausible values only. Values may therefore differ slightly from Tables 5.1 and 5.2. First generation immigrants have been excluded.

CONCLUSION

Ensuring the United Kingdom has a ready supply of young people with high-level academic skills is critical for economic development and to foster future technological innovations in this country. Moreover, developing the talents of able children from less fortunate backgrounds is crucial for social mobility; if we want more disadvantaged young people to enter the top professional jobs, then we need to make sure that they have the skills they need to succeed. Using the recently released PISA 2015 data, this report has tried to provide a comprehensive overview of the academic performance of the UK's most able pupils. In doing so, it has highlighted the following key findings:

- England compares quite favourably to the rest of the UK and other industrialised countries in terms of the academic performance of its highest-achieving children. This is particularly true in science, where England has some of the best and brightest 15-year-olds anywhere in the world.
- Wales, on the other hand, compares rather poorly relative to other industrialised nations. In reading and mathematics, there are only a handful of countries where the skills of the most able pupils are significantly lower.
- There has been no improvement in the reading, science and mathematics skills of the highest-achieving pupils across the UK since 2006, including those from disadvantaged social backgrounds. In some parts of the UK (Wales and Northern Ireland) there have been falls in some subjects (science). The situation for high-achieving pupils across the UK has therefore been stagnant at best.

To conclude, I now provide a summary of the situation regarding able pupils for each UK country.

England

England's greatest strength amongst able pupils is their comparatively high performance in science. There are only two OECD countries where able pupils do significantly better in science than in England. The same holds true when one focuses specifically upon able pupils from socio-economically disadvantaged backgrounds. Areas where England is weaker include the comparatively large socio-economic gap in science and reading between the most able girls (though this is partly due to the exceptionally strong performance of England's able girls from advantaged socio-economic homes). Able pupils in England could also be stretched further in mathematics, with little progress having been made in addressing this issue since 2006.

Northern Ireland

Northern Ireland has a strength in its comparatively narrow gap between the most able pupils from better-off and poor backgrounds. Although differences are still substantial – standing at around 2 years of schooling in each of the three PISA subjects – this is amongst the smallest gap anywhere in the industrialised world. Able pupils from disadvantaged backgrounds also perform quite well in science, with Northern Ireland just above the median OECD country (though the difference is not statistically significant). Mathematics is a particular area of concern; Northern Ireland is in the bottom quarter of industrialised countries for academically able pupils' performance in this particular subject and is well below the OECD median. There has also been a

worrying decline in able pupils' performance over the last decade, with a fall of between half and a whole year of schooling across the PISA subject areas.

Scotland

Scotland has few stand-out strengths when it comes to the performance of its most able pupils. It stands around the OECD median in science, while the size of the gap between able advantaged and disadvantaged children does not stand out as particularly large or small relative to other industrialised countries. However, there is no specific area where able children in Scotland really excel. The major weaknesses include a pronounced and sustained decline in able pupils' performance in science, equivalent to around a year of schooling, over the last decade. It is also below the median OECD country in reading and mathematics, while trailing behind the performance of able pupils in England in most subject areas.

Wales

One of the few bright spots to emerge for Wales from PISA is the reasonable performance of its most able pupils from poor backgrounds in science. This is one of the few areas where Wales is in line with the median OECD country. The gap between able advantaged and disadvantaged pupils in Wales is also comparatively small relative to other industrialised nations; though this is mainly being driven by the weak absolute performance of the top socio-economic group and, with the difference remaining at 2 years of schooling, is still substantial. Weaknesses include the low absolute PISA scores of the most able pupils in Wales; there are very few OECD countries where academically able pupils develop lower mathematics and reading skills than in Wales. There has also been a concerning decline in the science scores of the most able pupils in Wales since 2006.

APPENDIX: A NOTE ON METHODOLOGY

I divide the ESCS index into four equally sized groups within each country of interest. This then enters as the key covariate in my Ordinary Least Squares (OLS) and quantile regression models of children's science achievement. The intuition behind these techniques is shown in Figure 1. This presents hypothetical test score distributions for low socio-economic status (SES) and high SES children.[8] M^L and M^H represent the mean test score for these two groups. OLS regression that includes a binary indicator for socio-economic status (low versus high) captures the difference between these two points (conditional upon any other factors that have been included in the model). Quantile regression can be thought of in a similar way. The points Q^L and Q^H in Figure 2 represent the 90th percentile of the low SES distribution and the 90th percentile of the high SES distribution. A quantile regression analysis at the 90th percentile will capture the difference between these two points (again, conditional upon any other factors that have been included in the model). Throughout this report, I refer to pupils scoring at the 90th percentile of the PISA science test distribution as 'high achievers'.

All models were estimated separately for boys and girls, and control for whether the child was an immigrant or not. Results will be presented in terms of 'years of schooling'. This is based on the OECD's PISA 2015 international report which suggests that 30 PISA test points equals one year of schooling. Readers should note, however, that this is a fairly crude approximation.

How has the methodology changed since the Sutton Trust *Reading Gap* report using PISA 2009?

As noted by Jerrim (2015)[9] and Jerrim and Shure (2016), aspects of the PISA methodology changed in PISA 2015, which complicates comparisons of results over time.[10] This includes (a) the introduction of computer-based testing; (b) changes to the Item-Response Theory (IRT) model used to produce the PISA scale scores; (c) alterations to how certain questions where marked. Moreover, whereas the OECD previously equated 40 PISA test points to one additional year of schooling, they have updated their guidance to now equate this to 30 test points. These changes should be considered when interpreting the results in this report, particularly Figure 2 and Figure 5, where we discuss changes over time.

Additionally, I have altered aspects of the way I have analysed the PISA data since the original reading gap report. First, I am now using the PISA ESCS index to measure socio-economic background, rather than the ISEI index. Second, I have divided the population in each country into socio-economic quartiles (four groups) rather than quintiles (five groups). Third, all plausible values are now used in producing the results, rather than just the first plausible value. Fourth, rather than controlling for gender and immigrant status in the models, I have now simply excluded first-generation immigrants from most parts of the analyses. Finally, in this report, I have now produced separate estimates for each of the four countries that form the UK.

[8] In this example, I have set the shape of the high SES and low SES test score distributions to be different for illustration purposes.
[9] Jerrim, J. (2012). PISA 2012. How do results for the paper and computer test compare? Assessment in Education. Principles, Policy and Practice http://dx.doi.org/10.1080/0969594X.2016.1147420.
[10] Jerrim, J and Shure, N. (2016). PISA 2015 national report for England.

Hypothetical distribution of test scores for low and high SES children – an illustration of the difference between OLS and quantile regression estimates