Inequalities in educational achievement across the United Kingdom. How big are the gaps and how have they changed over time?

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This chapter uses data from multiple waves of PISA to discuss educational inequalities across the UK. We illustrate how inequalities in science outcomes are bigger in England than in Northern Ireland and Wales, driven in part by a significant decline in the highest-achieving pupils in some parts of the UK over the last decade. The results also highlight how the Welsh education system is not stretching the most able pupils enough, resulting in comparatively low scores of the most advantaged socio-economic group. Policy implications and directions for future academic work are then discussed.

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Introduction

Inequality in educational achievement and labor market outcomes has long been of interest in the UK. There is now a widespread belief that the UK is a country with high income inequality and low social mobility by international standards (Jerrim and Macmillan 2015), with little evidence to suggest that this situation has improved over time. Inequalities in educational achievement are thought to play a key role in linking family background to later lifetime outcomes (Jerrim and Macmillan 2015). Improving educational outcomes of disadvantaged youth is therefore thought to be key to reducing socio-economic inequalities in a variety of outcomes, and equalizing opportunities amongst the offspring of the rich and the poor. Inequalities in education by family background have therefore been a key policy focus throughout the United Kingdom in recent years, with some evidence emerging that disparities in achievement may be starting to narrow (Blanden and Macmillan 2016).

At the same time, over the last decade and a half, education policy has become a devolved matter across the four countries that form the UK (England, Northern Ireland, Scotland and Wales). Although the governments of all four countries have set about improving educational outcomes, particularly amongst socio-economically disadvantaged groups, they have done so in quite different ways. Indeed, many recent education policy reforms have only affected a single part of the United Kingdom. This has resulted in English, Northern Irish, Scottish and Welsh youth being exposed to rather different education systems and educational policies.

For example, publicly available league tables of school results are still freely available and widely used for accountability purposes in England. The same is not true in Northern Ireland, Scotland and Wales, where government produced league tables were scrapped around ten years ago. In contrast, Northern Ireland is the only country within the UK where extensive between-school tracking (in the form of grammar schools) continues to be used; England, Wales and Scotland are mostly non-selective comprehensive systems in comparison. Many of the most recent policy changes, such as the conversion of many schools into academies (schools which are centrally funded by government but have greater autonomy over how the school is managed and run) have only occurred in England and not the rest of the UK. Indeed, charities and organizations aiming to raise achievement of young people from disadvantaged backgrounds, such as the Education Endowment Foundation, have a specific remit to operate in England only. Moreover, within each of the four constituent countries, there are different minority groups of particular public policy interest. Whereas this is the White working-class in England, working class pupils of protestant faith are thought to be a group particularly vulnerable to educational underachievement in Northern Ireland, while the Welsh-speaking minority are of particular concern in Wales.

This diverging policy context makes comparisons of educational achievement across the UK particularly interesting. However, as noted by Taylor, Rees and Davies (2013), relatively few such ‘home’ international comparisons have been conducted. This is partly due to a lack of accessible and comparable data; although high quality administrative data on pupils’ school grades is available and relatively easy to access in England, the same is not true in other parts of the UK. Yet PISA represents an important exception. All four countries have taken part in this study, and met the OECDs response rate requirements, since 2006. Moreover, oversampling has been used so that results can be reported separately for England, Northern Ireland, Scotland and Wales. As rich data are also collected on pupils’ socio-economic background, PISA represents a rich resource that allows us to consider how educational inequalities compare across the UK, and how the situation has changed over the last decade.

A detailed consideration of inequalities in educational achievement across the UK is therefore the contribution of this chapter to the existing literature. We consider inequalities both in terms of educational 'outcomes' (e.g. the spread of achievement measured as the magnitude of the gap between the highest and lowest achieving pupils) and in terms of educational 'opportunities' (e.g. the association between family background and pupils' performance on the PISA test). When doing so, we begin by putting the UK into a broader international context, before focusing our discussion on differences between the four constituent countries. Consideration is then given to how educational inequalities across the United Kingdom have evolved over time. Given the policy interest highlighted in the preceding paragraphs, we also consider how performance in PISA differs between various minority groups (e.g. White working class pupils, Welsh-speaking pupils).

To trail out key findings, inequalities in educational outcomes in Northern Ireland and Wales are amongst the smallest anywhere in the developed world, but are much larger in England. There is also evidence that educational inequalities in science achievement have narrowed significantly over the last decade, particularly in Northern Ireland and Wales. However, as section three will reveal, this is perhaps not the positive outcomes that it may at first seem. Moreover, against conventional wisdom, we do not find any evidence that the relationship between family background and 15-year-olds test scores are particularly strong in the United Kingdom; the UK is actually similar to the average industrialized country in this respect. However, when looking inside the UK, socio-economic inequalities in achievement are a lot more pronounced in England than they are in Wales. This, however, is *not* due to poor pupils in Wales doing better on PISA than poor pupils in England. Rather, it is the result of significant underperformance in PISA amongst Welsh pupils from the most advantaged socio-economic backgrounds.

Data and methods

The data we use are drawn from multiple waves of the PISA assessment. The UK has participated in every round of PISA to date, with oversampling used to generate separate estimates for England, Northern Ireland, Scotland and Wales since 2006. The PISA 2015 sample size at the school (pupil) level is 206 (5,194) in England, 109 (3,111) in Scotland, 140 (3,451) in Wales and 95 (2,401) in Northern Ireland. Response rates for the UK as a whole, and for each of the four countries, were high in PISA 2015 and fully compliant with the rigorous requirements of the OECD. As science was the "major domain" in PISA 2015, the analysis we present in this chapter focuses upon pupils' performance in this subject.

We also consider data from previous PISA rounds, in order to understand how educational inequalities across the UK have changed over time. Some caveats do, however, need to be placed upon the results from these particular analyses. First, the UK fell short of the OECD's strict response rate requirements in 2000 and 2003 (Micklewright et al 2012) which may bias the estimates in these particular years (Jerrim 2013). Consequently, in this chapter we only consider trends in educational inequalities since 2006 (from which point the data for the UK are consistent and meet the standards required by the OECD). Second, a number of important changes have been made to PISA in 2015, including alterations to the PISA scaling model, the introduction of computer-based testing and how not-reached items are scored. Although the OECD has attempted to ensure the scores are comparable over time, there still remains some uncertainty as to the extent that this has been achieved. To highlight this uncertainty, all trends will be presented using a dashed line put through the 2015 data.

In the following section, we consider educational inequality across two dimensions (a) inequality in educational outcomes at age 15 and (b) socio-economic differences in pupils' performance. Our preferred measure of the former is the difference between the 90th and the 10th percentile of the PISA achievement distribution; the gap between the highest and lowest achievers within each country. Our preference for this particular statistic is that it is a widely used measure of educational inequality throughout the literature (e.g. Bruckauf and Chzhen 2016; Jerrim 2013) and is straightforward to communicate to non-specialist audiences. Moreover, very similar cross-country patterns occur when alternative measures such as the standard deviation are used[1]. We will also consider whether inequality is greater in the top or bottom half of the achievement distribution, by estimating the difference between the 10th, 50th and 90th percentiles.

We measure socio-economic inequalities in a number of ways. To begin, we use information that has been linked into the PISA database for England, Wales and Northern Ireland to compare the performance of pupils who are eligible for Free School Meals (FSM) to those who are not. Free School Meals is a widely used proxy for socio-economic status across the UK, and is widely used in policy discussions regarding educational inequality and targeting interventions. Although it has been to some extent validated as a measure of family background (Vignoles and Hobbs 2010), it is widely recognized to be rather blunt, capturing only differences between the poorest 15 to 20 per cent of pupils and the rest of the

[1] We find a cross-country correlation between the standard deviation and the gap between the 90th and 10th percentile of around 0.99.

population. Another drawback of this measure is that we do not have access to FSM data for pupils in Scotland, or for the small number pupils who attend an independent school.

We therefore also measure socio-economic inequalities using the PISA is the Economic, Social and Cultural Status (ESCS) index. This is a continuous variable derived by the survey organizers, and combines (via a principal components analysis) information on parental education, parental occupation and household possessions. The relevant pieces of information have been reported by participating pupils, with further details on the properties of this measure (and its separate components) available in Marks (2011) and Jerrim and Micklewright (2014). The index has a mean of approximately zero and standard deviation of approximately one across members of the OECD.

Within our analysis, the ESCS index is used to capture socio-economic inequalities in three ways. The first is the *impact* of the relationship between pupil's socio-economic backgrounds (ESCS score) and their attainment. This is measured as the change in PISA scores per each international standard deviation increase in the ESCS index. It is the parameter estimate generated by a simple Ordinary Least Squares regression of the ESCS index upon PISA test scores. The second is the *strength* of the relationship between pupil's socio-economic backgrounds. This refers to the percentage of variance in PISA scores explained by the pupils' backgrounds. The key difference is that whereas the 'impact' measure is influenced by the dispersion of the ESCS index relative to PISA test scores, the 'strength' measure is not. Finally, we also divide the population of pupils into four equal groups (quartiles) across the UK, and consider the difference in their scores. Throughout this chapter, we refer to the socio-economic ‘gap’ in achievement as the difference in performance between the highest and lowest achievers.

A key feature of the PISA 2015 data for England, Wales and Northern Ireland (though not Scotland) is that it has been linked to administrative records in each of the three countries. This provides us with additional information about the participating pupils that we can use to explore inequalities in pupils performance. In England, 90 percent of the PISA sample could be successfully matched; the remaining 10 percent were mainly pupils from independent schools for whom administrative records are not available. In Wales and Northern Ireland, 97 percent and 98 per cent of the participating pupils were successfully matched. As well as providing information on FSM eligibility, as mentioned in the paragraph above, the data also contains a number of indicators for groups of particular national interest. For instance, the administrative data for England includes information on pupils’ ethnicity, while religion is available from the administrative data in Northern Ireland and whether the pupil studies in English or Welsh language in Wales. We exploit this information within our analysis to consider inequalities in the different parts of the UK across these various different dimensions.

To aid interpretation of our results, a one international standard deviation increase in performance is approximately equal to 100 PISA test points (i.e. 100 points is equal to an effect size of 1.0). At various points throughout this chapter, we also discuss differences between groups in terms of ‘years of schooling’. We follow the guidance of the OECD when doing so, and equate a year of schooling to approximately 30 PISA test points (see OECD 2016 for further details).

Throughout the chapter, we follow the OECD’s recommended procedures in analyzing the PISA data. Final student weights and Balanced-Repeated-Replication (BRR weights) are applied throughout, while all statistics of interest are estimated ten times (once using each of the plausible values) and then averaged to produce the final results. This has been executed using the ‘repest’ command developed by Avvisati and Keslair (2014).

Results

Inequalities in educational outcomes

To begin, we have investigated the gap between the highest and lowest achievers across countries, putting the results for the four UK countries into a broader international context. Within the UK, inequality in science achievement is greatest in England; the gap between the highest and lowest achievers is 264 test points (nine years of schooling) and is significantly higher than in Scotland, Wales and Northern Ireland. Indeed, despite great policy concern about educational inequality in Northern Ireland and Wales, these two countries actually have a narrower distribution of science achievement than most other parts of the industrialized world. Indeed, out of the countries with a mean score above 450, only Russia, Latvia, Macao, Hong Kong and Viet Nam have a smaller gap between the highest and lowest achievers.

We then decompose this educational inequality into the differences in the bottom half (difference between the 10^{th} and 50^{th} percentile) and top half (difference between the 50^{th} and 90^{th} percentile) of the science distribution. From a UK perspective, the most important feature is that the main difference in inequality that across the four constituent countries occurs in the bottom half of the science achievement distribution. For instance, the P50-P10 gap is around 20 points smaller in Wales (116 points) than in England (138 points). On the other hand, inequality in the top half of the science achievement distribution is actually quite similar across these three countries, with the P50-P90 gap around 120 to 125 points in each. Together this highlights how England's comparatively high inequality in PISA science scores, relative to the rest of the UK, is largely due to the substantial difference in skills between the lowest-achieving 10 per cent and the average pupil.

This analysis is extended by considering how inequality in science achievement has changed across the UK since 2006. Whereas there has been only a slight narrowing of the achievement gap in England and Scotland, there has been a much more substantial change in Northern Ireland and Wales. Specifically, the difference between the 90^{th} and to10 percentiles has fallen by 14 points in England over the last decade, compared to a 50 point fall in Northern Ireland and a 30 points decline in inequality in Wales. Nevertheless, there is evidence for all four parts of the UK that inequality in science achievement may be more equal than it was ten years ago.

Although such reductions in inequality are often treated as a positive occurrence, further inspection of the data highlights how this result may not be such a good outcome. This is highlighted by Figure 1, where the 10^{th} percentile (panel a) and the 90^{th} percentile (panel b) are plotted over time. It becomes clear that there is little evidence of a trend in the change in the 10^{th} percentile over time in any of the UK countries. Rather, there are some large, one-off jumps, such as in Northern Ireland between 2006 and 2009 (from 359 to 378) and Scotland between 2012 and 2015 (from 400 to 372). Yet there is little evidence, in any part of the UK, of a sustained improvement in the performance of the lowest achievers in science between 2006 and 2015.

< Figure 1 >

Contrast this with the results for the 90th percentile (panel b). In three of the four UK countries, there is a clear, monotonic and sustained downward trend in the science test scores of the highest-achieving pupils over the last decade. For instance, in 2006, the top 10 per cent of 15-year-olds in Northern Ireland achieved a science score above 652 test points. This has declined steadily in each PISA cycle since, to 642 in 2009, 635 in 2012 and 618 in 2015. The same holds true in Scotland and Wales. In contrast, the trend has remained broadly stable in England; particularly from 2009 onwards. Together, Figure 1 highlights how the decline in educational inequality is to a large extent being driven less by improvement amongst low-achieving pupils, and more by a decline in performance amongst the highest-achievers. This serves to highlight an important point; although much of the narrative in public policy focuses upon ‘narrowing the achievement gap’, what policymakers really want to do is raise the achievement of the least able pupils. Figure 3.3 demonstrates how these are quite different things; Wales, in particular, has been “successful” at achieving the former (i.e. the achievement gap has narrowed in this country) but not at the latter (i.e. the scores of the least able pupils have essentially stayed still, while those of the highest achievers have declined dramatically).

Socio-economic inequalities in 15-year-olds science performance

Our analysis begins by documenting differences in science scores according to FSM eligibility. According to this measure, differences in the socio-economic gap across the United Kingdom are reasonably similar. In England and Wales, FSM pupils are around 18 months of schools (45 test points) behind their non-FSM peers. The difference is slightly larger in Northern Ireland (53 points) but not by a substantial amount.

Figure 2 then puts these results for these countries (plus also Scotland) into a broader international context, but now using the PISA ESCS index to measure family background. The horizontal axis captures the "strength" of the association (the percentage of the variance explained) while the "impact" (test score change per one standard deviation increase in the ESCS index) is plotted on the vertical axis. Countries with a comparatively modest association between family background and achievement are placed in the bottom-left had side of the graph; those where family background plays a particularly important role are in the top-right.

< Figure 2 >

England, Northern Ireland and Scotland are all in the center of this graph; family background actually has a similar relationship with pupil achievement in these countries as elsewhere in the world. Indeed, in these three countries, both the 'impact' and the 'strength' measures are comparable to the OECD average. Wales, on the other hand, is an interesting outlier. There is a much weaker relationship between socio-economic status and performance in this country than the rest of the UK. Indeed, according to this graphic, Wales is one of the most equitable countries anywhere in the developed world.

How can one reconcile the fact that socio-economic inequalities in England and Wales appear very similar in terms of the (binary) FSM measure, but rather different when using the ESCS index? We have investigated this issue by plotting the average PISA science scores against each ESCS quartile for each of the four UK countries. The results suggest that there are three particular points of note. First, according to the ESCS measure, the poorest children perform similarly across Northern Ireland, Scotland and Wales, and only slightly better in England. In other words, achievement differences across the UK amongst socio-economically disadvantaged 15-year-olds are relatively modest. Second, differences across the UK are particularly striking amongst pupils at the top end of the socio-economic distribution (i.e. the most advantaged 25 per cent of pupils). For instance, the most advantaged 25 per cent of pupils in England achieve an average science scores almost 45 points (18 months of schooling) above the most advantaged pupils in Wales. This is much bigger than the difference across these two countries when considering the most disadvantaged 25 per cent of pupils, where the difference is around 10 test points. In turn, this helps to illustrate a key limitation with FSM as a measure of family background. Specifically, analysis based upon FSM alone provides policymakers with little evidence on the interesting and important differences in achievement that are occurring in the middle and at the top end of the socio-economic distribution. Finally, Wales faces a particular challenge in the comparatively low-performance of its socio-economically advantaged pupils; both compared to the rest of the UK and relative to the average OECD country. Consequently, counter to much conventional wisdom, Wales may actually be a country where greater levels of socio-economic inequality in young people’s performance (through raising the achievement of the top socio-economic group) may actually be welcome.

To conclude this sub-section, we consider how the socio-economic gradient in 15-year-olds science scores has changed across the UK since 2006. Within all four countries, there is some suggestion that the gap in science scores between children from socio-economically advantaged and disadvantaged homes has declined. In England, the gap between the most and least advantaged 25 per cent of the population has declined from around 100 test points in 2006 to around 85 test points in 2015. However, much more pronounced declines have occurred in Scotland (100 point difference down to an 80 point difference), Northern Ireland (a fall from around 115 points down to around 80 points) and Wales (from around 100 points to just over 50 points). However, some caution is required when interpreting these results, particularly in Northern Ireland and Wales, with most of the decline occurring between 2012 and 2015 (when significant changes to the PISA methodology were made).

Academic schooling systems and socio-economic inequality

Academic selection is a topical and controversial topic in the UK. While the use of academic selection is still prevalent in Northern Ireland, very few selective schools remain in England, Wales or Scotland. However, at the time of writing, the Conservative government is looking to re-introduce grammar schools in England. The proponents of grammar schools and selective education often cite the promotion of social mobility and helping disadvantaged pupils to succeed as a key reason why they should be more widely available to families in England. But is there any evidence that selective schooling systems are indeed beneficial for the prospects of low socio-economic groups?

Evidence from PISA suggests not. Our analyses of the 2015 data indicates that there is actually a weak negative correlation between the selectivity of a country's schooling system and the proportion of its disadvantaged pupils who achieve high PISA scores ($r \approx -0.3$).

Likewise, we also find that, in countries where academic selection is prevalent, the socio-economic gap in 15-year-olds achievement tends to be greater ($r \approx 0.4$). See Jerrim and Shure (2016: chapter 6) for further details. Overall, there is therefore little evidence that academically selective schooling systems help disadvantaged pupils to succeed against the odds.

Inequalities within countries between policy-relevant sub-groups

In recent years, there has been a great deal of interest in England with respect to the educational underperformance of the White working class. There has been particular concern that children from such backgrounds have lower levels of achievement than pupils from similar socio-economic backgrounds but of different ethnicity. Does evidence from PISA support this view?

To answer this question we have compared the PISA scores of White and non-White pupils, depending upon their ESCS quartile. It is immediately clear that White working class pupils perform no worse, and perhaps slightly better, than equally poor pupils from other (non-White) ethnic backgrounds. What is more striking, however, is the fact that there is greater socio-economic inequality amongst White pupils in England than there is amongst non-White pupils. Moreover, the gap between the most advantaged White pupils and the most advantaged non-White pupils is particularly pronounced. Put together, evidence from PISA 2015 does little to support the notion that the White working-class are in particular need of policy attention (at least relative to equally disadvantaged children from other ethnic backgrounds).

A similar concern holds in Northern Ireland, though in respect to religion rather than ethnicity. Specifically, it is working-class children of Protestant faith who are often considered the most at risk of educational failure. We have therefore also investigated how socio-economic inequality is related to 15-year-olds performance, once the Northern Irish population has been stratified by religion. Much like the situation in England, PISA provides little support that the academic achievement is particularly low for this group. There is no statistically significant difference between the bottom ESCS quartile depending upon whether the pupil is of Catholic or Protestant faith. Consequently, PISA again provides little evidence that there is a need to focus specifically upon this sub-group (relative to socio-economically disadvantaged pupils of other faiths).

Finally, a major issue in Wales is the academic performance of Welsh language pupils. How do these pupils perform in PISA, relative to their English language peers? We have investigated this issue by estimating a series of OLS regression models. The first model includes PISA science scores as the dependent variable and a binary indicator of the language the pupil chose to take the test in (English/Welsh) as the sole covariate. Model 2 then adds controls for gender, parental education, parental occupation and the number of books at home. An additional control for language most often spoken at home is then also added in model 3.

Results from this analysis suggest that, in science and reading, pupils who took the PISA test in Welsh scored significantly lower scores than pupils who took the test in English. This holds true even after the control variables mentioned in the paragraph above have been added to the model. The difference is also large in terms of magnitude; Welsh language pupils are around nine months of schooling behind their English language peers in science (465 versus 487) and 10 months in the language which they took the test (455 versus 480). On the other hand, there is little evidence of a difference in mathematics.

We take this analysis one step further by considering the intersection between the language in which the pupil took the test and the language in which they are primarily taught in school. Interestingly, it seems that pupils who study Welsh as a first language in school actually do better if they take the English language version of the PISA test. Specifically, Welsh language pupils who took the test in Welsh (mean score 466) are around a year of schooling behind Welsh language pupils who took the test in English (mean score 495). Consequently, this raises questions as to whether the apparent educational disadvantaged of Welsh pupils in PISA really exists, or whether this is a function of their skills being lower in the language in which they chose to take the test.

Conclusions

Inequality has long been a topic of concern in the UK. Previous evidence has suggested that the UK is a high income inequality society with relatively low levels of social mobility (Jerrim and Macmillan 2015; Corak 2013). Politicians and policymakers across the political divide have consequently shown great concern regarding this issue, with many believing that raising attainment amongst low-performing pupils – particularly those from disadvantaged socio-economic backgrounds – is key to solving this problem. Yet, as education is now a devolved issue, policies and interventions that are being used to try and reduce educational inequalities differ markedly across the UK. This, in turn, means that success in raising achievement and narrowing gaps in one part of the country may not necessarily be replicated in another.

Despite the obvious policy interest in this issue, a lack of comparable administrative data means that only a limited amount of within-UK analyses have been conducted (Taylor, Rees and Davies 2013 is an important exception). This chapter has added to this literature by using multiple waves of the PISA data to consider how patterns of educational inequality have changed over time across the UK. We have illustrated how inequality in science achievement is significantly smaller in Wales and Northern Ireland than in England. Moreover, the gap between the highest and lowest achieving pupils in Northern Ireland has declined markedly over time – though the same is not true in England. Yet this is not necessarily the 'good news' story it may first appear; any reduction in science achievement that has occurred in Northern Ireland and Wales over the last decade seems to have been mainly driven by a decline in the performance of the highest-achieving pupils. On the other hand, the achievement of England's top-performing pupils has remained broadly stable.

Our analysis has also revealed interesting differences across the UK in terms of socio-economic gaps. Family background is a much weaker predictor of achievement in Wales than in England, Scotland or Northern Ireland. In-fact, according to PISA, Wales has amongst the lowest levels of socio-economic inequality anywhere in the world. However, we again show how this finding should actually be met by policymakers with concern. In particular, PISA 2015 data highlights how Welsh pupils from high socio-economic backgrounds are underperforming relative to their high socio-economic peers in other parts of the UK and elsewhere in the developed world. We have also illustrated how plans currently afoot in

England to bring back elements of academic selection into the secondary school system may be a regressive step. Indeed, there is no evidence that countries with academically selective schooling systems have smaller socio-economic differences in achievement or more disadvantaged pupils overcoming the odds to obtain a high PISA score. If anything, the opposite may hold true, with greater levels of socio-economic inequality emerging in countries where pupils are selected into different schools based upon their academic ability.

What do these findings imply for education policy across the four countries that form the UK? First, there are important and pressing educational challenges facing Wales. The education system in this country is clearly not stretching the most able pupils enough while, relatedly, allowing too many high socio-economic status pupils to coast through their time in education and not reach their full potential. There is an urgent need for this to be addressed, potentially via gifted and talented schemes, or by setting these pupils more challenging educational goals.

In many ways, Northern Ireland faces similar issues. In recent years there has been some relaxation of academic selection in the Northern Irish education system, and a widening of access to grammar schools. Although the PISA data cannot provide causal evidence on the effect such changes may have had, an obvious concern of policymakers is that this may have led to the striking decline in the academic performance of this country's high-achieving pupils. Nevertheless, the fact that average PISA scores have remained broadly stable while educational inequality in Northern Ireland has declined should be welcome news. Yet whether this trend is likely to continue into the future, if further changes to the education systems are made, is open to debate.

The concern for England is just how little progress has been made over the last decade. Despite widespread policy action and intervention, inequalities in educational achievement remain stubbornly large, while there is no evidence of an upward trend in the performance of the lowest-achieving pupils. Unfortunately, the major policy change currently being considered – the return of grammar schools and the re-introduction of academic selection – is unlikely to resolve this issue. In-fact, in terms of socio-economic inequalities, the international evidence provided by PISA 2015 suggests that this could actually be a backward step.

Finally, the decline in science performance in Scotland (particularly amongst the lowest-achieving pupils) is clearly something of concern to policymakers. However, our advice is for there to not be an overreaction to this result. It is entirely possible that the 2015 science result for Scotland may simply be due to a 'blip' in the scores. This has happened before in PISA, reading scores in Ireland in 2009 for example (see Cosgrove and Cartwright 2014), and it is too early to tell whether this is simply a one-off fall or part of a long-term trend. Hence, rather than highlighting the need for radical overhaul of the entire Scottish education system, the best approach for the Scottish government may to be to focus upon reversing the sustained downward trend in the performance of its highest achieving pupils in science. Although the decline in 2015 in its average scores, and its lowest achievers, in science is striking, we believe that it is best to wait and see what the PISA 2018 results bring, and avoid any knee-jerk reactions.

Our findings and policy recommendations are, of course, caveated by limitations with the PISA data and the need for further research. First, a number of technical changes were made to PISA in 2015, including the move from paper to computer assessment, and how certain questions were scored. This necessarily brings with these changes more uncertainty regarding the robustness of changes over time; particularly where there has been a sudden, sharp improvement or decline. Second, readers must remember that PISA is cross-sectional data only, and does not follow the academic progress pupils make as they develop. It is therefore difficult to establish why differences in educational achievement across different groups have emerged, or why performance of high-achieving pupils has declined markedly in some parts of the UK but not in others. Further work using longitudinal data sources, such as the Millennium Cohort Study, are needed to complement PISA in order to provide further insight into this issue.

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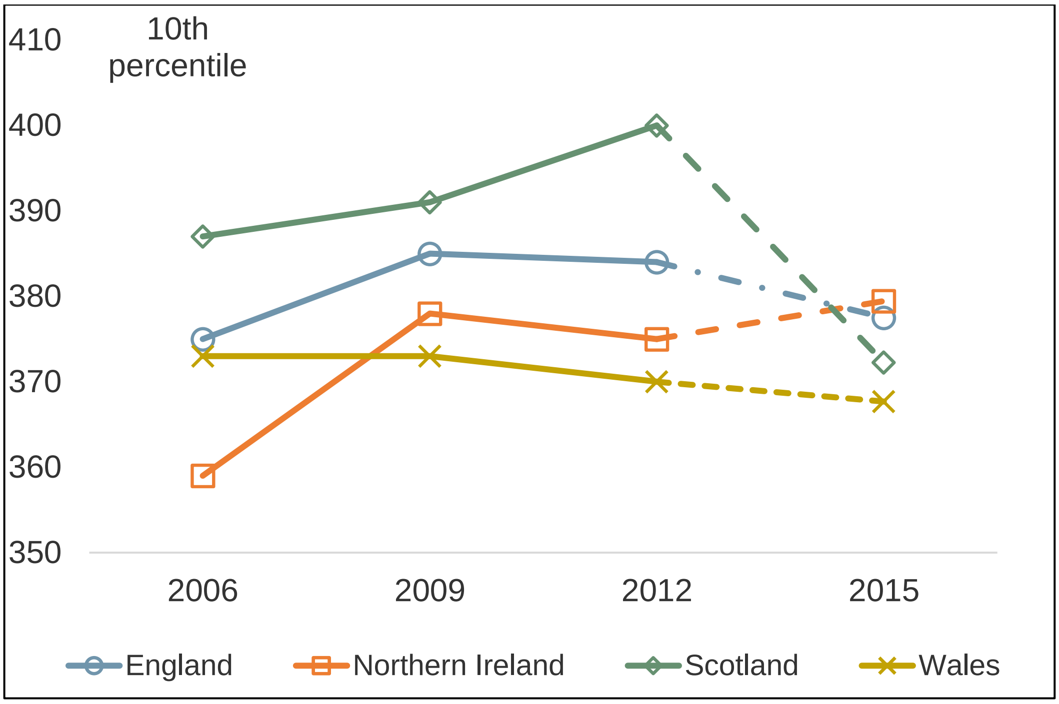
Figure 1. The change in the 10th and 90th percentile of science achievement since 2006

(a) 10th percentile



(b) 90th percentile

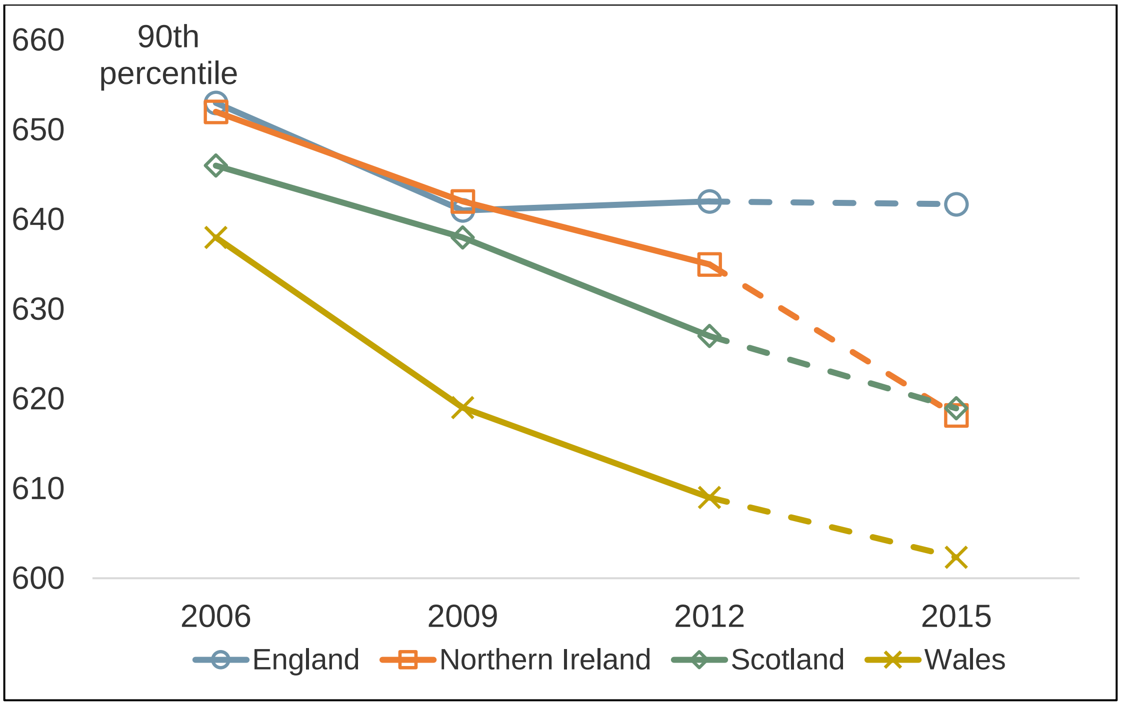
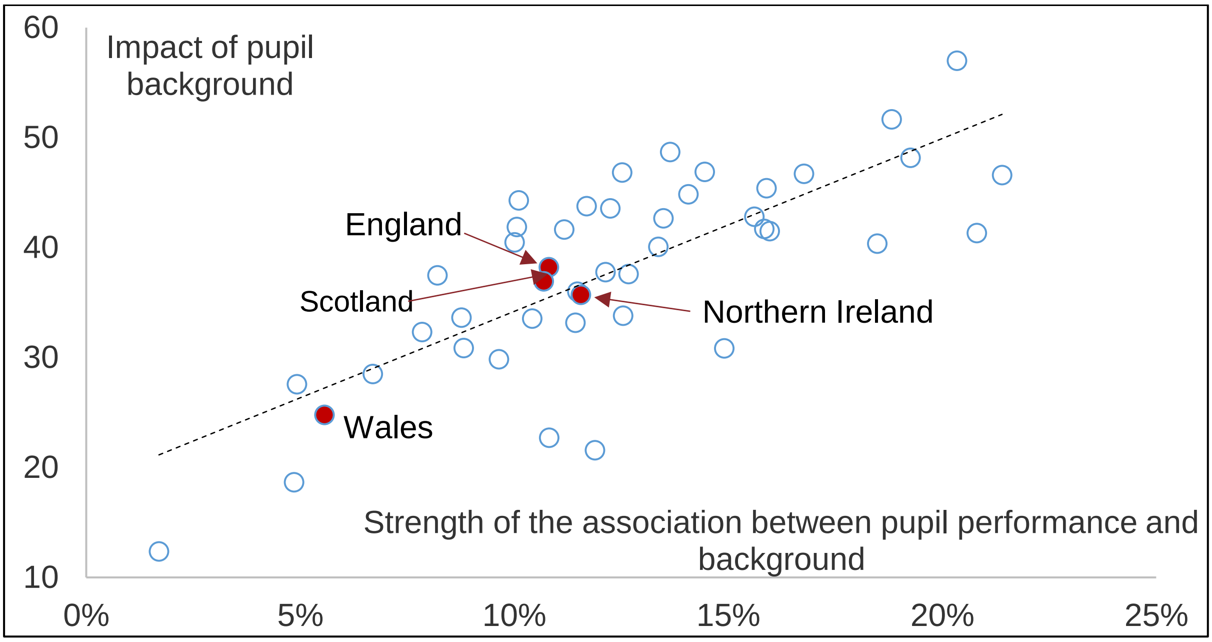


Figure 2. Socio-economic disparities in 15-year-olds achievement across countries



Notes: ‘Impact’ refers to the bivariate relationship between the ESCS index and science scores, estimated using OLS regression. ‘Strength’ refers to the per cent of variance in science scores that is explained by the ESCS index. Sample of countries restricted to those with a mean science score above 450.