First paper - Draft

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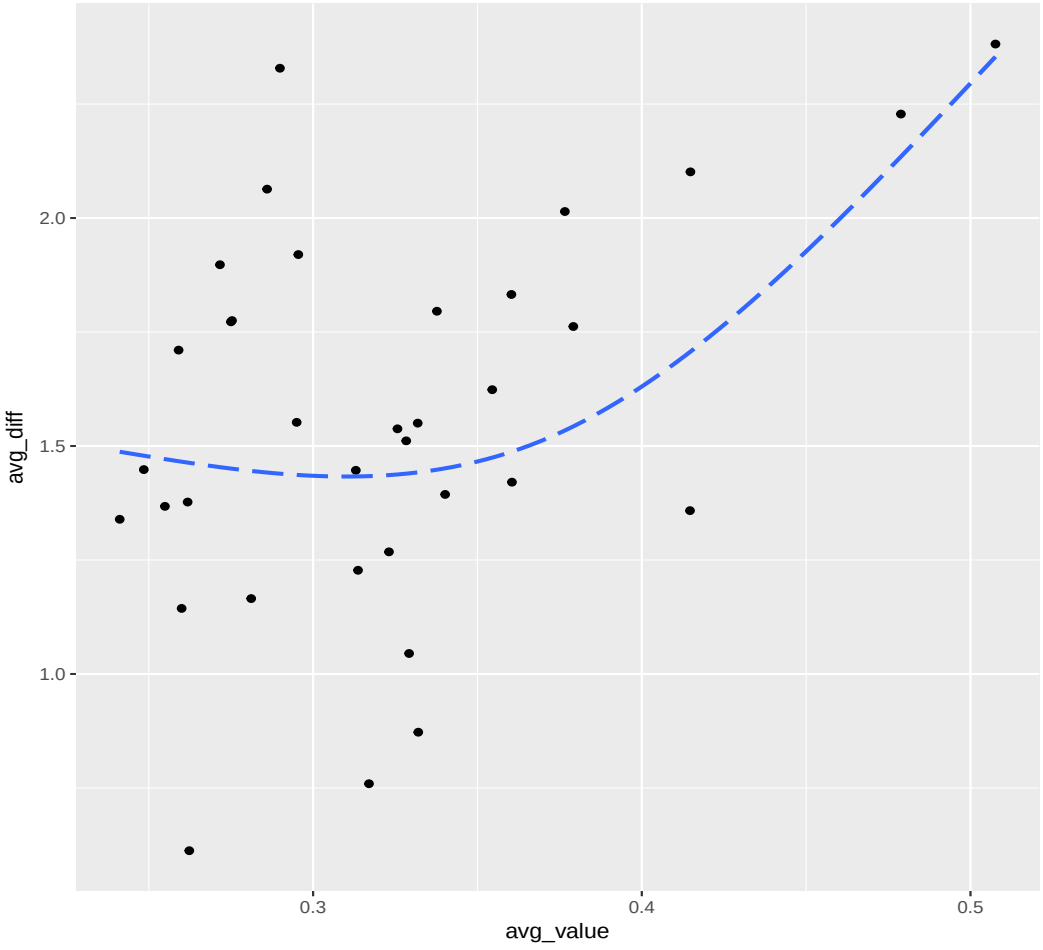

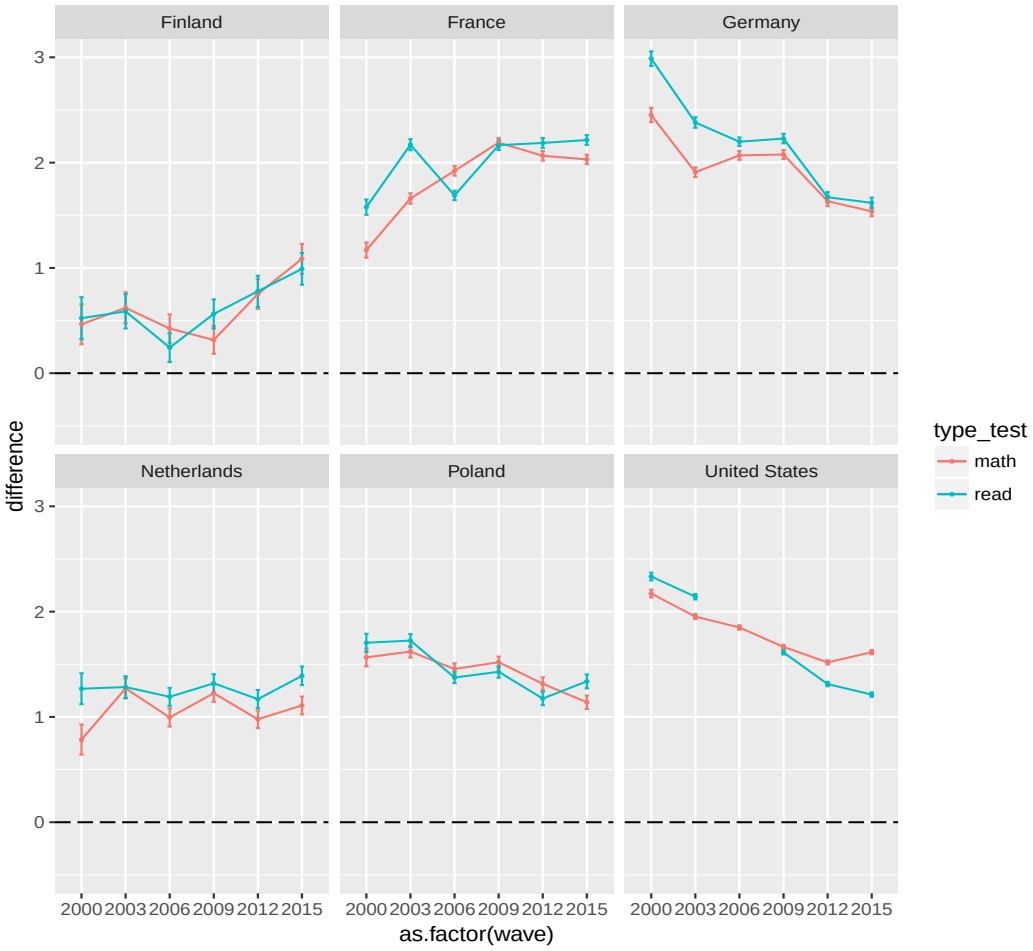
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Germany
Netherlands
Poland
United States
difference
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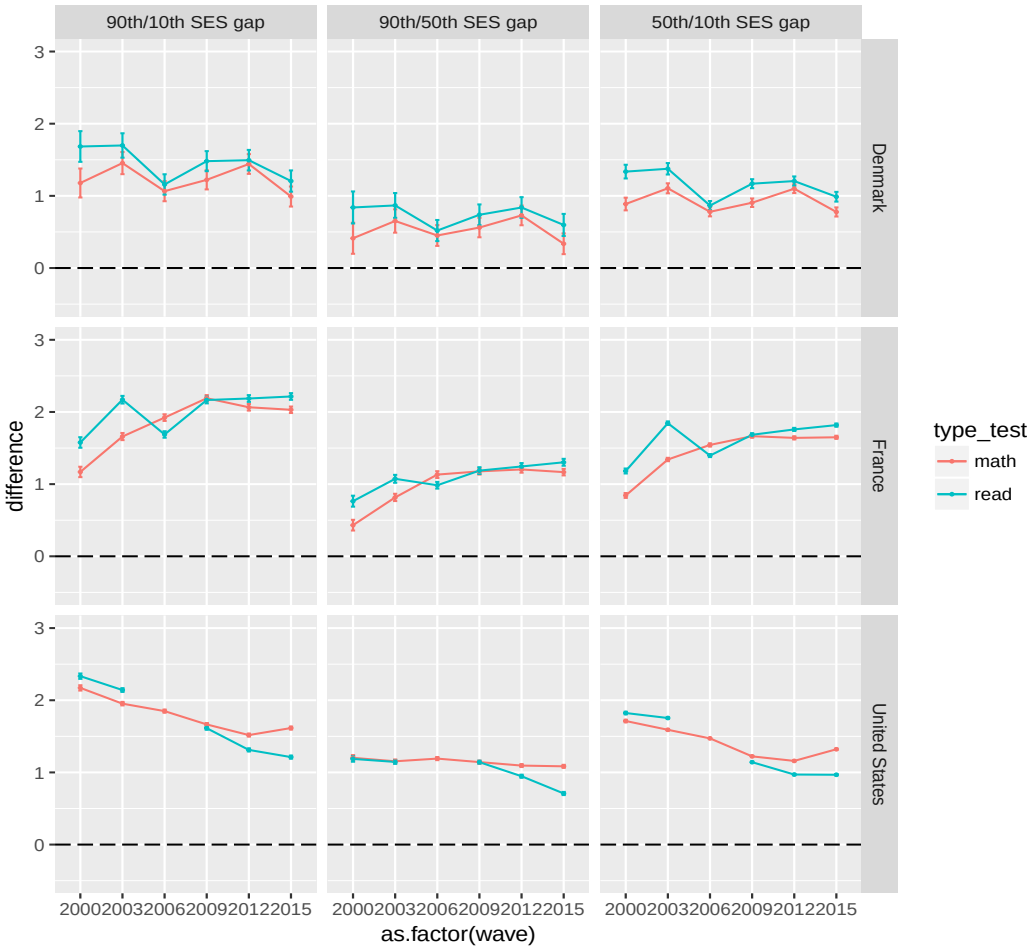
0
2000
2003
2006
2009
2012
2015
as.factor(wave)
type_test
math
read


90th/10th SES gap
90th/50th SES gap
50th/10th SES gap
Denmark
France
United States
difference
3
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2000
2003
2006
2009
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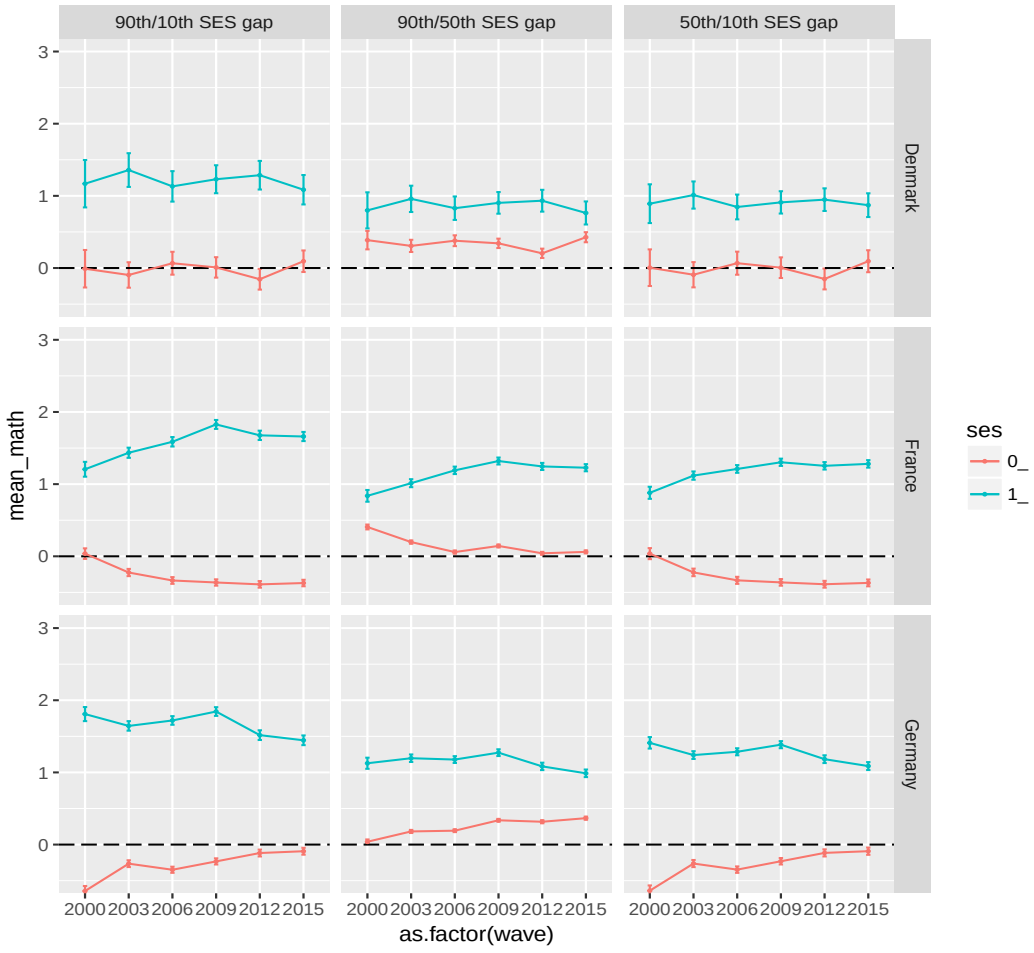
2015
as.factor(wave)
type_test
math
read


90th/10th SES gap
90th/50th SES gap
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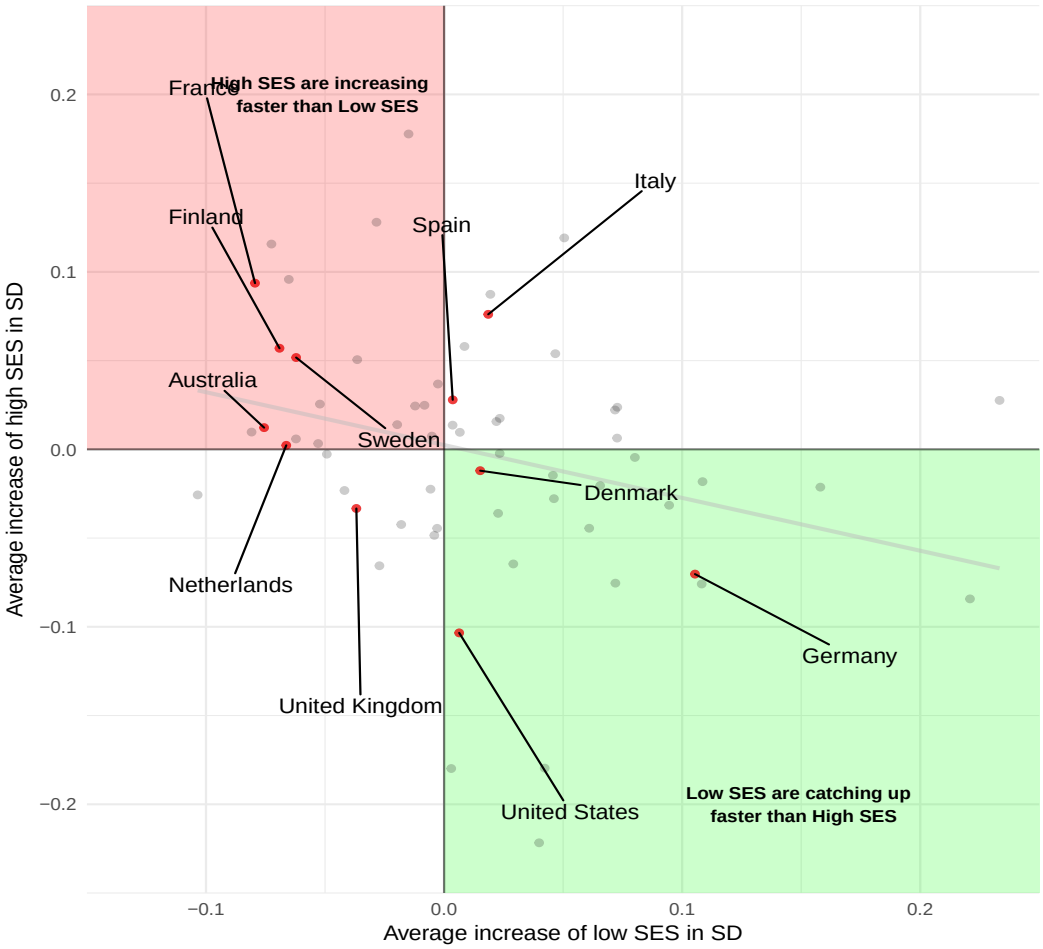
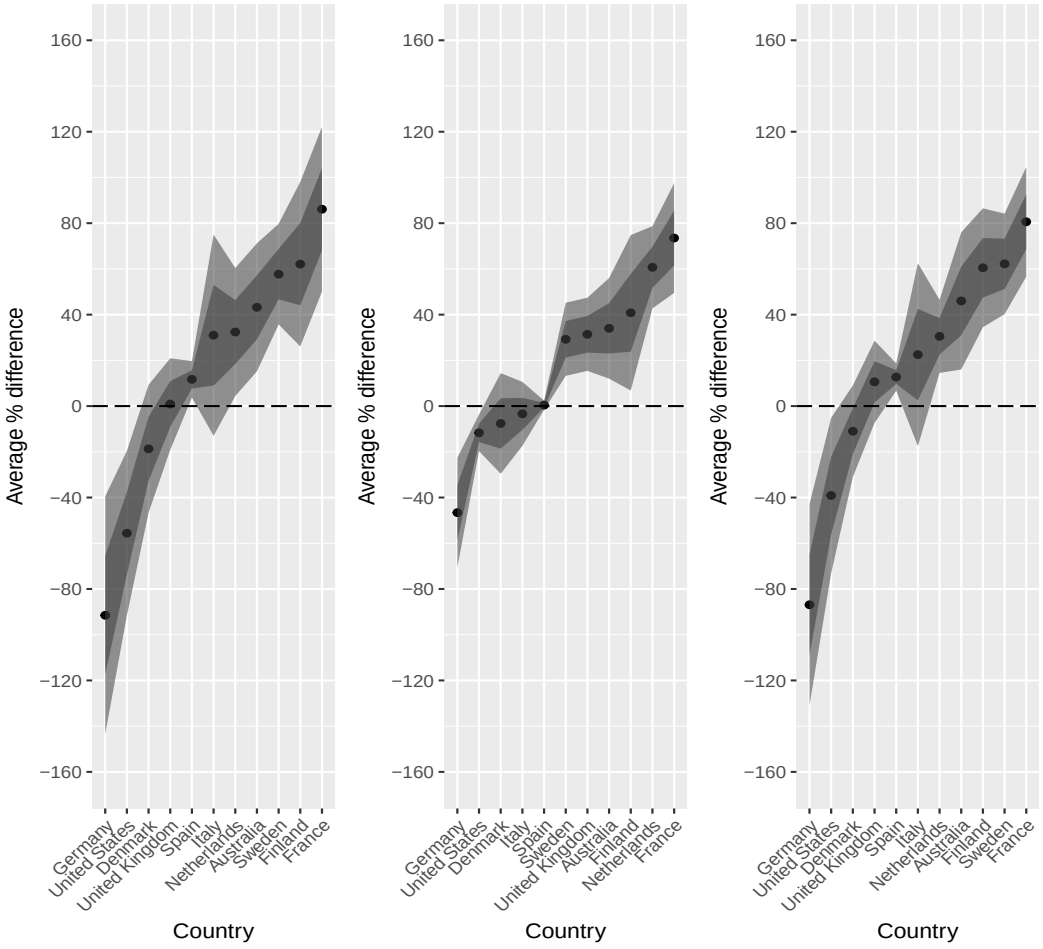
France
Germany
mean_math
as.factor(wave)
2000 2003 2006 2009 2012 2015
0 1 2 3
ses
0_
1_


High SES are increasing faster than Low SES
Low SES are catching up faster than High SES
France
Finland
Australia
Sweden
Netherlands
United Kingdom
Spain
Italy
Denmark
Germany
United States
Average increase of high SES in SD
Average increase of low SES in SD
0.2
0.1
0.0
−0.1
−0.2
−0.1
0.0
0.1
0.2



3 Literature Review

Recent research on educational inequality has found that differences in test peformance between High-SES and Low-SES kids has been growing quickly over the years. The literature on educational inequality has mainly concentrated on the United States (reardon here) but other international evidence is emerging with other similar findings for other count. The United States is usually the case study of interest, firstly, because it is the only country where cognitive testing is very widespread across surveys. And secondly, this trend has allowed to have testing records as early as 1940 (check reardon) until present day. Using this information, Reardon (2011) is the first to investigate the evolution of the cognitive gap and the results are very surprising. Not only has the cognitive gap between the 90th income percentile and the 10th income percentile grown over time, but it has grown faster and to be

wider than the highly contested white-black gap (cite study of white-black gap). The widening of the achievement gap has been happening in parallel to the growth of income inequality. Although very suggestive, it is hard to link both things causally.

Reardon (2011) finds that the increase has occured predominantely from the 1970's until the 2000's. In fact, hard numbers suggest that the gap increased by about 40-50%. The author also estimates the rate of change using data from the 1940's and finds an even higher increase of about 75%. Since the studies before the 1970's lack a lot of rigor in comparability and sampling, the author computes everything for the sample before/after 1970's separately Even after weighting appropriately.. Finally, Reardon (2011) concludes that the U.S gap between the 90th and 10th income percentile is at about 1.25 standard deviations. Corak and Waldfogel (2015) don't find results which are very far away from this. They find that for 14 year olds in the United States, the gap is above 1 SD but lower than 1.25. Duncan and Magnuson find similarly to the previous studies and confirms a gap of 1.25/1.50 standard deviations.

One important drawback of these studies is that they don't present the uncertainty of this estimate. Not necessarily to gauge their statistical significance, but to simply asses how much we can trust these numbers.

With very recent data, Reardon and Portilla (2015) have unexpectedly uncovered a new finding: the reversal of the trend. From 1998 until 2010, it seems like the income achievement gap [1] decreased at a rate of 0.01 and 0.008 standard deviations per year. In contrast to Reardon (2011), we find that in a 30-year span the gap was systematicaly increasing at a rate of 0.02, something not dramatically different from the previous estimates. The American situation is a very distinctive one relative to Europe. The reasons why we're seeing a reversal in the trend could be numerous and should be studied very close to context. For example, the American educational system lacks any formal curricular differentiation *la* European style. In contrast, Reardon and Portilla (2015) suggest that the reversal is likely due to the high increase of preschool enrollment. They suggest that in this same period (1998 - 2010) the income achievement gap in early schooling enrollment decreased substantially.

Some authors have taken this analysis to an international context in order to discover between-country trends. The comprehensive work of Corak and Waldfogel () performs a comparative analysis of Australia, United Kingdom, United States and Canada. Their research design is very distinctive in

[1] The income achievement gap is the difference between the 90th and 10th income percentile in the test of interest

that they use longitudinal data from children as early as age 2 and study the evolution of the achievement gap up until age 14 [2]. The core finding behind the book is that the American achievement gap is much wider than in any other comparison countries. As mentioned earlier, they find that once the achievement gap is present in early school entry, it doesn't seem to narrow very much over the life course. They find that the achievement gap is very stable all the way from early education to secondary school (although their studies cover up until age 14).

Say more above Corak and Waldfogel above (book).

Despite their high level of rigurosity, their analysis is based on four surveys that have significant differences and cannot be easily compared. Their findings are very reliable but should be taken as suggestive. For this reason we should also pay particular attention to studies such as Chmielewski and Reardon (2016) and Chmielewski (2017) which have attempted not only to compare gaps between countries, but to evaluate whether there is a general increase in educational inequality in many countries. These studies tackle a completely different question from the above, but they do provide support for the overall finding that the achievement gap is certainly not narrowing over time.

Chmielewski and Reardon (2016), using the Programme for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS) and PIRLS (the Progress in International Reading Literacy Study), the assess whether there are patterns of cross-national variation in the achievement gap. In other words, is the size of achievement gap different for many countries? Although there is potential to study countries over time using these surveys, they choose not to. They do so because their question of interest (income categories) was only asked in three waves; in the end the only had three countries repeated in all three waves.

Their work suggests that there is considerable variation in the achievement gap between top and bottom earning families across many developed countries. In comparison to the literature on achievement gaps, they find that the U.S has a gap a little over 1 standard deviation in the year 2005 (for 15 year olds) and Germany has a decreasing gap from around 1.25 to 1 standard deviation. They go even further and link this achievement gap to several country-level indicators related to income inequality, school differentiation, central exams, etc ... The correlations are indeed very suggestive but clearly we must be extremely cautios in drawing causal changes from

[2] To the best of my knowledge this is the only study that uses panel data to study achievement gaps, let alone to do this between countries

these two variables. But it is important to stress that their design is quite different from the work of Reardon (2011). Reardon (2011) takes studies in the U.S starting from the 1940's until 2015 [3] and makes them comparable across time. This gives the author a very long time series to build a reliable achievement gap (over 40 years). In their study, Chmielewski and Reardon (2016) change the aim of the study to model between-country differences from a cross-sectional perspective.

Chmielewski (2017), building on the work of Chmielewski and Reardon (2016) and Reardon and Portilla (2015) pooled together all the previously mentioned data, together with over 10 more studies ranging from the year 1964 until 2015 in order to discover differences between and across countries. With over 50 years of data, and over 100 countries, Chmielewski (2017) finds that there seems to be a general world increase in the achievement gap. However, once she disentangles the relationship by country, she finds a reasonable amount of heterogeneity, with some countries seeing the achievement gap closing, others no change at all, while others record a steady increase. One clear limitation of their study (as well as Reardon (2011)) is that the adjust for the age of each child in all studies. Although for their purposes is the right thing to do [4], they are masking age-specific achievement gaps by controlling for age, such as Reardon (2011) did.

The evolution of High/Low SES gaps for preschool children might be much less marked than the same gap for high school children. The explanation, although very debated, has been gaining much support in recent years. In countries with high levels of curricular differentiation, the transition from early schooling into the tracking system has been found to increase inequality of learning (Wossman and Hanushek diff-in-diff). Moreover, the vast sociological literature on educational transitions systematically finds that tracking tends to foster between-track inequality rather than erode their differences by tackling their specific needs (Van der Werfhorst and Mijs 2011). Based on this, we cannot simply assume that the achievement gap has been neither constant across cohorts (because there have been tracking reforms in many countries, introducing as well as elimination tracking structures) nor the same between ages, because tracking/no tracking might exarcebate the achievement gap.

With this being said, this paper introduces one novelty in the literature which is to evaluate the evolution of the High/Low SES achievement gap

[3] Each study is independent of each other meaning that the it might've been given to 6 year olds as well as to 12 year olds. Although the author adjusts for age, the trends can't be generalized to age-specific, but rather in overall terms.

[4] The differences in achievement could simply be due to changes in cognitive abilities across the lifetime. However, as we've noted before, Corak and Waldfogel (2015) find that the achievement gap is very stable across the life time

in the past 15 years for all PISA participant countries. This is different from previous work because it concentrates solely on 15 year old children, and it attempts to capture the evolution of the achievement gap for each country. The advantages of this study are numerous. First, we concentrate on the evolution of the gap for only 15 year olds. This is different from all the work of Chmielewski and Reardon, in which they pool all ages to get average changes, to study the properties of specific age-groups. As we've seen before, there are reasons to think that specific age-groups have seen changes in the achievement gap. Moreover, in almost all countries with a tracked curriculum children are either at or in the process of tracking by the age 15, meaning that we will be able to link whether tracked countries are the most variable in their evolution of achievement gaps.

Talk about reardon and portilla and how the achievement gap has been closing in the last 15 years. Talk about how the achievement gap has been widening in Malaysia and South Korea (or Japan?) Note how many of these studies haven't really concentrated on who is getting better or worse: top or bottom? Talk more about how countries with high social mobility has been linked to smallest achievement gaps Talk about Durpiez and Dumay and how there's not relationship between inequality income - inequality achievement in contrast to reardon and anna who find some relationship.

4 Research design

Make sure PISA variation is constant over time