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Exploring educational attainment by immigrant background:

An analysis of PISA data in six OECD countries

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Abstract:

This paper aims to show the variation in 2015 PISA reading scores in six OECD countries based on immigrant generation. OLS regression models for each country are used to consider self-selection into migration by parents and their human capital and ultimately predict reading scores of their descendants compared to ancestral natives. Particular attention is paid to national origins of immigrants in Australia and Austria to determine whether segmented assimilation is apparent. Additionally, there is in depth analysis of the 2.5 generation and how this group operates compared to both the natives and the mono-national second generation. Moreover, comparison between the parental composition of this 2.5 generation, native fathers versus native mothers is undertaken.

Results indicate that there is a gap between immigrant children and natives in non-Anglo-speaking countries. Positive self-selection, linguistics and stringent migration policies offer an explanation as to why these positive and negative gaps appear across the countries. Segmented assimilation is also identified with diverging trajectories based on different origin groups in both Austria and Australia. Within the 2.5 generation native fathers are more important than native mothers and this combination offers some form of buffering to avoid second generation disadvantage in certain destinations.

Keywords: Immigration, Educational Attainment, Second Generation, 2.5 Generation, Intermarriage

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Introduction

Children of immigrants are well-researched within the migration literature, with a considerable number of studies focusing on their life course outcomes. Scholars have studied their behaviours regarding fertility and nuptiality; health and morbidity; and socio-economic outcomes; including earnings and educational attainment. The education of children of immigrants can be seen to follow upward trends through the self-selection of their immigrant parents but equally there are examples of negative outcomes through institutional discrimination and an inability to access the level of education experienced by natives either through a combination of cultural and linguistic barriers. However, comparative studies are somewhat rare, and there is a lack of clarity about the educational success of immigrant children across immigrant destinations. There are additional inconsistencies regarding the behaviour of those who have one native parent and one immigrant parent. This study therefore builds upon and extends previous studies by focusing on educational attainment across six OECD countries: Australia, Austria, Belgium, Germany, Luxembourg and United Kingdom. The aim is to study how educational attainment varies based on immigrant generation, and the extent to which the determinants are generalizable across destinations.

As described in more detail below, the importance of the direction, and magnitude, of any differences between children – based on the migration background of their parents – is important for policymakers and educators alike. Educational inequality is a clear predictor of long-term disadvantage that can materialise later in life (Portes, Fernandez-Kelly, & Haller, Segmented assimilation on the ground: The new second generation in early adulthood, 2005). Being aware of the factors that cause a divergence in outcomes allows for an attempt to address this imbalance, for example through the use of targeted social policies to ensure that no systematic disadvantages continue to inhibit the adaptation of these children as they continue their life-course.

This manuscript therefore, aims to understand how parental background can influence educational attainment. It uses data from the Programme for International Student Assessment (PISA). Educational attainment is assessed using the reading scores in the standardised PISA test taken in 2015. Parental background is measured using a rich range of characteristics including: (a) country of birth, (b) parental country of birth, (c) parental socio-economic characteristics, and (d) language used in the family home. These variables are available for all of the six OECD destinations that are studied here.

Categorising students based on their country of birth and their parents' country of birth enables an analysis of the variability of their educational attainment across different generations and according to the complexity of their parental background. In its first analysis, this study explores the extent to which parental background determines variation in PISA reading scores. Controls for socioeconomic characteristics are used to help avoid selection bias and the confounding of parental human capital transmission. One of the key research questions for this first analysis is whether patterns of association are consistent across the six destinations.

There is also a focus on national origins; specifically looking to extend the literature regarding origin effects and identify the parental origin groups who perform worst when it comes to educational attainment. This section draws upon the theory of segmented assimilation, which predicts that some second-generation groups will experience disadvantage, including due to the individual, social and institutional barriers experienced by them and their parents (Portes, Fernandez-Kelly, & Haller, Segmented assimilation on the ground: The new second generation in early adulthood, 2005). The PISA data allows for observations regarding whether there is any evidence of segregated assimilation, with some second-generation groups outperforming others who are left behind, and whether or not this evidence is specific to particular destination countries. Given the availability of data on the 2.5 generation, it is also possible to examine the role of native parents in moderating segmented assimilation.

A consistent observation in the demographic literature is that partnership markets have become larger and far more dynamic, due to increases in international travel and migration alongside an increased ability to carry out relationships over long distances (Castro-Martín & Cortina, 2015). This has led to an increase in bi-national partnerships and an increase in children born with parents who have two different national origins. This includes an increase in the 2.5 generation (G2.5) – children who have one foreign-born and one native-born parent. This group have typically been ignored in demographic and sociological research or have otherwise been dealt with inconsistently.

The 2.5 generation are the focus of the final part of the study, which compares the outcomes of this unique group to those who have mono-national parents; both native and immigrant. Additionally, it will examine variation within G2.5 and determine if there are differences between those with native mothers compared to those who have native fathers.

The burgeoning 2.5 generation offers an ability to study how parental influences can differ between mothers and fathers, and the PISA data allow this to be done across multiple destinations. The results therefore provide insights into discussions around 'mixed' partnerships and whether the children of these partnerships are able to close any attainment gaps or whether they experience disadvantage versus children who come from mono-national backgrounds. The research questions, data and method are described in more detail below, but before that the next section provides a more detailed review of research related to the aims of this paper.

Background

The life-course of immigrants, their descendants and how they compare to natives is a broad topic. Immigrants are usually categorised according to their generational status, and there are clear differences between the progress of first-generation immigrants (i.e. people who are foreign-born) and the second generation (defined as those with foreign-born parents, although see below for more nuanced definitions).

The first generation have a clear disadvantage preventing them from feeling the benefit fully of education institutions, especially when compared to native children who have parents familiar with the system. Linguistic barriers are an obvious problem for the first generation and the outcome of their education in most US based studies find that immigrants with a Mexican origin are less likely to complete high school compared to natives and other immigrant groups (Baum & Flores, 2011). This suggests that there is a polarisation across origin countries, and they have different abilities to assimilate and benefit from education institutions. This effect is worsened the later into adolescence that migration occurs (Myers, Gao, & Emeka, 2009). Disruption from childhood immigration experiences can be a factor to explain why immigrant children are more likely to be in school grades below those from their birth cohort across Europe (Park & Sandefur, 2010). Their attainment is stunted by migration itself and other barriers, so consequently they are held back in school because their attainment is below the standard expected and achieved by native children. Chiswick & DebBurman (2004), find similar results with age at migration playing a significant part in explaining lower attainment among adolescent first-generation migrants. However, it can be noted that very early arrivals were seen to be the most educated group above all native-born children. They also contribute to the debate on the heterogeneity across origin countries, again Mexican immigrants doing far worse than natives and immigrants from Asian and European countries.

For the second generation there is mixed evidence about how they fare. Societal outcomes see them at higher risks of suicide (Hjern & Allebeck, Suicide in first- and second-generation immigrants in Sweden A comparative study, 2002) and also higher rates of illicit drug usage and other risky behaviours (Hjern, Illicit drug abuse in second-generation immigrants: a register study in a national cohort of Swedish residents, 2004). Much of the mechanisms behind second-generation outcomes is nestled in literature that discusses ethnic disparities. Discrimination along ethnic lines disproportionately effects second generation immigrants see: (Portes & Zhou, The New Second Generation: Segmented Assimilation and Its Variants, 1993) and (Silberman, Alba, & Fournier, 2007) for US and French studies respectively.

There is clear evidence of divergent pathways across different ethnic and national groups. Positive results can be seen in Asian communities in both America and Europe with white natives consistently outperformed by second-generation Asian students see (Kao & Tienda, Optimism and Achievement: The Educational Performance of Immigrant Youth, 1995) and (Kao, Parental Influences on the Educational Outcomes of Immigrant Youth, 2006) for America and (Heath & Brinbaum, 2007) and (Heath, Rothon, & Kilpi, 2008) for European studies. This divergence takes some immigrant groups beyond native levels leaving others behind, this gives light to the segmented assimilation theory (Portes & Zhou, The New Second Generation: Segmented Assimilation and Its Variants, 1993). Where despite a desire to acculture to native levels, the ongoing barriers across education institutions lead to lower levels of attainment and ultimately poor labour market performance for certain immigrant backgrounds. The origin effects vary across the political landscapes of the sending countries and are also more pronounced at first generation compared to second generation levels. However, it appears that second generation children are able to assimilate better and achieve higher levels of scholastic performance compared to first generation children of the same background (Levels & Dronkers, Educational performance of native and immigrant children from various countries of origin, 2008).

Parental Effects

Parental influences and socioeconomic characteristics are definitely explanatory factors in differences seen between natives and immigrant children (Marks, 2005). Parental factors appear as a recurring theme in much research that examines differences between immigrant and descendants and natives. An underlying concept is that of self-selection (Chiswick, Immigration policy and immigrant quality: Are immigrants favorably self-selected?, 1999)

whereby parents that have migrated possess higher levels of social capital than the average native and thus the intergenerational transmission to their children results in better outcomes than ancestral native children. Evidence from Germany finds that parental education is actually a poor proxy for second generation attainment as the self-selection into migration often negates the intergenerational human capital transfer that is seen in children of natives (Gang & Zimmerman, 2000). Naturally, parental factors and socioeconomics are complicit to the success of both immigrant children and native children; but there are differences in how immigrant status and these characteristics interact. For example, immigrant parents have far higher educational aspirations for their children compared to their similarly educated native peers (Portes & Hao, The schooling of children of immigrants: Contextual effects on the educational attainment of the second generation, 2004). Yet, despite immigrant parents having higher aspirations for their children, having an immigrant background alone is insufficient to explain educational attainment differences (Baum & Flores, 2011).

Culture and Linguistics

The performance of immigrants in any destination country is related to their (or their parents) origin, those from culturally similar places usually face less barriers to integration and are therefore likely to have incomes higher than those from places with a vastly different culture **(Adsera & Chiswick, 2007)**. The ease of exploiting cultural similarities to succeed in the labour market may extend to linguistic similarities which means a wider range of labour market opportunities are available and the possibility to expand skillsets through education institutions exists.

Linguistics is an ongoing area of interest for researchers studying attainment gaps. Investigations into immigrant groups in the United States suggests that for the second-generation maintaining minority language skills is beneficial to overall academic achievements. In theory this would give the American-Hispanic second generation an advantage over their Asian-American counterparts (Hao & Bonstead-Bruns, 1998), since the Spanish language is retained far more often. However, the opposite gap is generally observed between these communities creating more evidence that there is a selection bias into migration for Asian parents. Simultaneously, there are deeper socio-economic and discriminatory issues within the United States political and education system which inhibits Hispanic success far more than for Asians.

Language development is the focus of Rumbaut's (2006) study, observing that destination language development was better in the second generation compared to the first generation immigrants and was similar to natives in the USA. Rumbaut also identified the potential uniqueness of the 2.5 generation's language skills, deeming them more likely to lose their foreign language skills but achieving better English skills than mono-national second-generation children. Language can also be discussed from the perspective of the destination country and it has been found that Anglo-speaking countries have lower attainment gaps than the high immigration countries of continental Europe (Schnepf, Immigrants' educational disadvantage: an examination across ten countries and three surveys, 2007). Results like this can potentially be explained by improved parental knowledge of English as a second language, which is passed onto children preventing them from falling behind children with native parents.

Policy environment

When we consider self-selection and the intergenerational transmission from immigrants to their children, the importance of policy in the destination is evident. Stricter immigration regimes will see only those with high level skills migrate and thus the educational attainment of their children would be greater. Apparent in many western European countries where only very qualified migrants can settle **(Borjas, 2001)**. The validity of Borjas' statement is questionable now though, particularly within the European Union and the skills of migrants being less relevant to their ability to settle due to free movement of people. The lack of cohesion between European immigration strategies and policies has seen highly skilled external migrants "put-off" in favour of the USA and Australia **(Wiesbrock, 2016)**. The EU only attracts 5% of global skilled migrants, with a lot of migrants entering for family reunification, temporary study purposes and refugee/asylum reasons. Within Europe mobility is high at skilled and unskilled levels but 75% of intra-EU migrants end up in just 5 countries (Germany, Spain, United Kingdom, Italy, and France) **(Eurostat, 2011)**.

Destination countries are naturally not heterogeneous and selection bias towards educated migrants in certain countries is clear. When comparing Australia to European countries now, the stringency of settling in Australia compared to Germany and the United Kingdom (amongst others) mean that parental levels of education amongst Australian immigrant children are higher compared to the average (Entorf & Minolu, 2005). In Europe, low-skilled labour migration is more apparent and relatively more low-education and

linguistically limited people do settle and raise children. Policy is a broad concept and includes domestic policies which increase assimilation and integration of immigrants. Examples of such policies include those which assist in overcoming language barriers for both the first-generation parents and consequently their second-generation offspring (Chiswick & DebBurman, Educational attainment: analysis by immigrant generation, 2004).

Immigration policy as a whole has the potential to explain education attainment differences. As established, studies from the United States have clearly shown the division between Latin American and Asian migrant children at both first- and second-generation levels and offers support to the existence of the segmented assimilation hypothesis. Asian-Americans routinely outperform natives and at the other end of the spectrum children with Latin American backgrounds are more likely to drop out of high school and achieve lower socio-economic outcomes (Portes & Rivas, The Adaptation of Migrant Children, 2011). Speculation regarding this discrepancy includes that it can be attributed largely to undocumented Hispanic migrants. Many children who came very young have few prospects because they lack legal status and thus are locked in a cycle where they and their parents cannot access resources that would see them overcome the education and life course barriers, especially regarding access to education institutions. The rigid policy environment and ongoing fear of detection and deportation provides an obstacle to assimilation despite these children benefitting from native life.

A final note on policy is that education systems as a whole differ substantially and this heterogeneity is driven by macro policy that subsequently effects the outcomes of all children. Work by Dronkers & de Heus (2016), found that children of immigrants underperform more in countries with teacher shortages. This macro finding indicates that domestic education policy in the destination country has greater effect on the children of immigrants who are more reliant on high quality teaching as their parents are unable to pass on certain key skills that drive high education outcomes and assimilation.

The 2.5 generation

The 2.5 generation and their outcomes are yet to be fully explored in academic research, with many different empirical approaches to their categorisation. Previous research into children of immigrants' education have, without justification, included these mixed origin children with the *'pure'* second-generation group. One found that the second-generation were more likely to drop out of education than children of natives (White & Kaufman, 1997) but

this apparent disadvantage could differ if the 2.5 generation were isolated and analysed separately. In addition, Washbrook, et al. (2012) also aggregated both groups. With results that support the hypotheses that children of immigrants perform worse even after parental and socio economic controls. However, the potential influence of having one native parent is ignored and is a limitation of their study.

Conversely, Schnepf (2004), shows that the apparent education advantage for natives could be attributable to a benefit of having mixed national parents, with her work classifying one native parent an ancestral native. For some research the decision is made to remove the 2.5 generation from the sample such as (Algan, et al., 2010) removing any ambiguity and ensuring that comparison between natives and second generation is free from this complication. However, it does lose an ability to be representative of the population in an ever more global world.

The varied approaches seen regarding the definition of immigrant bckground categories demonstrates the value of researching how the 2.5 generation fare if they are considered as a distinct group. Discovering whether they are closer in outcomes to the natives or the second-generation which could then set a precedent for future research on this group and their entire life course. Alternatively, they could operate entirely differently and present evidence that they should continue to be treated as separate. So far though there has been limited work to isolate them. Some works have isolated them as a distinct group, in an effort to avoid the potential uncertainties (Azzolini, Schnell, & Paler, 2012). Results of Azzolini et al.'s analysis in Italy and Spain found that G2.5 are hard to distinguish from natives. Creating evidence that if any aggregation was to happen, they are better considered with natives. It appears that there is a sort of 'buffer' that comes from having one native parent. This buffer lifts the 2.5 children closer to ancestral natives, similar results were found in a French study (Boado, 2011). Karthick Ramakrishnan (2004), also showed that systematic differences between the 2.5 generation's outcomes and those of the second generation do exist. The results were positive, G2.5 having lower odds of dropping out at all levels of education, higher long term incomes and more total years of education compared to second generation. Models involving dummy variables were used by Levels, et al., (2008) which also found a positive influence of having one native parent compared to two immigrant parents. Supporting the hypothesis that mixed national origins can close the attainment gap between the disadvantaged second generation and the children with native parents. Most recently a publication by Smith et al., (2018) isolated the 2.5 group in the Swedish context and summarises that the existence of a native

parent presents the opportunity for enhanced social networks and thus should benefit the 2.5-generation in terms of their assimiliation.

Gender differences

Gender gaps in education is a key concept that has been studied for many decades. Now it is widely agreed than in OECD countries girls outperform boys in academic environments (van Hek, Kraaykamp, & Wolbers, 2016). This has been largely credited to girls having a better engagement with authority, putting more focus on work outside of the classroom and generally having higher expectations of themselves (Warrington, Younger, & Williams, 2000). Within migrant communities these gender differences are even more pronounced with bigger differences between immigrant girls and boys than between ancestral native girls and boys (Dronkers & Kornder, 2014). Second-generation immigrants in Western Europe have been found to assimilate to performance levels that reflect these gender differences. They can differ in terms of magnitude compared to native gaps, but all represent a direction with girls outperforming boys (Fleischmann, et al., 2014). Even when looking at immigrant outcomes in the labour market gender differences are clear. Within an EU context, immigrants from outside the area fare worse in terms of income compared to natives. But the size of the earnings gap varies by gender, between immigrant women and native women it is lower than the observed gap for men. In addition, the returns on education also benefit immigrant women over immigrant men (Adsera & Chiswick, 2007).

The gender difference specifically that this study considers is within G2.5 specifically, and the difference between those with native mothers and those with native fathers. Research in this area shows that the intergenerational transmission of resources is clear; parental effects are a widespread determinant of all long term success of children, and take into account the status of both mother and father (Korupp, Ganzeboom, & van der Lippe, 2002). Although, it has also been found that fathers matter more for sons and mothers for daughters (Dearden, Machin, & Reed, 1997). Within OECD countries most parents of adolescents were themselves raised by parents who both worked, as a part of the overhaul of female labour force participation with mothers equally educated and continuing to balance career and families (Fernández, Fogli, & Olivetti, 2004).

Therefore, when discussing children who have a potentially bicultural identity, how do these family dynamics adjust or factor into attainment discussions? Is the native parent more influential regardless of their gender? Or is there a gender specific transmission from mothers

and fathers to daughters and sons? Early work done within second generation American men found that there was an earnings advantage largely due to self-selection into immigration, but it was far larger for those with foreign born fathers compared to foreign born mothers (Chiswick, Sons of Immigrants: Are They at an Earnings Disadvantage?, 1977). Chiswick's work is early into the second generation being a discussion topic and most of the fathers of the 2.5 generation were educated labour migrants, which is the probable explanation of these results. Now we have experienced the feminisation of migration particularly in Europe the results may not be replicated. Karthick Ramakrishnan (2004) found that within the American 2.5 generation those with native-born fathers were more likely to complete highschool yet those with native mothers performed better in the longer run with higher earnings and higher college completion rates, so interesting inconsitencies are apparent. Further American research on high school drop-out rates finds that there is no significant difference between the effects of native women childbearing with immigrant men or the reverse, once again parental controls explaining away all the descriptive differences (Furtado, 2009).

Outside of the United States there is a gap in the literature involving comparing within the two subgroups of G2.5. A natural experiment in the Netherlands found that those with native mothers out performed those with native fathers in the Moluccan community (van Ours & Veenman, 2010). Whilst this is a very narrow frame of one immigrant group in one country, it is a starting point. This 2.5 generation have heterogeneous characteristics within it and there are conflicting results when looking at which parent is a native, so further research is required.

Research Questions

Given the theoretical literature and the findings of previous studies, the overarching aim of this research is to determine how immigrant background impacts PISA reading scores. This will be investigated descriptively, with respect to the bivariate associations between PISA scores and immigrant generation. Additionally, it will be studied through the examination of how these associations vary across origins and destinations, as well as how they change with the addition of controls for aspects of parental, socioeconomic, and linguistic background. Moreover, the analysis includes a focus on the 2.5 generation, including their outcomes as compared with children who have a homogenous parental background, and according to whether their native parent is their mother or father.

The research questions are therefore as follows:

Q1. How do the PISA reading scores of children vary by the migration background of their parents?

Adaptation or inequality

Q1a: Are the scores of the second generation closer to the scores of ancestral natives than those of the first generation?

The role of parental origin

Q1b: How consistent are the differences between generations when we focus on particular parental origin groups?

Q2. How do children fare if they have both a foreign-born and native-born parent? (i.e. members of the 2.5 generation)

Performance of the 2.5 generation

Q2a: Do children with only one foreign-born parent achieve higher scores than those with two foreign-born parents?

The intersection between parental gender and migration background

Q2b: Within the 2.5 generation is there a difference between those with native fathers and native mothers?

Data and Methods

The data used is the 2015 Programme for International Student Assessment (PISA) (OECD, 2018). This is a test and accompanying survey taken by children aged fifteen, where school attendance is virtually universal in OECD. PISA is not a qualification or school leaving exam; instead the test aims to challenge thinking and interpretation skills covering; literacy, mathematics, science, financial literacy and collaborative problem solving. Although, the latter two are not present across all countries involved. The accompanying questionnaire given to the student asks questions regarding attitudes towards school alongside questions aiming to uncover socioeconomic and demographic characteristics. In some countries an additional parental questionnaire is completed. In 2015, 72 countries participated including all of the OECD. The survey uses stratified sampling in order to select a variety of schools covering different regions, types of school and differing demographic characteristics with the aim of obtaining a representative sample across the nation. Smaller countries (including Luxembourg) are able to administer the test to all students of the correct age and achieve near 100% participation.

Sample

The 2015 PISA wave had responses from over 500,000 children across the 72 countries. For this analysis six countries are selected for analysis totalling 57,147 observations. These countries are Australia, United Kingdom, Austria, Germany, Belgium and Luxembourg. The selection of these countries is primarily due to relatively large sample sizes across different immigrant groups. Additionally, they offer specific information regarding the place of birth of both parents, which can be used for analysis of origin effects and explore the segmented assimilation hypothesis. This information is not perfect but particularly large origin countries are highlighted separately rather than just a binary question of being foreign-born or not which other countries do use.

For the analysis some cases were dropped if they lacked information regarding the place of birth of any of their parents or themselves – as this would make their immigrant generation impossible to define accurately. Furthermore, they were dropped if they had missing information regarding any of the control variables that were to be used. A full table which indicates the reason for attrition across all six countries can be found in the appendix.

Dependent variable: PISA Reading Score

The dependent variable is the reading score obtained in the PISA test. The published data contains ten plausible values for each test subject for each child observed. These plausible values are not raw scores but "multiple imputations of the unobservable latent achievement of each student" (Wu, 2005) based on the fair assumption that the residual of the actual performance of each child is not equal to zero. Full details of the construction and estimation of the plausible values can be seen in the PISA technical report (OECD, 2017). However, in brief the estimation is done by using item response theory (IRT) models which focus on the answers and scores actually recorded by children and are calibrated to maintain consistency with previous PISA cycles. This model is then combined with population modelling using latent regressions; whereby the parameters recorded in IRT model are fixed and the latent regression model fitted to estimate weights and residual variance for each students' results. The ten plausible values are then drawn from the estimates provided by these models. The overarching assumption is that proficiency (scores) from children vary based on both the ability of the child and then a wide range of background characteristics that the questionnaire asks about. Therefore, the use of plausible values is an attempt to lessen the contextual differences between and within the country's institutions and populations.

For this analysis the reading score was used, this is deemed the most relevant score to try and focus on linguistics and language skills that play a central part in the theories which explain immigrant disadvantage and ultimately illustrate the long-run differences between the life courses of immigrants, their descendants and natives. As stated above PISA scores in each subject are scaled and standardised using a complex manner and models which consider the likelihood of a correct response given the student. The models for this scaling have developed through the waves of previous studies, constantly adjusting in order to track national progressions. The first wave in year 2000 saw the scores for each subject distributed with a mean of 500 and standard deviation of 100, this is still similar to the observed scores now. In the appendix there are histograms for the reading scores in each country.

Independent variable: Immigrant Generation

The main independent variable is the generation group of the children. Students were categorised into the generational groups shown below in table 1. Parental background was gathered from the parental questionnaires where possible, to eliminate the scenarios where a child is misinformed of their parents' place of birth. Where parental questionnaires were not available the answers given by the children were used.

Group	Description
Native	Child, Mother and Father are all born in country of test
First Generation	Child, Mother and Father all born outside of the country of test
Second Generation	Child is born in country of test but BOTH parents were born in another country
2.5 Generation	Child is born in country of test and only ONE parent was born in test country.
Native Parents & Born Abroad	Child is born abroad but BOTH parents were born in test country.
Mixed Parents & Born Abroad	Child is born abroad and only ONE parent is born in test country.

Table 1 - The six generational groups used to classify children in this study

Across the six groups the latter two were small, totalling less than 2% of all children in each country, see appendix. Given the ambiguous nature of these categories these children were removed. Table 2 shows the final sample size across the immigrant groups and by country with column percentages. This is after all attrition for subsequent missing values recorded for any of the control variables discussed below.

Sample	Australia	United Kingdom	Austria	Germany	Belgium	Luxembourg	Total
Native	7681 62.8%	8810 79.7%	4640 73.5%	3775 75.6%	5964 72.0%	1412 31.8%	32282 68.2%
1st Generation	1274 10.4%	833 7.5%	382 6.1%	137 2.7%	599 7.2%	935 21.0%	4160 8.8%
2nd Generation	1229 10.0%	483 4.4%	730 11.6%	583 11.7%	630 7.6%	1382 31.1%	5037 10.6%
2.5 Generation	2045 16.7%	932 8.4%	562 8.9%	496 9.9%	1092 13.2%	713 16.1%	5840 12.3%
Total N	12229	11058	6314	4991	8285	4442	47319

Table 2 - Sample across each generation group analysed

Control Variables

Parental Education:

As self-selection into immigration and the subsequent intergenerational transmission of education is apparent in the literature, parental education must be controlled for in order to obtain any meaningful results. The PISA data measures the years of schooling achieved by the highest achieving parent. Descriptive statistics for the years in education across the six countries can be found in the appendix.

International Socio-Economic Index of Occupational Status (ISEI):

Parental occupational status is another control that is used. This variable differs from parental education as it clarifies that any education level achieved by parents has actually transformed into a social status, making this an additional control which can be considered a proxy for social class (Erola, Jalonen, & Lehti, 2016). It can reflect the mechanism which defines the social environments a child is exposed to which can influence educational attainment. Higher ISEI's indicate higher occupational success, the variable is discrete and varies between 16 and 90. The index is constructed by OECD using answers from open ended questions asked in the student questionnaire (OECD, 2017). The coding is based on International Standard Classification of Occupations (ISCO) and further developed more by

Ganzeboom & Treiman (2003). ISEI scores focus on scaling the ISCO's to enhance the indirect effect of education on income and minimise the indirect effect. The coefficients used relate occupational status to both education and income. The benefit of the methodology is that ISEI can be represented in a continuous manner and gives strength and robustness when used in regression models. For the analysis here the ISEI variable refers to the highest ISEI recorded by either parent. See the appendix there are descriptive statistics for this variable.

Home Possessions:

The OECD construct an index to measure possessions in a child's home. The presence of various items signifying wealth which includes; cars, televisions and internet access is recorded. In addition, they are asked about the existence of specific items that encourage education, books, dictionaries and even desks. Each country also has the flexibility to ask about specific items that relate to wealth in the context of their country, see appendix for details. Ownership of certain items such as computer have been linked as predictors of school performance amongst children (Schmitt & Wadsworth, 2006), making this a worthwhile variable which helps control for familial wealth and also the familial attitude towards educational enrichment in the home. The answers given by children are composited into an index the methodology of which is in the PISA technical manual (OECD, 2017). The scaling allows this variable to operate continuously with higher value indicating more possessions and thus higher wealth and access to educational objects. The descriptive statistics across this variable in each country analysed can be found in the appendix.

Language used at home:

Students are asked the binary question of whether the language that the test is being taken in was the main language that they use at home. This variable is used to attempt to control for the transmission and advantage passed on to second generation immigrants regarding parental language proficiency. Theoretically, the use of a foreign language at home indicates lower level of acculturation and assimilation of the parents which would be a negative predictor for the attainment of children. However, one caveat to note is that foreign language use at home is also a proven method of ensuring that the child is raised bilingually thus maintaining cultural links with their foreign background and an ability to communicate with extended family that does not know the language of the destination country (Fishman, 1970). Furthermore, possessing multiple languages is positively associated with academic achievement in many contexts (Hao & Bonstead-Bruns, 1998). Therefore, the use of foreign

language at home could be an indication of parents attempting to increase human capital in the children in the long term. In general, this is the only variable in the dataset which can attempt to control for language barriers inhibiting education attainment of the children. See the appendix for specific results of this question in the national samples used here.

Gender:

As seen in the literature there are gender differences in educational attainment (van Hek, Kraaykamp, & Wolbers, 2016) and this is particularly important in the immigration sphere. With attainment gaps between immigrant boys and immigrant girls as found by Dronkers & Kornder (2014) who incidentally used PISA reading scores. Therefore, a dummy variable of gender is used to equalise these differences and adjust for differing sex compositions in the sample, see appendix for breakdown of these sex compositions.

Country of Origin:

To answer the research question around the national origin of these migrant children. A specific country of origin variable was generated. Children were asked the place of birth of each of their parents and this allowed for their origin to be determined, regardless of whether they were first, second or G2.5. Scope was given to the national administrators to categorise origins into groups and the specific origins that would be most prevalent were listed in the questionnaire. The question was not open ended and consequently many of the immigrant children had to select other. What is more, in a small number of cases it was not possible to accurately determine country of origin as the parental questionnaire was answered with information that contradicted the children's answer to the question of "where was your mother/father born?" used to categorise the immigrant generation. Usually, this was from children listing parents' place of birth as the country of the test, with the parents declaring themselves as born abroad. For the bulk of the analysis in this study this variable was not required, and the contradictions were irrelevant as the parental questionnaire was used to confirm the generational category. The specific country of origin analysis was done using Austria and Australia, neither of which had these contradictions however, some cases would have to be dropped when utilising these questions for analysis of origin differences in other countries.

Methodology

The first part of the analysis uses descriptive statistics to estimate the differences between generational groups (as defined above). This analysis is then expanded upon by using separate linear regression models, one for each country, to see whether differences remain after controlling for socio-economic characteristics. Given the design of PISA and the use of plausible values for each child, survey weights must be used to ensure that the results account for the sampling and non-response bias of schools and their pupils. All analysis is carried out in Stata version 15 (StataCorp, 2017). Weights and the plausible values are incorporated using Stata's repest command for both the descriptive statistics used initially and all subsequent regression models which control for parental and socioeconomic characteristics. This command is a user installed command and specifically designed for use with complex surveys like PISA which use plausible values (Avvisati & Keslair, 2014). The principle behind the PISA data construction, and why the repest command is used, is to ensure that analyses are unbiased and are more representative of the target populations of each country. The analysis initially uses the descriptive results and weighted mean differentials between the immigrant groups and natives. More detailed analysis is then done by including the control variables including parental education and socioeconomic characteristics with the intention of overcoming the biases of selection into migration and subsequent effects.

The second research question seeks to investigate origin differences and whether the generation gaps are consistent across different immigrant groups. This is done by isolating the origin groups alongside the natives and comparing the estimated reading score differentials for each immigrant group compared to the natives, once again using the repest command to deal with plausible values and create the weighted means of each generation group for each origin. A lack of statistical significance is to be expected due to the small sample sizes in operation and very small origin groups will not be discussed at all. However, the attainment gaps found between the larger origin groups and natives (across generations) can be compared with the purpose of identifying whether the overall trend found in the country is replicable across the origin groups.

This part of the analysis will utilise only Austria and Australia, full breakdown of the observations in each origin group at different generational levels can be seen in the appendix. The rationale behind using these two countries included that; they offered the most detailed and specific origin groups which could potentially provide a more detailed spectrum of

assimilation. Moreover, they represent two different linguistic groups allowing for discussion of the importance of linguistic ability to integration. Furthermore, they had no observable contradictions between parental answers and children's answers regarding place of birth. In more detail, there were example of children selecting parental national origin as the test country, but the parental response disagreeing and stating that they were foreign born. Lastly, the descriptive results of these countries showed that they had the most similar performing results for the native group (see the constant in table 3).

The United Kingdom cannot be considered as the supporting surveys distributed to students across the different regions of the United Kingdom are not identical. Meaning, origin groups cannot be accurately defined. For example, English schools used Poland as a specific parental origin whilst Scottish schools did not. This would mean that children of Polish origin in Scottish schools were grouped into 'other'.

The second research question looks more deeply at G2.5. To address research question 2a the weighted descriptive results and the OLS regression model with the controls will be used again and the results of G2.5 compared to the natives and also the 2nd generation. To address parental gender and nativity (research question 2b) the sample will be restricted to only G2.5 and ancestral natives. At this point the 2.5 group will be further split into those with native mother and immigrant father and subsequently those with the reverse. The weighted means and the weighted OLS model will then be rerun using the repsest command in order to see the magnitude of attainment gaps, between these groups and natives. A post estimation test, specifically Wald test, will then be used to answer the second research question and determine if there are significant differences between these two subsets of G2.5 across each of these six countries.

Results

Research Question 1a: Are there differences?

The weighted averages across the immigrant groups by country can be seen in table 3. Where it is clear that for the non-Anglo speaking countries, all immigrant generations sampled achieve significantly worse PISA reading scores compared to natives. In all of those nations, the first-generation performs worse of all with improvements for the second generation and then G2.5 recording scores closest to the natives. In German speaking Europe, the differences between the first-generation and natives is far larger than in Belgium and Luxembourg.

Additionally, in Belgium and Luxembourg the first and second generation score similarly. The introduction of one native parent lifts the scores in all four of these countries however they are still significantly worse performers compared to the natives. In the United Kingdom the results differ slightly, there the first generation still score worse with a 25-point attainment gap. However, the natives are not the best performing group nor do their scores differ significantly from the second-generation. The best performing group are G2.5. The gaps between immigrant groups and natives in both the UK and Australia are much lower than the other countries. Australia in particular is unusual as the ancestral natives are the lowest scorers overall. The second and the 2.5 generation both record higher scores at 99% confidence. The first generation also score higher albeit with less significance. Australian results also see the homogenous second-generation children achieving higher scores than the mixed parented children of the 2.5 generation, which differs from all the European countries.

When adding in other explanatory variables the results can be found in table 4, and graphically alongside the descriptive results in figure 1. The direction of the difference remains unchanged although the magnitude of the effect does fall, bringing the predicted scores closer to the native level. This is to be expected as all previous evidence indicates that some score differentials can be explained by the differences in the socioeconomic characteristics of immigrant parents. However, the remaining gaps does offer support that the existence of an immigrant background is on average detrimental to PISA reading scores, across the continental European countries analysed in particular. When the controls are added, Germany and Austria see G2.5 with lower scores than their non-mixed second-generation peers, a shift from the raw score analysis in table 3. In fact, the controls explain away all the negative effect of having two immigrant parents in Austria and Germany, and they no longer statistically differ from similar natives. For Australia where the descriptive statistics put the natives as the worst performing group, these controls actually increase the positive gaps between the first and second generation and the natives. Although, the 2.5 generation effect shrinks and becomes less significant.

Generation	(1) Australia	(2) UK	(3) Austria	(4) Germany	(5) Belgium	(6) Luxembourg
1st Generation	5.31	-25.75***	-74.70***	-86.47***	-56.23***	-43.87***
	(4.32)	(9.30)	(8.85)	(14.01)	(6.34)	(4.74)
2nd Generation	22.73***	-0.89	-47.79***	-42.92***	-54.76***	-42.17***
	(4.22)	(6.53)	(5.98)	(7.51)	(6.58)	(3.85)
2.5 Generation	13.09***	8.60*	-10.25*	-22.26***	-22.95***	-18.67***
	(3.35)	(5.10)	(5.64)	(6.61)	(4.12)	(4.42)
Constant (Native)	505.45***	511.10***	503.49***	535.36***	522.86***	515.41***
	(2.30)	(2.79)	(2.86)	(3.00)	(2.09)	(2.43)
Observations	12,229	11,058	6,314	4,991	8,285	4,442

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 - Descriptive differences in mean scores across generation groups

Within the controls, both parental occupational attainment and the home possession index are highly significant and positive across all six countries. Parental years of education is also a positive predictor although only significant in Australia and Austria. Gender differences between girls and boys follow the pedagogy literature that suggest boys are worse readers, with substantial and significant negative results for the dummy variable. Lastly, the use of another language is a negative predictor, this is unsurprising but the effect is far larger in the non-Anglo speaking countries, in the United Kingdom the result is not significant and in Australia it is less than half the magnitude as the predictor seen in the other countries.

VARIABLES	(1) Australia	(2) UK	(3) Austria	(4) Germany	(5) Belgium	(6) Luxembourg
1st Generation	10.41***	-16.48**	-34.14***	-40.71***	-19.42***	-31.51***
	(3.80)	(8.19)	(7.64)	(12.48)	(6.43)	(5.04)
2nd Generation	29.05***	4.94	-4.20	-4.76	-19.48***	-18.86***
	(4.07)	(6.46)	(5.83)	(6.28)	(5.78)	(4.24)
2.5 Generation	7.52**	6.10	-8.29	-11.33**	-7.31**	-17.14***
	(3.10)	(5.09)	(5.51)	(5.69)	(3.62)	(4.15)
Male	-27.92***	-22.83***	-24.44***	-17.58***	-15.80***	-16.66***
	(3.11)	(3.36)	(4.61)	(3.24)	(3.02)	(3.10)
Other Language at Home	-15.62***	-7.21	-28.56***	-31.62***	-35.90***	-42.20***
	(5.33)	(7.15)	(6.11)	(7.97)	(5.19)	(5.37)
Parental years of education	6.63***	0.68	2.74***	0.73	0.77	0.43
	(0.87)	(0.78)	(0.82)	(0.58)	(0.51)	(0.55)
Highest parental ISEI	0.82***	0.87***	1.13***	0.97***	1.28***	1.45***
	(0.06)	(0.07)	(0.09)	(0.08)	(0.08)	(0.09)
Home Possessions Index	12.81***	18.18***	15.78***	26.20***	20.09***	16.17***
	(1.79)	(1.75)	(2.00)	(2.43)	(1.88)	(1.90)
Constant	375.39***	454.63***	412.16***	473.19***	446.48***	466.07***
	(11.39)	(10.48)	(11.90)	(7.54)	(8.34)	(11.44)
Observations	12,229	11,058	6,314	4,991	8,285	4,442

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 - Full model of predicted PISA reading score, incorporating parental and socioeconomic characteristics

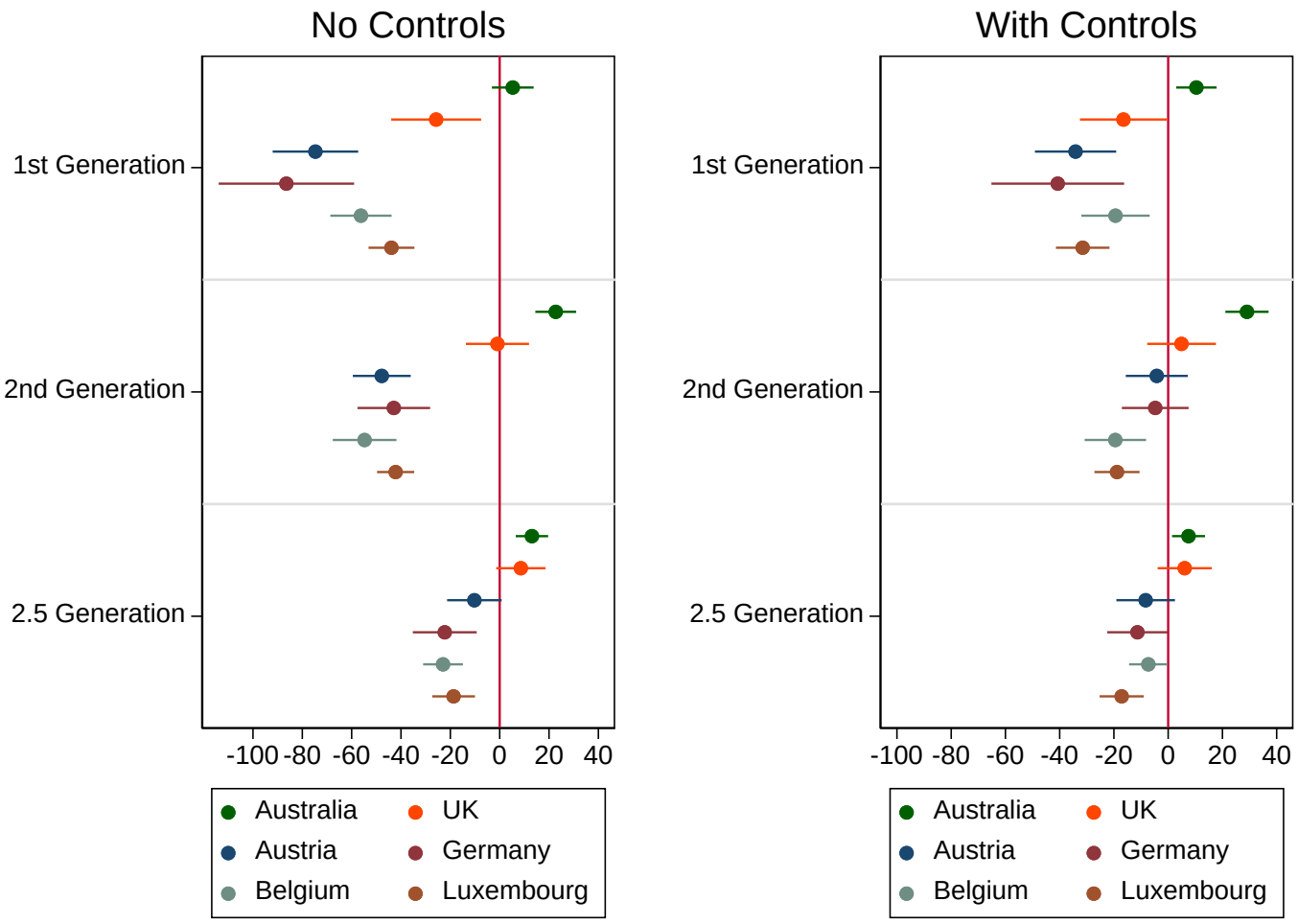

Figure 1- Coefficient plot of generation groups before and after addition of control variables

Research Q 1b: Origin differences

Australia and Austria both present interesting cases for further analysis. Austria has a large gap between natives and immigrants of any generation. Whilst Australian results indicate that immigrant background offers an advantage for educational attainment with the lowest scorers of all the generational groups there. Additionally, the constant (natives), in both countries are similar in the pre-control results and are the lowest of all six countries. They are similar regarding their 1st generation which is the 'worst' performing immigrant group with the biggest negative gap in Austria and the smallest positive gap in Australia. There are differences between the 2nd and 2.5 generation though, with the mixed parent being the best (or least bad) in Austria but mono-national second generations being, on average, the highest achievers in Australia. To see if these results remain consistent across different generation groups the sample was restricted to natives and the origin group of interest and the mean PISA reading scores estimated from the plausible values. Results are displayed in figures 2 (Australia) and 3 (Austria) of the origin groups who had over 50 observations alongside the overall immigrant results for reference. In the appendix the numerical results (which also indicate the significance) can be seen for all observable origin groups including those not discussed due to small sample size.

In Australia the results indicate that overall the results for the first generation are the lowest performing immigrant generation, the exceptions being Indian and British origins. In both the exceptions the first-generation score higher than any other. In terms of the overall spectrum seen across the immigrant generations, only the Chinese and Filipino origins follow the same pattern of second-generation being top performers, followed by G2.5 and then first generation the lowest. Most results from the bigger origin groups do support the theory that there is a second-generation advantage. However, the wide spectrum of results is interesting, the Asian nations seem to display very large benefits at both second-generation and G2.5. Chinese and Vietnamese results are around native levels for the first generation, likely due to the difficulty of learning English. A language that differs drastically from their mother tongue. However, for the children of immigrants (either one or two) from these origins the difference in reading scores compared to ancestral native children are substantial: over 90 points advantage for second-generation children of Chinese origin. The lowest performing origin group is the culturally similar New Zealand children, who perform worse than natives at every generation, the only group where that is found.

The results in Austria shown in figure 3 have no exception to the norm that first-generation children are consistently scoring the lowest across all origins. The German born first generation are the only origin group with a reading score greater than native Austrians (and not significant). Bosnian and Turkish origins are the largest groups and they support the overall pattern that shows that the addition of one native parent does bring the predicted reading score closer to the level of natives. However, some groups do have the mono-national second generation as the best parental composition compared to mixed-national, Croatian and Serbian for example. Perhaps unsurprisingly, the German group are the best performing origin group attributable to linguistic and cultural similarities and therefore lower institutional barriers which often lead to migrant disadvantage. However, these descriptive results show that those with a mixed German-Austrian parent combination perform worse than those with two German parents. Perhaps not fully supporting a 'best of both worlds' hypothesis. But maybe revealing that the behaviours of Germans and Austrians in Austria are indistinguishable from each other.

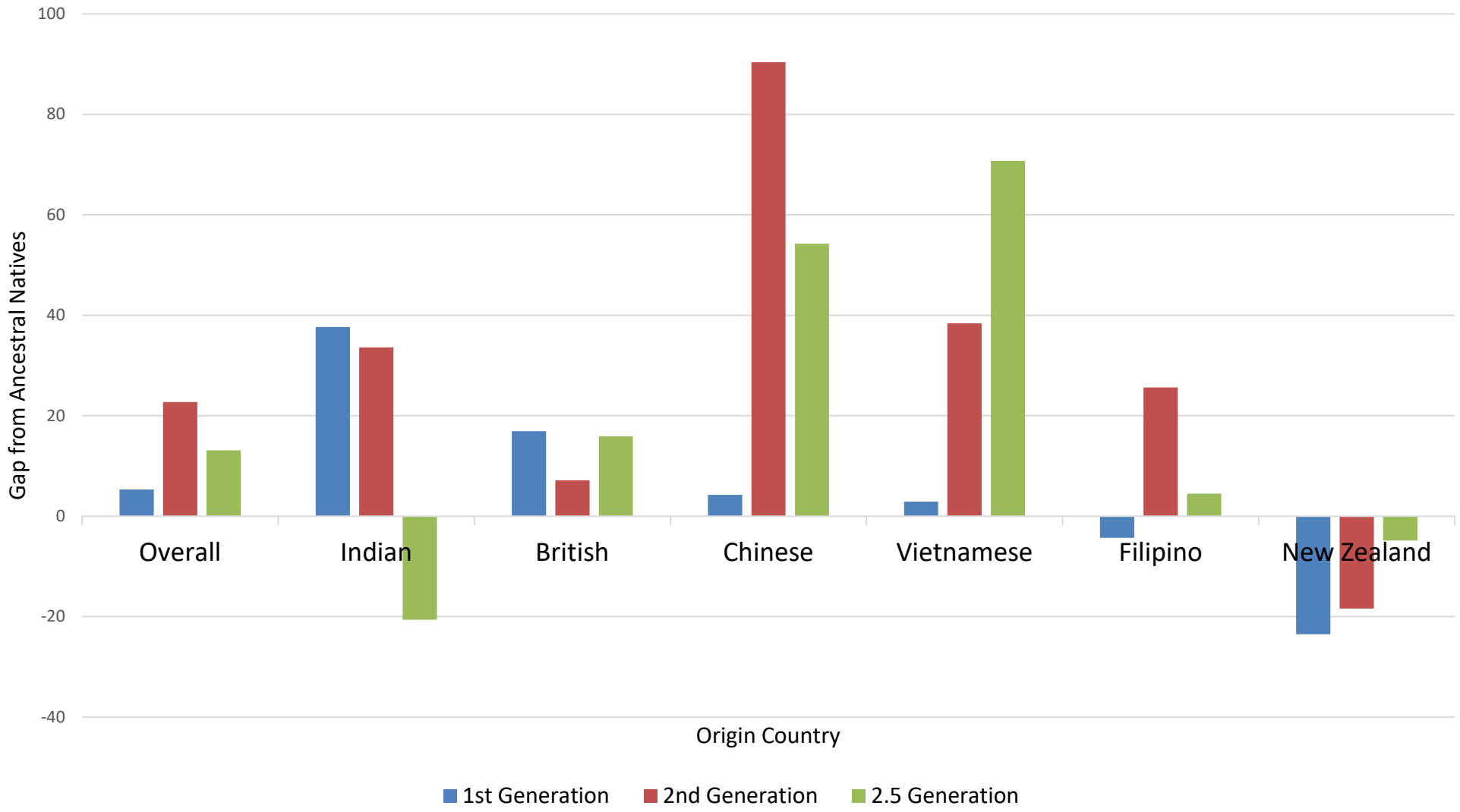

Figure 2 - Graph of attainment gaps between different origin groups and generations in Australia

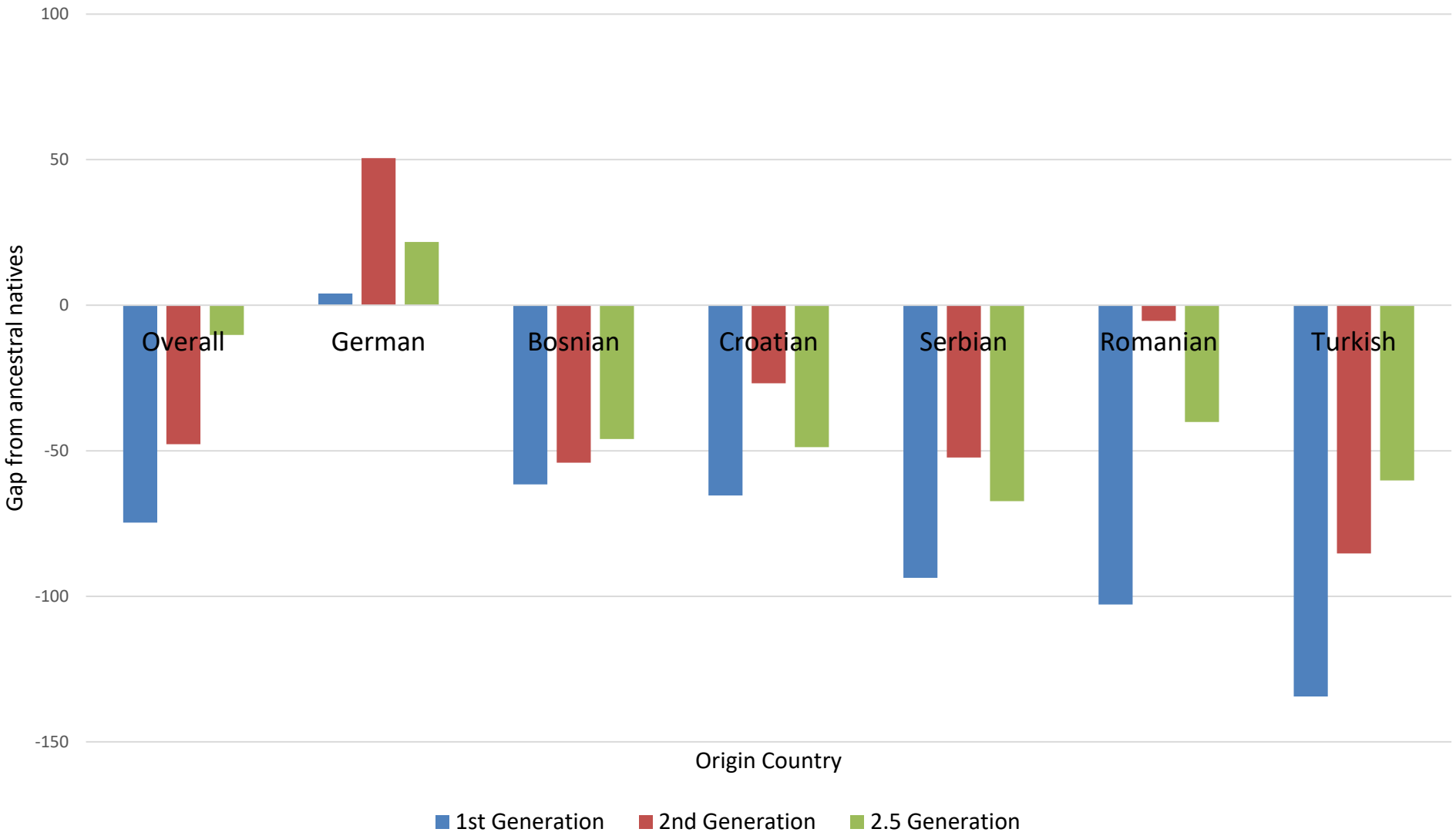

Figure 3 - Graph of attainment gaps between different origin groups and generations in Austria

Overall, the origin results between children in Australia and Austria show some similarities. The first generation generally are the lower performers compared to the subsequent generations from the same origin. However, differences between the second generation and G2.5 are inconsistent in both countries. British second-generation children in Australia have the least advantage over ancestral natives of all the British origin children. Whereas the G2.5 of Vietnamese ancestry are the highest performers from that origin. In Austria amongst the G2.5, those with a Bosnian or Turkish background benefit the most from the addition of one native Austrian parent. However, other groups including Serbs and Germans do not experience this benefit when an ancestral Austrian parent is added and the second-generation perform better. These results heighten intrigue into the behaviours of G2.5 making them worthy of further exploration in this paper.

Research Q 2a: Performance of G2.5

From the descriptive results in table 3 (and figure 1) we can see, with the exception of Australia, that G2.5 have on average better scores than homogenously parented children of the second-generation, although not consistently the same across all origin groups. When parental factors and other controls are added (table 4) there are changes in the ordinal result. G2.5 remain closest to the natives in Luxembourg and Belgium whilst in Austria and Germany they perform lower than a similarly backgrounded mono-national second-generation child. The additional controls also explain away some of the larger positive gaps seen in Australia and the United Kingdom. Further support for the statement that parental transmission is of importance. Much of the statistical significance of the differences between natives and G2.5 is lost with no statistical evidence that G2.5 (or second generation) are different from natives in the United Kingdom and Austria.

Research Q 2b: Native mother or native father?

However, there is a need to uncover potential differences between the 2.5 generation regarding parental composition and which parent is the native. To do this G2.5 is split into those with native mothers and those with native fathers. The sample breakdown for the subsequent analysis is in table 5, the model is restricted to those who are ancestral natives and those who are G2.5 only. Overall the split between the two subgroups is relatively even. Australia and Belgium have the heaviest skew in favour of the native mother and immigrant father composition.

Sample	Australia	United Kingdom	Austria	Germany	Belgium	Luxembourg	Total
Natives	7681	8810	4640	3775	5964	1412	32282
Native Mothers	1130	494	274	269	614	337	3118
Native Fathers	915	438	288	227	478	376	2722
Total N	9726	9742	5202	4271	7056	2125	38122

Table 4 - Sample sizes for comparison of G2.5 subgroups to ancestral natives

Descriptive results from the new restricted sample estimates can be seen in table 6. Between the two groups those with a native father and immigrant mother outperform the reverse group. Again, the Anglo-speaking countries have positive attainment gaps for the immigrant children. With native fathered children having a larger positive estimated score than those with native mothers. The continental European countries all have negative gaps with the group with native fathers being closer to the native scores. In fact, amongst those, only Belgium has the native father immigrant mother combination as statistically different from the ancestral native reference category.

	(1) Australia	(2) UK	(3) Austria	(4) Germany	(5) Belgium	(6) Luxembourg
G2.5: Native Mothers	7.06*	2.19	-18.31**	-31.01***	-23.17***	-31.06***
	(3.94)	(6.28)	(7.68)	(7.74)	(5.67)	(6.32)
G2.5: Native Fathers	20.54***	17.15**	-2.88	-11.68	-22.68***	-7.51
	(4.84)	(8.16)	(8.00)	(8.59)	(5.10)	(5.90)
Constant (Natives)	505.45***	511.10***	503.49***	535.36***	522.86***	515.41***
	(2.30)	(2.79)	(2.86)	(3.00)	(2.09)	(2.43)
Observations	9,726	9,742	5,202	4,271	7,056	2,125

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 - Estimated PISA reading score differences of G2.5 subgroups

When the subsequent control variables are added the magnitude decreases with far fewer subgroups statistically differing from the natives. However, it is still evident that the combination of native mother immigrant father is detrimental compared to the reverse. In Luxembourg and Germany, a significant negative gap of 22 and 14 points respectively is estimated for that group. Australia and the United Kingdom, which have previous results indicating second generation advantage, again show positive results. The native father

immigrant mother combination there is positive and significant (Australia at 99%, UK at 90%). The use of the covariates does clearly limit the predicted effect of being in G2.5. The covariates mostly remain significant and are all in line with general theory that parental socioeconomic characteristics are positive predictors of child academic success and that reliance on a foreign language in the home is a negative predictor. Language at home is significant in all countries except Luxembourg. The Luxembourg anomaly is reasonable given the fact that the PISA test in Luxembourg is sat in either French or German. This is deemed more convenient as all children in Luxembourg speak one of these languages. However, the national language is Luxembourgish which is usually spoken at home meaning most native children answer no to the question regarding the use of test language at home (see appendix for the table regarding that variable). Pre and post control variables can be seen graphically in figure 4, with the regression output in table 7.

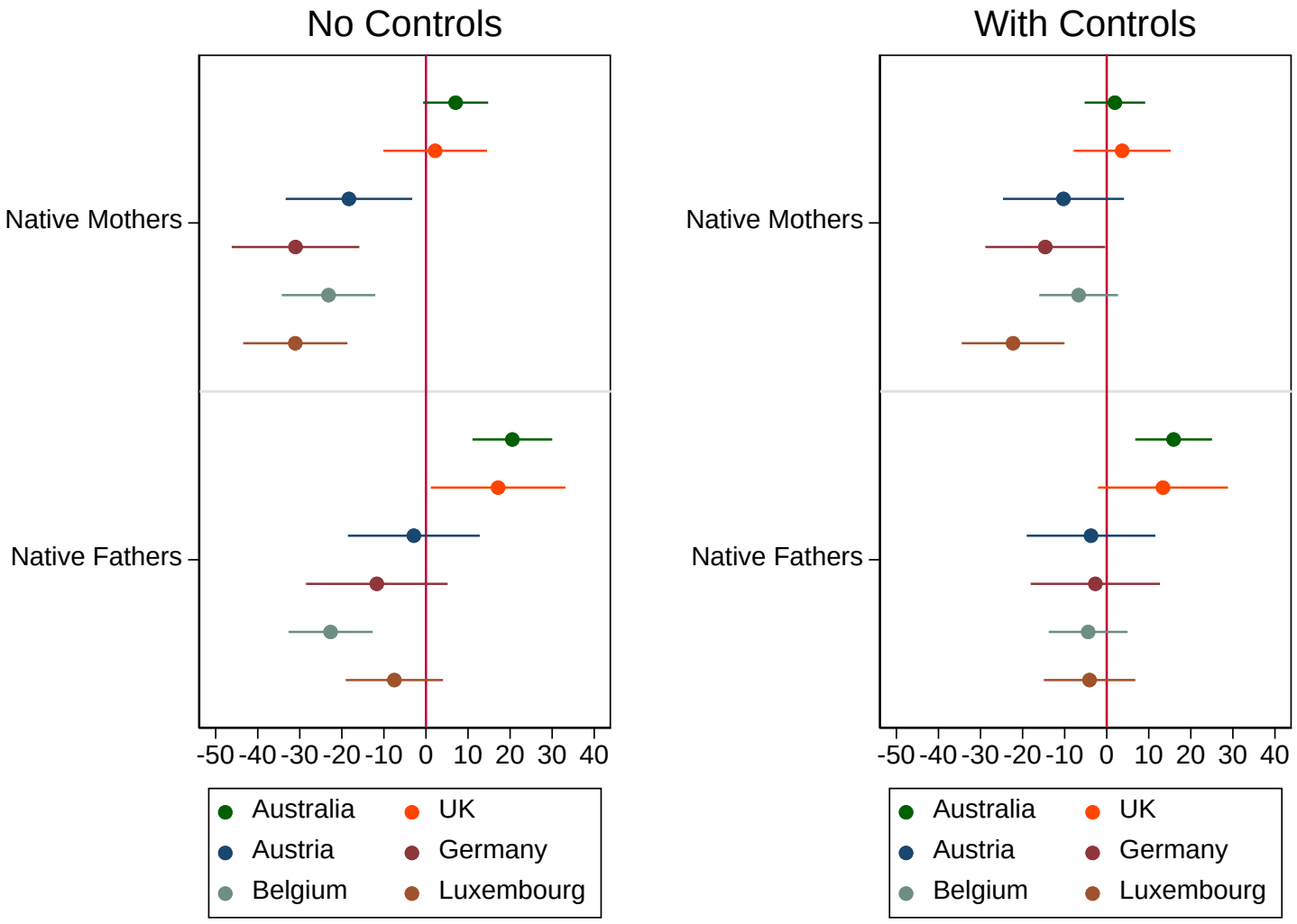

Figure 4 - Performance of G2.5 subgroups, with and without controls, compared to ancestral natives

There is evidence that differences exist between PISA reading scores of the two G2.5 subgroups. To further test if the estimated coefficients were indeed different post-estimation Wald tests were conducted on the full model. The p-values of these are at the bottom of table 7. Luxembourg and Australia are the only countries to show significant results (both 95% confidence) in support of differences between the predictions of the 2.5 attainment gaps. Certainly, this significance is more likely in these nations because they have the largest proportion of G2.5's in the overall sample. Whilst these results may seem inconclusive the visible differences that can be seen in the numbers do suggest that further discussion about how G2.5 operates and the characteristics of the parents that create this generation is necessary.

VARIABLES	(1) Australia score	(2) UK score	(3) Austria score	(4) Germany score	(5) Belgium score	(6) Luxembourg score
G2.5: Native Mothers	1.94	3.68	-10.29	-14.60**	-6.67	-22.26***
	(3.67)	(5.89)	(7.34)	(7.27)	(4.79)	(6.23)
G2.5: Native Fathers	15.92***	13.39*	-3.73	-2.70	-4.41	-4.07
	(4.66)	(7.89)	(7.81)	(7.84)	(4.78)	(5.55)
Male	-27.28***	-23.09***	-26.55***	-15.88***	-17.17***	-13.12***
	(3.39)	(3.47)	(4.61)	(3.66)	(3.16)	(3.96)
Other Language Used at Home	-69.15***	-38.33***	-37.75***	-44.43***	-42.42***	-10.19
	(9.74)	(10.19)	(8.55)	(10.80)	(6.98)	(9.79)
Parental years of education	7.73***	-0.19	2.43**	0.83	0.55	1.97*
	(1.00)	(0.75)	(1.09)	(0.63)	(0.51)	(1.02)
Highest parental ISEI	0.80***	0.95***	1.29***	1.03***	1.37***	1.24***
	(0.07)	(0.08)	(0.10)	(0.08)	(0.08)	(0.12)
Home Possessions Index	14.05***	19.11***	16.03***	26.16***	20.71***	15.80***
	(1.96)	(1.78)	(2.02)	(2.79)	(1.84)	(2.95)
Constant (Natives)	361.38***	462.23***	408.87***	467.69***	445.56***	421.19***
	(12.96)	(9.90)	(15.31)	(8.15)	(8.18)	(19.05)
Observations	9,726	9,742	5,202	4,271	7,056	2,125
R-squared						
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						
WALD TEST						
2.5 Gen Native Mothers = 2.5 Gen Native Fathers						
p	0.01**	0.30	0.51	0.22	0.72	0.02**

Table 6 - Full OLS model with predictors of G2.5 subgroups. With WALD test to compare predicted coefficients.

Discussion

On reflection of the descriptive results there is a clear distinction between the English-speaking countries and continental Europe. Australia and the United Kingdom both have clear second-generation advantage when it comes to the weighted reading scores. Schnepf's (2007) explanation would fit this finding, whereby immigrant parents have higher levels of English language skill since English is considered the global language. This means that most parents are therefore able to offer some level of support for their child's literacy ability. The continental European groups conversely see huge disadvantages associated with having immigrant parents within the descriptive results. But there is adaptation and assimilation visible through the generations, with the second-generation out performing the first generation and G2.5 being closest to ancestral natives.

Lingusitics and self-selection of parents is certainly a potential explanation as to why we see these advantages. Regarding lingusitics it seems that immigrant parents in the Anglo-countries are able to negate the diasadvantage of speaking a foreign language at home, this is possibly why the United Kingdom second-generation seem indistinguishible from natives. Migrants into English speaking counties are more likely to possess command of the English language and can transmit that to their children; in fact speaking a foreign language at home could purely be a way of trying to increase the human capital of the child and encourage their bilingualcy. Without command of the English language migration to the United Kingdom and Australia would be an unwise choice and make labour market access near on impossible. This is not exactly the case in the other counties where opportunities to work in English in large multinational corporations or research institutes do exist. However, if there is this positive self-selection of high achieving immigrants parents who don't speak the native language in continental Europe this is definitely not a large enough number to alter the descriptive results, with all immigrant generations performing worse, even if the second-generation make some inroads and are closer to the native levels.

When the covariates are included to control for parental background the disadvantage does disappear in Germany and Austria. Where there is no apparent disadvantage of having immigrant parents compared with the children of socio-economically similar native parents. Native parents on average posess higher education than immigrant parents and this human capital transmission drives the descriptive differences. The controls also diminish the size of the attainment gap in Belgium and Luxembourg but there remains a large negative effect of having immigrant parents in these two countries after the controls. The underlying mechanism that operates in Belgium and Luxembourg is something more than the higher

parental education and better language knowledge of the native parents over non-native parents. To speculate, it could stem from structural problems in the education institutions, or an endemic discrimination against immigrants that inhibits adaptation to the levels of the native peers at the first generation and subsequently their offspring face similar battles having already started at a disadvantage. Overall though, in terms of the research question the second-generation do appear to be closer to the ancestral natives in all countries except Australia. In Australia there is a large second-generation advantage over natives which is attributable to the highly skilled labour migration that sees far more second-generation children born to very educated parents.

Origins in Australia were studied in more depth for the second research question, alongside Austria. Before even looking at the attainment gaps it is worth noting the choice of origin countries that PISA administrators selected to ask of specifically. The selection of groups which are most common in society is expected and this in itself provides evidence that the reason for migration is of interest when looking at the diverging performance of immigrants and their descendents in these countries. Austria's largest origin groups are Turks and Balkan countries. Whilst the reason behind parental migration is not explicit in the data, the war in Yugoslavia certainly led to an increased number of refugees in the 1990's and their children born in 2000 were eligible to sit the PISA test in 2015. The origin countries selected in Australia are either culturally (and liguistically) similar such as United Kingdom and New Zealand, or countries in east Asia which are known to produce 'Asian-tiger' parenting style. This cultural norm is found to be related to high scholastic performance (Watkins, Ho, & Butler, 2017). However, this rather lazy stereotype is a product of self-selection into migration from East Asians (specifically from Korea, China and Vietnam) that entered the United States throughout the 20th century, and are now the parents of the high achieving second generation. However, Australia replicates this well, the barriers to migration are highest for those from these Asian countries. Therefore, the parents that do manage to migrate possess the highest level of education and human capital thus producing high scholastically performing children.

However, the origin countries visible do offer an explanation for the overall discrepancy between immigrant children and natives in these countries can be found based on the numbers from particular origins. The second-generation advantage in Australia is seen in those with Asian origins. Conversely, in Austria the immigrant groups from the backgrounds where there is less favourable self-selection are underperforming compared to natives even when parental characteristics are controlled for.

The origin analysis does indicate that segmented assimilation is apparent in both these countires. Although sample sizes are small, which inhibits statistical significance, there is a clear advantage to those belonging to Asian communites in Australia especially after the first generation. First generation Asian students must grapple with learning a new language, and considering the drastic difference between Mandarin and English the stunting of first generation results is perhaps unsuprising. Yet, at the lower end there is relatively poor performance from the communities which are most culturally similar, notably the New Zealanders who perform worse than the native population. This divergence may appear unusual as children of New Zealanders should be in the priviliged position of facing low cultural and linguistic barriers. However, the similarity between them and the native population could be explained by the liberality of the migration regime between Australia and New Zealand. The immigrant parents from New Zealand are less favourably selected compared to those coming from the Asian countries. Similarly, since they face fewer barriers to cultural intergration they adapt to native levels quicker, it just so happens that the native level is lower than the scores of those with Asian origins. The previous literature that demonstrates the Asian advantage in an American and European context appears to be applicable here too- for example Kao & Tienda (1995). To generalise, the divergence in Australia comes from the less stringent educational requirments placed on immigrant parents from these culturally similar origins.

Austrian results indicate that the most cuturally similar group, the Germans, are most similar to ancestral native Austrians. Those from Serbian, Bosnian and Turkish backgrounds lag behind. Here, the covariates also indicate that there is a disadvantage of coming from a nation where German is not spoken. At second generation in particular the children of Germans exceed the natives by far with the children of Turkish and former communist European countries to the east at the bottom of the spectrum. Whilst it may not be only the German group who are indicating an advantage, since many origins are hidden in the ‘other’ category. There is a clear divergence of origin groups regarding their ability to assimilate. At first generational levels this is unsuprising, but within the second generation the benefits of citizenship and language acquisition should drastically reduce this attainment gap, and though it is somewhat reduced there are still significant discrepancies. Overall, these results support the segmented assimilation hypothesis and different origin groups in Austria certainly take divergent paths.

Austrian results have more consistency than Australian. With the first generation the lowest performing group across all origins in Austria, the disruption of migration itself and the immediate cultural barriers are simple but highly sensible reasons that these children lag behind. Australian results do not show the same consistency. The Indian and British first generations are actually better performers than the second-generation of the same origin. Lower linguistic barriers could offer a partial explanation, especially when considered alongside the high self-selection into migration that was discussed above. Additionally, this is also evidence that education regimes in India and the United Kingdom better prepare first-generation immigrants for success in Australia compared to native children. Hence why the second generation children of the same origin who grow up in Australia do not improve upon the first generation's advantage.

When G2.5 is considered in both Austria and Australia there are origins which see the addition of a native parent associated with better reading scores, with the opposite case for other origins. Their behaviour and performance is more complex than a simple middle ground between the native group and second generation group. Across all countries the G2.5 results vary. In Australia, the 2.5 are the lowest performing immigrant generation with only a small benefit compared to the natives. If the stringent barriers to migration that have been well discussed are the reason for the apparent immigrant advantage then the G2.5 results offer further support for this and the native parent could be considered a disadvantage. In the United Kingdom the results have G2.5 as the highest performing group but without any significant difference from ancestral natives. In continental Europe G2.5 still score lower than natives; in both Germany and Austria the G2.5 scores are below the mono-national second-generation, whilst in Belgium and Luxembourg the opposite is observed.

The results in Belgium and Luxembourg support the theory that the presence of a native parent brings an immigrant child closer to the natives as they receive better quality human capital transmission from this native parent rendering them more prepared than a child with two immigrant parents. Subsequently, enabling them to attain a level similar to native children. What the results in Germany and Austria indicate is the opposite. Self-selection could once again provide an explanation, potentially those who partner an immigrant are from a certain subset of the population with lower resources, leading to worse off children. Additionally, there could be stigmas associated with being a child from a bi-national relationship. Importantly, the risk of union dissolution of mixed national unions and therefore children being raised by a single parent is higher (Milewski & Kulu, 2014). So these children's results could be influenced by that unobserved charateristic that is statistically

more common in this subset of the population.

Upon further analysis of G2.5 and the comparison of those with native mothers and native fathers there are inconclusive results. Only Luxembourg and Australia have statistically significant results from the Wald test which compares the two G2.5 sub-populations. This is firstly a symptom of these countries having 25% of the sample falling into the G2.5 category, larger than all the other groups. Both these countries see the group with native mothers and those who have native fathers as statistically different. However, numerical comparisons of the coefficients in all six countries do follow the same trend; the group with native fathers perform better than the comparable group with native mothers. Fathers nativity is more important than the mothers. In the countries where immigrant background is a disadvantage, the existence of a native father can bring this group closer to the native scores. After the controls, these subgroups are indistinguishable from natives: even before the controls only Belgium sees the native-fathered G2.5 statistically different from the ancestral native population. In Australia and United Kingdom where the reading scores for immigrant descendents are higher, the existence of a native father is still more important than a native mother immigrant father combination. The G2.5 with native mothers in these countries are statistically similar to natives and perform worse than those with native fathers and immigrant mothers. This contravenes theories that mothers are more integral to future attainment as they are usually the predominent caregiver in a child's early years and supports theories of patriarchy and male-dominated life course.

Structural inequality could be a reason for differences between the G2.5 subgroups. The experiences of children from the mixed national relationships with immigrant fathers could be more negative than those with immigrant mothers. This could catalyse a negative school experience of varying intensity across destinations. Across all the countries there is a further self-selection into mixed-national relationships: native men who choose an immigrant partner could higher human capital. This human capital is then transmitted to children who achieve higher PISA reading scores. Even with the attempt to control for parental education and similar there is still a gap emerging between the subgroups. This certainly presents, an avenue for further research into why these differences exist and both quantitive and qualitative studies could attempt to identify the mechanisms that underpin these inequalities, ultimately driving policy to address them.

Limitations

The research presented here is just a first step in measuring the education outcomes of

immigrants and their descendants and it is not without potential limitations. Omitted variable bias is ever present in social science research and here there are infinite characteristics, some of which are always unobservable, that influence child attainment. Notable variables missing in this analysis include social networks and community exposure. Immigrant socialisation is what catalyses assimilation speed, and this will be heavily influenced by social networks and the community they are exposed to (Rumbaut, 1994). Certain immigrant groups have weaker ties to the origin country and adapt beyond the levels of other immigrant groups who remain exposed to a community which have lower attainment levels. Regrettably, this analysis does not consider any exposure of the children to these influential networks. Though inclusion of parental factors is a potential mitigation as it is generally a parental decision to transmit community values and therefore attachment to a particular identity (Sabatier, 2008). However, again there is a lack of information about parental involvement in any particular community with no indication that a parent being born in a particular country actually means they have involvement with that country, its immigrant community or its values in the present.

Similarly, this analysis considered any second-generation parent as a native. Meaning a very large assumption was made that these parents had assimilated to native levels. This is not necessarily the case as a second-generation parent could still be heavily influenced by cultural norms from the origin country despite being classed as a native in this analysis. This has potentially large repercussions for those of G2.5; how different are they from a mono-national second-generation child if their 'native' parent is a second-generation immigrant who has not felt any influence from the destination country? The arrive age of any immigrant parent is therefore important, earlier arrivals are associated with increased socio-economic resources that can be invested in their children, plus improved grasp of the language (Guvan & Islam, 2015) meaning they are able to assist with schoolwork and development. Even though some studies have suggested that parental age at arrival is irrelevant so long as socio-economic controls are used (Glick & Hohmann-Marriott, 2007), there is strong evidence that later arrival decreases education and social outcomes significantly for first generation immigrants, with the critical age around eight years old (Beck, et al., 2012). This paper does not seek to make bold statement about the first generation due to small sample sizes. But the first generation who are the parents of the second-generation (and G2.5) are a heavy focus and must not be considered as homogenous in their experience after migration.

Moreover, there is no attempt in the PISA questionnaires to consider household

composition as a whole and whether children actually interact with their parents. This relates to any community effects that may be missed and also parental transmission of human capital which is so central to child development. Within immigrant communities this has further importance as children of immigrants are more likely to experience the disruption of union dissolution and living apart from one (or both) parents (Hannemann & Kulu, 2015) and (Milewski & Kulu, 2014) amongst others. This is an important unobserved characteristic which is missing in this analysis.

A final flaw is attrition bias. This is unavoidable to some extent and the children in the sample without parental information had to be dropped in order for the immigrant generation classification to be error-free. However, it is doubtful that these children, who were unable to offer information about one or both of their parents are randomly found across all children in the sample. They are more likely to be low performers and their removal from immigrant and native groups alike may skew the estimated results. The attrition is seen in the appendix and more complex models of imputation could have been created if more data was available. Furthermore, the OECD guidelines about which students can be excluded within selected schools includes those who "have received less than one year of instruction in the assessment language" (OECD, 2017). The low language proficiency of these students who we can assume are first generation immigrants most likely means that the negative first-generation gaps estimated here are likely underestimated.

Conclusion

Despite the limitations the 2015 PISA reading scores from these six countries paint differing pictures around immigrant generation and its association with educational attainment. Positive self-selection into immigration in Australia is posited as the reason for the success across all immigrant generations there. Whereas in Europe liberal migration regimes, with more culturally distant parents with low education have entered, there are larger attainment gaps found in the descriptive results. Linguistics and parental knowledge of English similarly explain why second-generation advantage in United Kingdom and Australia is seen descriptively. Parental factors can explain away the difference in Austria and Germany and the second-generation there are not significantly different from native children.

More detailed analysis into origins suggested that segmented assimilation was apparent in both Australia and Austria and sees varying consistency across first, second and

G2.5 compared to what was found in the overall sample. More detailed data with larger immigrant communities would be beneficial to fully understand the direction and magnitude of any gaps between natives and specific origin backgrounds at each defined generation. It seems plausible that culturally similar backgrounds can negate positive self-selection in Australia and actually prevent second-generation advantage in those origin groups. In Austria, the linguistic benefits of being a German migrant in Austria forces clear advantages over those who have come through a move of desperation like asylum cases. As we see a new wave of refugees following the civil war in Syria over the last few years, there is definitely future scope for continued research into the educational attainment of immigrants and their descendants focussing on the context of their origins and migration motivations.

Concerning G2.5 specifically, their performance is descriptively better than the non-mixed second-generation across all countries except Australia. This reverses for both Austria and Germany when the control variables are added. In United Kingdom the second-generation and G2.5 are both indistinguishable from natives, implying that assimilation to native levels exists there more easily than other destinations. Again, linguistics and parental characteristics can be the reason for this. But institutional barriers in the continental European destinations should be considered and this is an important contribution offered here. Both educators and policymakers should be aware that G2.5 and the second-generation are operating in different manners and if trying to address the attainment gap they may require different targeted policies.

Long term outcomes of immigrant children and their descendants should continue to be a focus of academic literature. G2.5 will continue to grow in the future and should be considered in future research and as the number increases so too does the justification for considering them as a standalone group. The previous studies which have discounted them or aligned them with natives could become outdated and are open to critique. The gender dynamics within these mixed origin relationships have not yet been fully explored and this paper found indication that those with native fathers and immigrant mothers are higher performers than the reverse parental composition. Wald tests determined significant differences only in Luxembourg and Australia (owing to sample size), however the numerical results had this subgroup scoring higher in all six countries.

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