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Abstract

The educational outcomes of second-generation children born to refugees (G2CR) are shaped by unique challenges - some of which are rooted in their parents' refugee experiences, yet these dynamics remain underexplored. This study investigates how residential location impacts the educational performance of the G2CR in Sweden, using longitudinal register data and employing multi-level modeling techniques. We address three core questions: (1) How does living in refugee-dense neighborhoods influence the educational outcomes of G2CR? (2) What is the role of neighborhood-level educational attainment in shaping these outcomes? (3) How do these effects compare across different population groups, including Swedish-born children of Swedish-born parents and foreign-born refugee children?

Our findings reveal a complex interplay of factors. On average, Swedish-born children of refugees have lower compulsory educational grades than children who have two Swedish-born parents. However, if we compare those with similar backgrounds who live in similar areas, the second-generation children of refugees seem to who have better results at the end of compulsory schooling. Residing in refugee-dense areas is generally associated with lower educational performance, yet neighborhoods with higher average education levels offer significant benefits. These effects vary across different refugee backgrounds, reflecting the diverse adaptive strategies and challenges faced by second-generation refugees. The study underscores the importance of residential context in shaping opportunities for educational success and highlights the role of spatial inequality in perpetuating disparities.

By providing insights into the long-term educational consequences of residential segregation and refugee settlement patterns, this research contributes to ongoing discussions on integration and inequality in Sweden. Our results call for targeted policy interventions aimed at enhancing educational outcomes for children of refugees, particularly in socioeconomically disadvantaged areas, to promote more equitable educational opportunities.

Keywords: neighborhood effects, second-generation refugees, educational inequality, residential segregation, ethnic networks

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INTRODUCTION

A long history of research has documented the impact of residential location - in particular neighborhoods - on various aspects of the lives of immigrants' children. These include, but are not limited to: cognitive development (Brooks-Gunn et al., 1993; Fan et al., 2021), academic and economic achievement (Christian et al., 2015; Minh et al., 2017; Sykes & Kuyper, 2009; W. J. Wilson, 2012), as well as partnership and family formation (South & Crowder, 1999; Wachter & Costa, 2023; B. Wilson & Kuha, 2018). In separate studies, researchers have focused on refugees, finding that neighborhoods are a determinant of disparities in their socioeconomic outcomes, relative to the native-born population (Ainsworth, 2002; Alba, 2014; Portes et al., 2009; Zhou, 1997). This includes studies of Sweden (R. Andersson et al., 2019; Åslund et al., 2011), which is the context that we focus on here. However, much less is known about the Swedish-born children of refugees (the second-generation children of refugees, G2CR), including the linkages between their neighborhood contexts and socioeconomic outcomes. This may be an important gap in research because their lives may differ in varying respects from other immigrants' children. This is particularly true given the additional obstacles faced by their parents, such as limited opportunities to determine where they live and raise their children (R. Andersson et al., 2019).

Research that seek to explore the effects of neighborhoods on the educational outcomes of immigrant children often highlights the importance of communities with high social capital (social networks, community engagement, social efficacy) to good educational outcomes (Woolley et al., 2008). On the contrary, children's ability to thrive academically may be impeded by exposure to concentrated poverty, crime, and social isolation (Cutler & Glaeser, 1997; W. J. Wilson, 2012). However, our study specifically focuses on different aspects of neighborhood environments which we investigate by looking at the presence of ethnic networks and area-level educational attainment. Ethnic networks, reflecting the concentration of individuals from similar backgrounds, can provide supportive resources and role models (Bankston et al., 1997; Edin, Fredriksson, & Aslund, 2003; Zhou, 2005), potentially mitigating some of the challenges faced by the G2CR. Conversely, area-level education - representing the general educational attainment of residents - serves as a proxy for the quality of educational resources and support available in the neighborhood (Leventhal & Brooks-Gunn, 2000; R. J. Sampson et al., 2002).

This focus on ethnic networks and area-level education provides a clearer lens through which we can assess the implications of neighborhood characteristics on educational outcomes. Our study seeks to highlight the crucial role these factors play in shaping the challenges and opportunities faced by G2CR, thereby adding valuable insights into the broader discourse on systematic inequality and the effects of residential segregation.

In this study, we assess whether the educational outcomes of the second-generation children of refugees in Sweden (i.e. children born to parents who were granted refugee status in Sweden) are affected by their residential location. Utilizing high-quality longitudinal register data of the entire Swedish population, we examine how the educational outcomes of the second-generation children of refugees are affected by; (1) their residence in refugee/migrant-dense areas, (2) the

area-level education (proportions of highly educated persons living in an area) as well as (3) intra and inter-group heterogeneities. Specifically, we aim to answer three questions*; (1) Does living in an area with a high proportion of refugees have an effect on the educational outcomes of second-generation children of refugees? (2) How is area-level educational attainment associated with the educational performance of the second-generation children of refugees living in that area? (3) How do these area-level associations vary for different groups of children of refugees, and as compared with other population groups?*

In the subsequent sections, we present a brief background to our research, empirical findings, discuss their implications, and offer suggestions for future research.

BACKGROUND

Neighborhood Context and Educational Outcomes

Education is widely recognized as a key measure of integration, in particular for their descendants. The process of successful adaptation, wherein immigrants and their descendants become more like the majority population (Portes et al., 2009) can be assessed by examining their relative educational outcomes over time. Investing in education during early years is crucial; neglecting this investment risks negatively impacting associated life course outcomes, including economic success (Becker, 1995; Mincer, 1974; Schultz, 1961) and health (Dubuc, 2012; Jones & Duncan, 1995). Consequently, a lack of early educational support may result in future generations who are less able to live independently, maintain good health, or contribute positively to their communities

Neighborhoods play a crucial role in shaping these educational outcomes, particularly for marginalized populations such as refugees and their families. Studies have shown that the neighborhood context in which children grow up can significantly impact their academic achievement, school engagement, and overall educational trajectories (Ainsworth, 2002; Leventhal & Brooks-Gunn, 2000; R. J. Sampson et al., 2002). Understanding this relationship between neighborhood characteristics and educational outcomes is essential for designing effective interventions and policies to support the children of refugees (and children more generally) in their educational journey.

This intersection between neighborhood context and educational outcomes is important, at least for compulsory schooling, because most individuals attend school within, or close to, the neighborhoods in which they reside. There are many ways that neighborhoods can affect children's school outcomes. Drawing on previous research and theories of neighborhood effects (Galster, 2012), we can distinguish among at least four ways that neighborhoods may determine education, via: (i) socioeconomic status (SES), (ii) social cohesion and community support, (iii) physical and environmental conditions, and (iv) institutional systems. Though we present these explanations separately in the following paragraphs, as a means of motivating this study, we do not mean to imply that they are mutually exclusive.

Socioeconomic status (SES) within the context of neighborhoods plays a critical role in shaping educational outcomes among children. Neighborhoods characterized by higher levels of poverty, unemployment, and social deprivation often face significant challenges in providing adequate support and resources for educational attainment (Galster, 2012; Massey & Denton, 2003; W. J. Wilson, 2012). This may be linked to the fact that families residing in socio-economically disadvantaged neighborhoods are likely to face barriers such as limited access to quality schools, inadequate educational funding, and fewer opportunities for academic enrichment, all of which can negatively impact children's educational outcomes. Consequently, if refugees are more likely to have low SES, and live in disadvantaged areas, then this may have material consequences for their children's educational outcomes.

Social cohesion and community support within neighborhoods may also influence educational experiences and outcomes. Neighborhoods characterized by strong social networks, collective efficacy, and supportive community organizations can provide valuable social capital and resources that contribute to positive educational outcomes (Forrest & Kearns, 2001; Woolley et al., 2008). Conversely, neighborhoods with low levels of social cohesion and high rates of social disorganization may present additional challenges for refugee families, including social isolation, discrimination, and limited access to supportive networks and services (Ermansons et al., 2024; Yu et al., 2020).

Neighborhoods' physical and environmental conditions are important for well-being and academic performance. Neighborhoods with safe, clean, and aesthetically pleasing environments can promote positive psychological development and create conducive learning environments (Christian et al., 2015). Conversely, neighborhoods characterized by environmental hazards, crime, and dilapidated infrastructure may contribute to stress, anxiety, and reduced academic engagement among students (Cutler & Glaeser, 1997; W. J. Wilson, 2012). Refugees, in particular, may be disproportionately affected by these adverse neighborhood conditions, as they are more likely to reside in areas with significant environmental hazards and may face heightened vulnerability to their impacts (Vogiazides & Mondani, 2020; Wiśniewski et al., 2024). Examining these dynamics is essential for developing holistic approaches to support the educational needs of refugee children and promote their long-term academic success.

Educational outcomes may be shaped by institutional systems, including resource access, public service disparities, and stigmatization. Schools not only provide education but also social and career opportunities (Gamoran & Long, 2007). However, funding gaps, teacher quality, and curriculum differences can create achievement inequalities (Hanushek, 1992). Children of refugees may face additional barriers, such as language difficulties, cultural differences, and implicit biases (Crul et al., 2012, 2019; Jencks & Mayer, 1990; Kao & Thompson, 2003). Many are more likely to attend under-resourced schools due to neighborhood disadvantage (Saporito & Sohoni, 2007), while discrimination and low teacher expectations might further hinder their progress (Alan et al., 2023; Blanchard & Muller, 2015; Burgess & Greaves, 2013; Pit-ten Cate & Glock, 2018). Access to support services, including language programs and academic counseling, exacerbates these challenges (OECD, 2018). Understanding the role of institutional factors in shaping educational outcomes is crucial for promoting equity and ensuring that the second-generation children of refugees have access to the same opportunities as their peers.

A range of empirical studies have demonstrated that neighborhoods are important for determining the educational outcomes of immigrants' children (G. Borjas, 2000; G. J. Borjas, 1992, 1994; Chetty et al., 2016; Portes & Zhou, 2010; R. Sampson et al., 2008; K. L. Wilson & Portes, 1980a), just as they are for children in general (Jencks & Mayer, 1990; Sanbonmatsu et al., 2006). One of the largest strands of research has focused on the role of co-ethnic networks, which are often seen as a 'double-edged sword', providing social support, shared resources, and cultural continuity but, at times, limiting access to broader opportunities due to social isolation or reinforcing socioeconomic disadvantage (G. J. Borjas, 1992; Portes & Zhou, 2010;

Waldinger, 1995). For children of immigrants, these networks are generally associated with positive outcomes when they help mitigate structural disadvantages, although the effects may vary by context and group. However, it is presently unclear whether this relationship is the same for the children of refugees. Some studies have examined the experiences of refugees, such as (Åslund et al., 2011), who examined the first generation (G1.5) and others have either combined both G1 and G2 refugees, combined refugees with other immigrants, or studied the entire population (Bevelander & Lundh, 2007; de Vuijst et al., 2017; Hedman et al., 2015). Yet quantitative evidence is lacking about native-born children of refugees, especially evidence based on whole-population data that can aid in exploring the role of co-ethnic networks of refugees.

At the same time, there have also been studies that have looked at the role of peer effects and socialization processes in shaping educational outcomes for immigrant children. These suggest that the presence of high-achieving peers and strong social norms favoring education can positively impact academic performance, while exposure to disengaged or disadvantaged peers can have the opposite effect (Card, 2013; Hanushek et al., 2003; Sacerdote, 2011). In the Swedish context, studies have found that school composition, including the proportion of students from immigrant backgrounds, influences educational attainment (Brandén et al., 2019; Jonsson & Mood, 2008; Skolverket, 2012).

Similarly, spatial segregation and economic disadvantage have been widely studied as determinants of educational disparities among immigrant youth. Residential segregation often results in unequal access to high-quality educational resources, as schools in low-income, migrant-dense areas tend to have lower funding, less experienced teachers, and limited academic support programs (E. Andersson et al., 2010; R. Andersson et al., 2019; W. J. Wilson, 2012). The concentration of poverty in these neighborhoods also exacerbates challenges related to social mobility and intergenerational inequality (Chetty et al., 2016; Gustafsson et al., 2017).

Finally, the average level of education in a child's neighborhood (a key measure of area-level education) has been shown to influence academic achievement through mechanisms such as ethnic networks, parental aspirations, and the availability of educational resources (Åslund et al., 2011; Leventhal & Brooks-Gunn, 2000; R. Sampson et al., 2008). For children of immigrants, higher area-level education might be associated with better academic performance due to increased exposure to positive role models and higher educational expectations within the community (Ainsworth, 2002; Cutler & Glaeser, 1997).

However, as with co-ethnic networks, there is a lack of research specifically focusing on the children of refugees and whether similar patterns hold for this group in Sweden. In this study, we respond to this research gap by leveraging large-scale longitudinal data and providing insights into whether and how neighborhood contexts impact the educational achievements of Swedish-born children of refugees. Understanding these dynamics is essential for formulating policies that address educational disparities and promote equal opportunities for all children, regardless of their parental migration background.

In the following section, we provide a short background of the Swedish context, and then we present the results of our analysis of the Swedish case

The Swedish Context

The Swedish educational system mandates compulsory school attendance, ensuring access to education for all children between ages 6 and 16 (Education Act, 2011). Unlike some countries with strict zoning policies, Swedish parents by way of the 1992 school choice reform nowadays enjoy considerable freedom in selecting their children's schools, regardless of residential proximity. Notwithstanding, the proximity between a child's home and school (närhetsprincipen - the residence principle) (Education Act, 2011) is given priority in the allocation of children to schools. This freedom is facilitated by Sweden's system of school vouchers (Osman & Lund, 2022), where public funding tailors to the student's chosen institution. This also holds irrespective of whether students are enrolled in public schools (kommunala skolor) or private schools (friskolor). Moreover, geographical constraints, particularly in rural regions, can limit families' practical choices despite the theoretical freedom to choose (Brandén & Bygren, 2018). Thus, school choice is closely linked to the neighborhoods in which children reside.

Educational outcomes in Sweden historically outperform global averages (OECD PISA, 2024), reflecting high literacy rates and educational achievements among Swedes. However, disparities emerge when comparing the educational attainment of native-born Swedes with immigrants, including both non-refugee immigrants and refugees (See figure 1). For the second-generation groups (non-refugees and refugees) the gaps between them and their native counterparts have narrowed in more recent years. However, despite this, we still observe notable and larger disparities that persist for G2 children of refugees. Refugees, in particular, face a myriad of challenges integrating into Sweden's educational system (Pupaza et al., 2023). These challenges include language barriers, cultural differences, and socio-economic inequality, which often hinder their educational attainment and integration. As a result, educational outcomes among refugees and their children tend to lag behind those of native-born Swedes, underlining the need for tailored integration programs and support mechanisms.

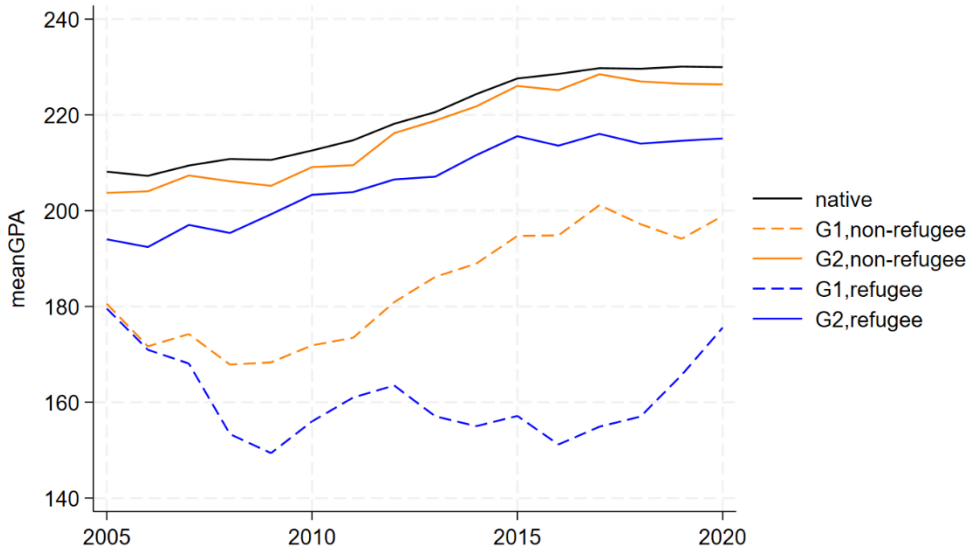
The children of refugees (G2), in particular, experience additional complexities compared to their first-generation (G1) parents. While refugee families often face housing limitations and placement policies that force them to settle in areas with high immigrant or refugee densities (See History of Placement Policy), their children are faced with unique educational challenges likely connected to these areas where they have to grow up. These neighborhoods, sometimes referred to as ethnic enclaves in the literature, present both opportunities and challenges. On the one hand, ethnic enclaves can offer communal support and cultural continuity (Edin, Fredriksson, & Aslund, 2003; Wahl et al., 2006), but on the other hand, they can also present barriers to social integration and hinder socio-economic mobility (K. L. Wilson & Portes, 1980b). Researchers in Sweden have explored the dynamics of enclave living, demonstrating both the benefits and limitations of living in concentrated refugee and immigrant communities (Edin, Fredriksson, & Åslund, 2003).

For the second generation (G2), these challenges may be compounded by the additional layer of navigating both the refugee background of their parents and the broader Swedish society. G2 children often grow up in environments where social and economic opportunities are limited, and where they are expected to integrate into a society that may perceive them as "outsiders" due to their immigrant background. This is despite the fact that they are born and raised in Sweden, which can create an identity struggle between their heritage and the dominant Swedish culture. These factors make the educational outcomes of G2 children particularly important to study, as they face a combination of generational and contextual barriers.

To address the educational disparities exacerbated by geographical and socio-economic factors, Sweden implemented various integration and educational policies over the years. See (R. Andersson et al., 2011; Robinson et al., 2003). These include language acquisition programs, multicultural education strategies, and resource allocation aimed at improving educational access in disadvantaged areas. While these policies have sought to mitigate segregation and promote social cohesion, the extent of their success remains debatable. What is clear, however, is that understanding the intersectionality of education, geography, and socio-economic factors is essential for crafting inclusive policies. Moreover, policies that focus specifically on G2 refugees are crucial, as this group potentially faces a unique set of challenges that differ from those faced by G1 refugees.

In this study, we aim to address these gaps in the research by focusing on G2 refugees, highlighting patterns of inequality and their possible consequences. We also propose recommendations for further research, emphasizing the need for policies that better address the educational needs of the G2 children of refugees, ensuring they are not left behind as they navigate both their familial background and the broader Swedish society.

Figure 1 Mean Grades by Generation type in Sweden (2005-2020) (Range 0-320)



DATA AND METHODS

Data

The dataset used in this study is derived from longitudinal register data covering the entire Swedish population leaving compulsory school between 2005 and 2020 (generally born within the period 1990-2005). The Swedish registers make it possible to carry out all of the analyses and include all the variables that are described later. Unlike most countries, the Swedish registers afford access to whole-population longitudinal microdata on family change, linked to individual-level data on migration background, the asylum period, integration outcomes, and other sociodemographic variables. We can link each individual to microdata on nuclear family members (parents, partners, and children) who have ever lived in Sweden, and the life events of these family members. The education registers include information collected over multiple years, capturing individuals' educational progression. Thus, this dataset is comprehensive and provides a rich source of information for investigating the educational outcomes of second-generation children of refugees in Sweden.

Neighborhood data is sourced from the geography register. We utilize unique Demographic statistical areas - Demografiska statistikområden (DeSO) as our measure of residential area. DeSO categorize Sweden into 5,984 regions, each comprising a population ranging from 700 to 2,700 residents. These divisions account for geographical features such as streets, water bodies, and railways to delineate boundaries effectively. Key components utilized in establishing DeSO include urban zones and electoral districts. Using DeSOs as our neighborhood measure provides detailed data at a small-area level, allowing for a more precise analysis of neighborhood effects. This granularity enables us to enhance the statistical power of our analysis and capture variations within neighborhoods, which may be overlooked when using larger geographical units as used in many previous studies of a similar context.

The findings presented herein are based on analyses conducted on individuals leaving compulsory school between 2005 and 2020. The original sample size underwent some reduction based on specific criteria of missingness and/or incongruency of (a) values of the dependent variable (grades at the end of compulsory schooling); (b) geographical areas (utilized to identify students' neighborhoods); (c) essential parent information such as country of birth and immigration history; and (d) adopted children. This study population reflects a total of 1,559,496. 82 percent of these individuals were children of natives (children of two Swedish-born parents, 104,370 individuals or 7 percent were G2CR (our main interest group). See Table 1. The migration background of individual in study population is quite diverse. Major countries of birth of parents include Iraq, Yugoslavia, Bosnia & Herzegovina, Iran, Lebanon, Sweden Syria and Somalia. A look at the figures in appendix 1 gives a snapshot of the varied origins of the parents of the G2CR in this study. Generally, there is a similarity in the major country of origins of mothers and fathers with some variations in ranking.

Table 1 Study Population

Generations	Total	Male	Female
Native	1,280,519	656,654	623,865
G2 Children of refugee (G2CR)	104,370	53,103	51,267
G1.5 Children of refugee (G1.5CR)	62,897	33,092	29,805
G2 Children of non-refugees (G2NR)	93,344	48,032	45,312
G1.5 Children of non-refugee (G1.5NR)	18,366	9,589	8,777

Outcome

Our outcome variable of interest is the overall grade at the end of compulsory schooling. This is a grade on a range of 0-320 (320 being the maximum attainable grade). This grade is an amalgamation of all subjects taken by the student. In our analysis, we have converted these to percentages for ease of interpretation (where 100% represents a grade of 320). Compulsory schooling grades are used in the assessment of entry into post-secondary education. Given that this is the main grade used for onward academic pursuit in Sweden, we propose that this is a more appropriate measure of educational attainment compared to grades in specific subjects (e.g. Math or English).

Covariates

We measure our predictor variables in the year before individuals take their final examinations. Variables are broadly grouped into two types of characteristics: (*i)area-level*, *and (ii) individual-level.*

Area level variables

Four main dichotomous area-level variables were constructed to examine the role of neighborhoods in answering our research questions.

i. *Refugee density, characterized by the proportion of refugees living in a DeSO.*
ii. *Immigrant density, characterized by the proportion of immigrants (non-refugee) living in a DeSO.*
iii. *Area-level education, the proportion of persons living in a DeSO with high versus low level education.*
iv. *Area Level employment, the proportion of persons living in a DeSO who are reported as being employed vs not employed.*
(Proportions above 50% were classified as high)

Individual/Familial Characteristics

For individual characteristics, we investigate the influence of various socio-economic factors such as parents' education, employment, and family disposable income. Existing research suggests that parental education, employment, and income significantly influence children's academic outcomes (Coleman, 1968). We also control for the following individual factors: sex (to examine potential disparities between girls and boys), migration background of parents, and year of examination (which could proxy temporal variations in educational, integration, and/or immigration policies)

We operationalize the migration background of individuals into five categories.

v. *natives,* individuals born to two Swedish-born parents
vi. *Second-generation children of refugees (G2CR), individuals born in Sweden who have at least one parent who came to Sweden as a refugee*
vii. *First-generation children of refugees (G1.5CR), individuals born outside Sweden who have at least one parent who came to Sweden as a refugee*
viii. *Second-generation children of non-refugees (G2NR), individuals born in Sweden to at least one non-refugee immigrant parent (the other parent not being a refugee)*
ix. *First-generation children of non-refugees (G1.5CR), individuals born outside Sweden to non-refugee immigrant parents.*

Analytical Plan

To examine the relationship between compulsory education and various characteristics of a child's residential neighborhood, a multilevel regression analysis is conducted. This approach accounts for the hierarchical structure of the data, where individuals (students) are nested within neighborhoods. A two-level model is specified, with students as level-1 units and neighborhoods as level-2 units. Throughout the analysis, neighborhoods may also be referred to as DeSOs, residential locations, or neighborhood units. The model controls for a range of individual and familial characteristics to isolate the effects of neighborhood-level factors on compulsory education outcomes. Using a sequential approach, we first analyze an unconditional model to determine the variation in the dependent variable attributed to the individual and neighborhood levels and to determine the initial model fit for assessing subsequent models. Following the estimation of the unconditional model, we add neighborhood-level characteristics to investigate the first two research questions examining the impact of neighborhood conditions on educational outcomes. To address the third research question about heterogeneous neighborhood influences, we first conduct analyses of restricted populations based on generational backgrounds (natives, G2CR, G1.5CR, G2NR, and G1.5NR). Finally, we explore heterogenous effects within the G2CR by looking at country of origin differences based on mothers' country of birth.

RESULTS

Descriptive

Table 2 presents descriptive statistics for the individual-level and neighborhood-level variables. We limit our comparison here to our main groups of interest – the G2CR and Swedish-born children of Swedish-born parents (natives). We however offer an extended description with other groups in Appendix 2. The population groups are split evenly by sex. The average grade of individuals at the national level was approximately 68 percent with G2CR obtaining grades around 3 percentage points lower than their Swedish counterparts as well as the national average. We observe that the parents of the G2CR have lower educational attainment relative to the parents of the native group in all levels of education except for primary school education where a relatively high share (27%/24%: mothers/fathers) only having primary school education relative to very low shares for the parents of natives (6%/12%: mothers/fathers). Forty-five percent of mothers of the native-born have education at the tertiary level compared to the 34 percent of fathers of the native-born. Whilst for the parents of the G2CR, this share is notably lower with similar shares for mother and fathers (28 and 29 percent respectively).

Parents of the native-born have higher rates of employment. We observe high and similar shares of employment for mothers and fathers within groups. Parents of the native-born also have higher incomes than those of the G2CR.

Table 2 Descriptive statistics

	Native			G2CR			Total		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Individual/Family level									
Outcome: grades (percent)	68.53	0	100	65.44	0	100	67.72	0	100
Female(=1)	0.49	0	1	0.49	0	1	0.49	0	1
Parents' education									
Mom primary	0.06	0	1	0.27	0	1	0.10	0	1
Mom secondary	0.48	0	1	0.45	0	1	0.47	0	1
Mom tertiary	0.45	0	1	0.28	0	1	0.43	0	1
Dad primary	0.12	0	1	0.24	0	1	0.14	0	1
Dad secondary	0.54	0	1	0.47	0	1	0.51	0	1
Dad tertiary	0.34	0	1	0.29	0	1	0.34	0	1
Parents employment									
Mom employed	0.94	0	1	0.78	0	1	0.90	0	1
Dad employed	0.95	0	1	0.79	0	4	0.91	0	4
Income quintile (0 lowest)	2.20	0	4	1.18	0	4	2.01	0	4
Neighborhood level (n=5980 neighborhoods)									
High refugee share (=1)	0.00	0	1	0.03	0	1	0.00	0	1
High foreign-born share (=1)	0.01	0	1	0.30	0	1	0.05	0	1
High area-level education (=1)	0.01	0	1	0.00	0	1	0.01	0	1
High area-level employment (=)	0.99	0	1	0.89	0	1	0.98	0	1

Multilevel analysis

Table 3 displays the results of four multi-level models estimating students' grades at the end of compulsory schooling. In pre-analysis (not shown), we estimate a simple unconditional OLS regression and find that grades for the G2CR are 3 percentage points lower than those of children with two Swedish-born parents (aligning with the descriptive statistics in Table 2). However, this differential changes with the multilevel design modeling. (Table 3, model 1). Comparing children who live in the same neighborhood, we see the G2CR slightly outperforming the Swedish-born children of two Swedish-born parents by 0.8 percentage points.

In model 2, we add four neighborhood-level predictors. This addition significantly improves the fit of the model by explaining a higher percentage of the between-neighborhood variance in grades. All area-level predictors have significant associations with grades. Areas with high shares of refugees as well as high shares of foreign-born (non-refugees) have similarly strong negative associations with grades (lower grades by approximately 2 percentage points). Significant positive associations are observed for areas with high area-level employment and high area-level education of approximately 2 percentage points higher grades.

The individual/familial-level predictors (socioeconomic variables – parental education, employment and income) are introduced in model 3. As one would expect, having parents with higher levels of education is associated with higher grades, with the educational level of mothers resulting in approximately 2 percentage points higher grades than it does for fathers in a mother-father comparative at different educational levels. Parental employment is also significantly associated with higher grades. Mothers' employment is associated with approximately 3 percentage points higher grades, while having a father who is employed improves grades by about 2 percentage points. Grades of individuals are also significantly improved with increases in disposable household income, estimating around 2 to 3 percentage points stepwise-increase between income quintiles. We observe upwards of 10 percentage points higher grades for individuals in households falling in the highest income quintile. The model was significantly improved with the addition of these individual level/familial-level predictors which explained a significant share of model variation.

A series of cross-generation analyses were introduced in models 4-8 (appendix 3) to explore heterogeneities between different groups of individuals with varying migration backgrounds (natives, G1.5NR, G2NR, G1.5CR, G2CR). The detailed results of these analyses are presented in the appendix. Here, we first describe in detail the results of model 4 - the restricted model for the G2CR (our main group of interest) (Table 3).

When we restrict the population to the G2CR, we find some area-level factors to be significant in predicting grades. High proportions of refugees living in the areas reduce grades by 1.4 percentage points. However, we observe a positive association between their grades and living in areas with high proportions of foreign-born (non-refugees) – albeit not significant. Higher levels of parental education, parental employment and families in higher income quintiles are associated with higher grades for their children.

Table 3 Multi-level model results

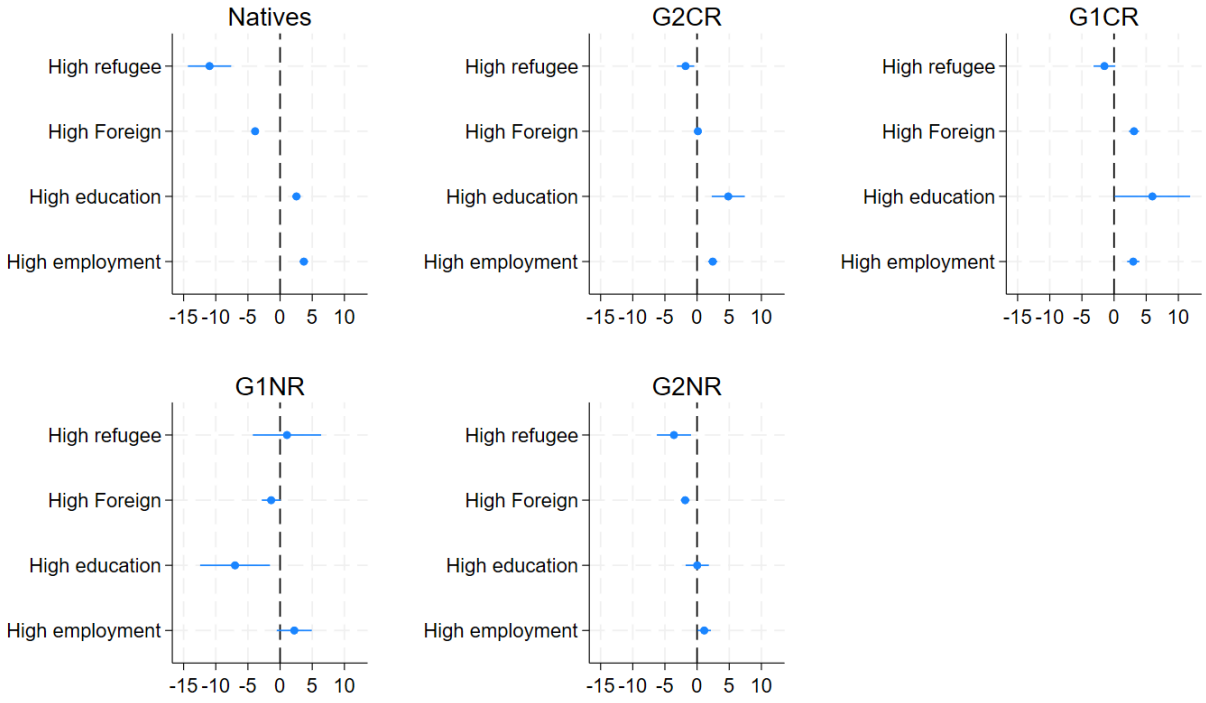
VARIABLES	Model 1	Model 2	Model 3	Model 4
				G2CR
G2CR	0.865***	0.081	4.201***	
	(0.127)	(0.071)	(0.067)	
Female		7.311***	7.274***	6.750***
		(0.032)	(0.030)	(0.118)
High refugee		-1.946***	-1.082**	-1.394***
		(0.529)	(0.461)	(0.538)
High foreign-born (non-refugee)		-2.121***	-0.398**	0.283
		(0.215)	(0.168)	(0.226)
High area-level education		1.906***	2.020***	4.140***
		(0.285)	(0.248)	(0.952)
High area-level employment		2.432***	2.835***	1.970***
		(0.194)	(0.173)	(0.271)
Mom's education (secondary) ref=primary			5.694***	3.902***
			(0.060)	(0.154)
Mom's education (tertiary) ref=primary			11.173***	8.414***
			(0.063)	(0.182)
Dad's education (secondary) ref=primary			3.513***	3.183***
			(0.047)	(0.154)
Dad's education (tertiary) ref=primary			9.224***	6.969***
			(0.054)	(0.178)
Mom employed			3.108***	2.120***
			(0.065)	(0.171)
Dad employed			1.786***	2.003***
			(0.071)	(0.174)
2nd income quintile			2.761***	1.521***
			(0.058)	(0.184)
3rd income quintile			4.653***	3.351***
			(0.061)	(0.210)
4th income quintile			6.783***	4.654***
			(0.064)	(0.239)
5th income quintile			9.856***	7.008***
			(0.069)	(0.301)
Constant	67.667***	59.070***	39.088***	45.623***
	(0.086)	(0.210)	(0.201)	(0.455)
Observations	1,384,889	1,384,889	1,384,889	104,370
Number of groups	5,980	5,980	5,980	5,340

Robust standard errors in parentheses

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

Heterogeneities exist across different generational groups as shown in Figure 2. Notably for some area-level factors, we observe a consistent direction of association (and often similar magnitude), whereas for others there is not the case. Living in neighborhoods with high shares of refugees is associated with lower academic performance across all groups except for the G1.5 non-refugee, with the most significant decline in grades observed among children with two Swedish-born parents. For areas with high shares of foreign-born (non-refugee) we observe significantly lower grades for natives and the non-refugee groups. However, living in areas with high shares of non-refugee immigrants is associated with higher grades for the G2 groups albeit the result is insignificant for the G2CR. We also observe variations in the magnitudes and directions of the association (mostly positive) between area-level education and grades. Specifically, for the G1.5NR we do not observe the positive associations of area-level education on grades as we do in other groups. For areas with high levels of employment we see that children from all groups have higher grades with fairly similar percentage points increases (1-3 percentage points).

Figure 2 Results of multi-level analysis of grades by generation groupings



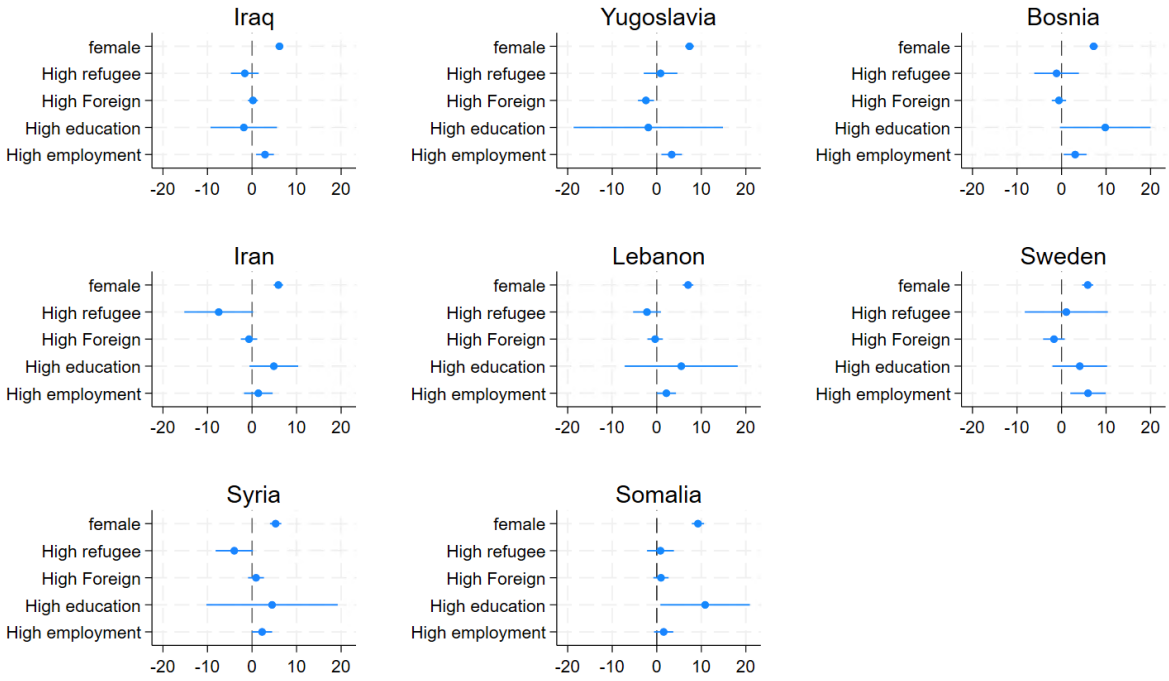
** Includes controls for sex, income, parental employment and year fixed effects (not shown in figure)*

Our final set of analyses (presented in Figure 3) explores variations within the G2CR group. We use our restricted population of only G2CR and look at their outcomes by mothers' country of birth. The top 8 countries of birth for mothers are presented here. In these results, we also present coefficients for sex. We see higher grades for girls than boys on a range of +5 percentage points for children with Iranian mothers to 10% percentage points higher for girls with Somalian mothers. Children living in areas with high proportions of refugees have lower grades if their mothers were born in all countries with the exception of Sweden and Yugoslavia. G2CR living in these areas with mothers born in these two countries achieve higher grades of

approximately 1 percentage point. Children with mothers born in Iran have the largest reduction in grades (-7 percent points) if they live in areas with high shares of refugees.

For areas with high proportions of foreign-born (non-refugees), the magnitudes of the difference in grades are somewhat smaller, but still lower grades for G2CR with mothers from Yugoslavia (-3), Bosnia(-1), Iran (-2), Lebanon(-1) and Sweden(-3). Notably, in a few instances, there are reverse directional associations between children's grades and high refugee areas versus grades and high foreigner(non-refugee) areas. This is the case for Iraq, Yugoslavia, Sweden, and Syria.

Figure 3 Results of multi-level analysis of grades by country of birth of mother (G2CR only)



** Includes controls for sex, income, parental employment and year fixed effects (not shown in figure)*

Living in an area with high levels of employment is associated with relatively similar higher grades for the G2CR irrespective of their mothers' country of birth. High area-level education is associated with higher grades for the G2CR refugees with mothers born in all countries except for Iraq and Yugoslavia. High-level education doesn't seem to be significantly associated with grades for those G2CR whose mothers were born in these countries.

DISCUSSION

In this study, we investigated the impact of residential location on the educational outcomes of second-generation children of refugees (G2CR) in Sweden. Utilizing comprehensive longitudinal register data on compulsory schooling between 2005 and 2020, our multilevel analysis revealed several insights. G2CR exhibit slightly higher academic performance compared to their native-born counterparts when comparing children in the same neighborhood. This highlights the profound influence of neighborhood context on educational outcomes.

Our findings indicate that high proportions of refugees and immigrants within a neighborhood correlate with lower educational outcomes for G2CR. Specifically, a high refugee density has a more pronounced negative association, suggesting that areas with concentrated refugee populations may lack the resources or social capital necessary to support academic achievement. This aligns with previous research indicating that ethnic segregation can exacerbate educational disadvantages (Massey et al. 1993; Massey and Denton 2003b; W. J. Wilson 2012). At the same time, neighborhoods with higher levels of education and employment are positively associated with better educational outcomes for G2CR. These factors likely provide enhanced educational resources, better schooling environments, and greater community support, contributing to improved academic performance. This aligns with literature highlighting the benefits of living in socioeconomically advantaged neighborhoods (R. J. Sampson, Morenoff, and Gannon-Rowley 2002).

Consistent with existing literature, parental education, employment, and income significantly influence children's academic outcomes. Higher parental education and employment, especially maternal employment, are strongly associated with higher grades, underscoring the role of socioeconomic status in shaping educational trajectories. The impact of neighborhood characteristics varies across different generational groups. While high refugee density negatively affects all groups, its association is most significant for native-born children, highlighting potential integration challenges within these neighborhoods.

Another important dimension of heterogeneity observed in our study relates to the educational outcomes of G2CR by mothers' countries of birth. The results indicate that children of mothers from certain countries tend to have higher educational outcomes than others. This may suggest that cultural and social capital brought by mothers from different countries significantly influences their children's academic success. Cultural/social capital embedded within the household environment might influence not only academic expectations but also access to opportunities that facilitate their learning and achievement. These values and resources parents bring from their cultural backgrounds might be helping to shape their children's educational trajectories.

Overall, these findings underscore the complexity of neighborhood effects on educational outcomes and suggest that future research should explore the mechanisms underlying these patterns. Longitudinal studies could provide deeper insights into how these effects evolve over time, while comparative analyses across different contexts may help identify conditions that

either mitigate or exacerbate educational disparities. Understanding these dynamics is crucial for informing nuanced discussions on educational equity and integration.

Our findings also suggest potential avenues for future research to better understand the educational outcomes of G2CR and other marginalized groups. Further studies could explore how neighborhood resources, family support, and inclusive educational policies interact with diverse contexts to shape academic trajectories. Specifically, examining the variability in the magnitude and direction of observed inequalities may clarify the conditions under which targeted interventions are most effective. This approach would contribute to a more nuanced understanding of the mechanisms driving educational disparities and inform evidence-based strategies tailored to specific populations and settings

Limitations*:*

While the findings provide valuable insights, several limitations must be acknowledged:

Model Specification:

The multilevel models used in this study assume that individual and neighborhood effects are additive and independent. However, interactions between individual and neighborhood characteristics may exist, which our models do not fully capture. Future research could explore these interactions to better understand the complex dynamics at play.

Measurement of Neighborhood Characteristics:

While we rely on proxy measures for neighborhood effects, such as educational attainment and employment levels, these proxies have been shown to be robust indicators of neighborhood 'quality' in prior research (Leventhal & Brooks-Gunn, 2000; R. J. Sampson et al., 2002). These proxies allow for a broad analysis of socioeconomic status and its correlation with educational outcomes, consistent with methodologies used in seminal studies on neighborhood effects (Galster, 2012; Jencks & Mayer, 1990). However, we acknowledge that these proxies may not fully capture the complexities and multifaceted nature of neighborhoods. Future research could seek to explore more direct measures of neighborhood quality, such as school quality, availability of social services, and levels of social cohesion, to provide a more nuanced understanding of the mechanisms through which neighborhood contexts influence educational outcomes. Despite these limitations, we believe our current approach is a valid and widely accepted method for examining the broad impacts of neighborhood effects on education.

Temporal Changes

We utilized data spanning several decades, during which significant social, economic, and policy changes have occurred. While we account for some temporal variations in the analysis, our models may not fully adjust for all changes over time, potentially affecting the generalizability of the results. This echo concerns raised by scholars about the challenges of accounting for temporal dynamics in longitudinal studies (Singer & Willett, 2003). Nevertheless, our approach remains valid and robust, as it aligns with established methodologies in longitudinal research that effectively address temporal variations through the use of fixed-effects and random-effects models (Allison, 2009; Curran et al., 2010).

Additionally, our inclusion of year-fixed effects further mitigates potential biases, ensuring that our findings can be adjudged both credible and relevant (Wooldridge, 2010).

Causal Inference:
The nature of the study limits our ability to draw causal inferences. While the multilevel modeling approach helps mitigate some confounding factors, unobserved variables and reverse causality may still influence the results. The inclusion of year fixed effects helps control for time-varying factors that could affect educational outcomes, yet it does not fully address potential endogeneity concerns. For instance, families with stronger educational aspirations may selectively move into certain neighborhoods, influencing both the composition of the area and observed outcomes.

Concluding remarks

This study underscores the critical role of neighborhood context in shaping the educational outcomes of second-generation children of refugees in Sweden. Our findings underscore the need for targeted interventions to support G2CR and other marginalized groups, emphasizing the importance of inclusive educational policies and community-based initiatives.

We have been able to fill a long-existing research gap by highlighting the significant role of neighborhood characteristics in shaping the educational outcomes of the second-generation children of refugees (G2CR) in Sweden. Our findings reveal that the G2CR often exhibit slightly higher academic performance compared to their native-born counterparts once neighborhood effects are accounted for. This underscores the profound influence of neighborhood context on educational outcomes, challenging some preconceived notions about the disadvantages faced by this demographic. Specifically, our results highlight the importance of neighborhood composition, area-level education, and employment, as well as individual and familial factors, in shaping educational trajectories.

The nuanced understanding of how area-level factors interact with individual and familial characteristics provides valuable insights for developing effective educational and social policies and interventions to support the G2CR and other marginalized groups. By addressing the structural inequalities present in disadvantaged neighborhoods and supporting families through targeted policies, we can foster more equitable opportunities for success and well-being across the population.

Future research could seek to explore more direct measures of neighborhood quality, such as school quality, availability of social services, peer influence within schools, and levels of social cohesion, to provide a more gaged understanding of the mechanisms through which neighborhood contexts influence educational outcomes.

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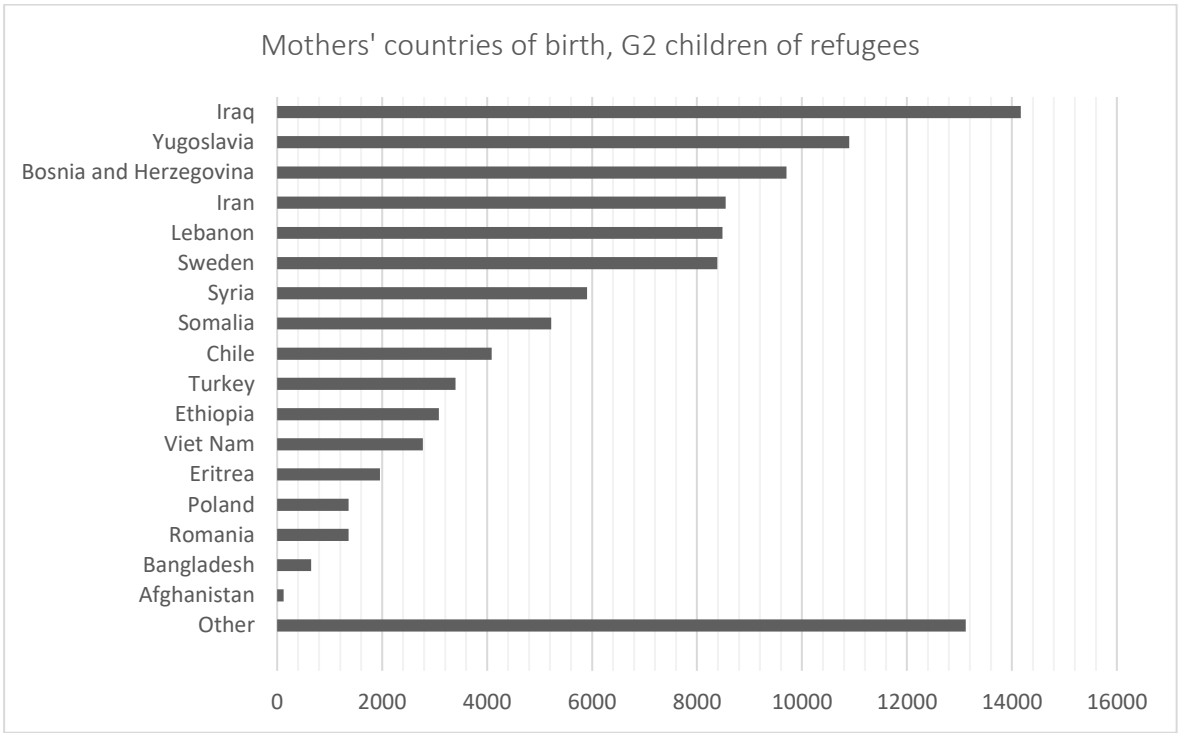
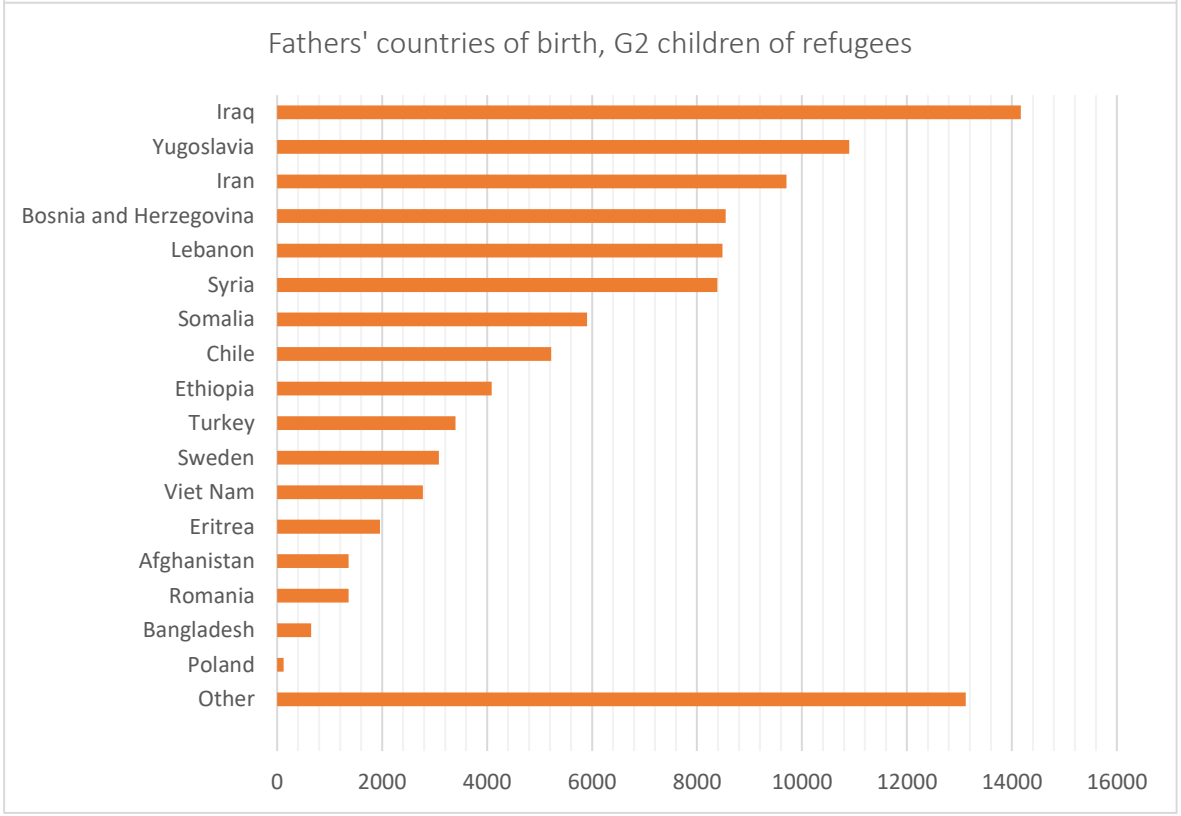
APPENDICES

Appendix 1: Major countries of birth of mothers and fathers of the G2 children of refugees





Appendix 2 Descriptives for all generational groups

	Native				G1.5NR				G2NR				G1.5CR				G2CR				Total			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Individual/Family level (n=																								
grades	68.53	19.88	0	100	63.66	25.53	0	100	68.49	21.58	0	1	55.14	24.22	0	1	65.44	20.83	0	1	67.72	20.50	0	1
Female(=1)	0.49	0.50	0	1	0.48	0.50	0	1	0.49	0.50	0	1	0.47	0.50	0	1	0.49	0.50	0	1	0.49	0.50	0	1
Parents' education																								
Mom primary	0.06	0.24	0	1	0.20	0.40	0	1	0.17	0.38	0	1	0.46	0.50	0	1	0.27	0.44	0	1	0.10	0.30	0	1
Mom secondary	0.48	0.50	0	1	0.32	0.47	0	1	0.39	0.49	0	1	0.28	0.45	0	1	0.45	0.50	0	1	0.47	0.50	0	1
Mom tertiary	0.45	0.50	0	1	0.48	0.50	0	1	0.44	0.50	0	1	0.26	0.44	0	1	0.28	0.45	0	1	0.43	0.50	0	1
Dad primary	0.12	0.33	0	1	0.17	0.38	0	1	0.20	0.40	0	1	0.35	0.48	0	1	0.24	0.43	0	1	0.14	0.35	0	1
Dad secondary	0.54	0.50	0	1	0.36	0.48	0	1	0.43	0.49	0	1	0.29	0.46	0	1	0.47	0.50	0	1	0.51	0.50	0	1
Dad tertiary	0.34	0.47	0	1	0.47	0.50	0	1	0.38	0.49	0	1	0.35	0.48	0	1	0.29	0.45	0	1	0.34	0.47	0	1
Parents employment																								
Mom employed	0.94	0.24	0	1	0.75	0.43	0	1	0.86	0.34	0	1	0.46	0.50	0	1	0.78	0.41	0	1	0.90	0.30	0	1
Dad employed	0.95	0.22	0	1	0.84	0.37	0	1	0.84	0.37	0	4	0.56	0.50	0	4	0.79	0.41	0	4	0.91	0.28	0	4
Income quintile (0 lowest)	2.20	1.35	0	4	1.26	1.40	0	4	1.62	1.44	0	4	0.37	0.78	0	4	1.18	1.27	0	4	2.01	1.41	0	4
Neighborhood level (n=5980 neighborhoods)																								
High refugee density	0.00	0.01	0	1	0.01	0.11	0	1	0.01	0.08	0	1	0.04	0.20	0	1	0.03	0.17	0	1	0.00	0.07	0	1
High foreign-born density	0.01	0.09	0	1	0.26	0.44	0	1	0.17	0.37	0	1	0.29	0.45	0	1	0.30	0.46	0	1	0.05	0.22	0	1
High area-level education	0.01	0.08	0	1	0.01	0.09	0	1	0.01	0.10	0	1	0.00	0.04	0	1	0.00	0.07	0	1	0.01	0.08	0	1
High area-level employment	0.99	0.08	0	1	0.95	0.22	0	1	0.95	0.22	0	1	0.85	0.36	0	1	0.89	0.31	0	1	0.98	0.15	0	1

Appendix 3: Sequential Models

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
				G2CR	G1.5CR	G2NR	G1.5NR	Natives
G2CR	0.865***	0.081	4.201***					
	(0.127)	(0.071)	(0.067)					
Female		7.311***	7.274***	6.750***	6.440***	6.600***	6.463***	7.320***
		(0.032)	(0.030)	(0.118)	(0.172)	(0.348)	(0.129)	(0.030)
High Refugee		-1.946***	-1.082**	-1.394***	-1.349**	-1.589	-3.039***	-7.693***
		(0.529)	(0.461)	(0.538)	(0.662)	(2.044)	(0.996)	(1.180)
High foreign-born (non-refugee)		-2.121***	-0.398**	0.283	2.651***	-1.068*	-1.519***	-3.269***
		(0.215)	(0.168)	(0.226)	(0.318)	(0.611)	(0.279)	(0.229)
High area-level education		1.906***	2.020***	4.140***	2.145	-7.659***	1.217*	1.955***
		(0.285)	(0.248)	(0.952)	(2.070)	(2.011)	(0.687)	(0.254)
High area-level employment		2.432***	2.835***	1.970***	2.838***	1.623	0.736*	3.209***
		(0.194)	(0.173)	(0.271)	(0.354)	(1.010)	(0.384)	(0.249)
Mom's education (secondary) ref=primary			5.694***	3.902***	5.065***	4.627***	3.150***	6.412***
			(0.060)	(0.154)	(0.223)	(0.545)	(0.195)	(0.066)
Mom's education (tertiary) ref=primary			11.173***	8.414***	8.397***	8.726***	8.691***	11.907***
			(0.063)	(0.182)	(0.245)	(0.569)	(0.209)	(0.069)
Dad's education (secondary) ref=primary			3.513***	3.183***	4.893***	2.960***	2.897***	3.668***
			(0.047)	(0.154)	(0.227)	(0.552)	(0.181)	(0.049)
Dad's education (tertiary) ref=primary			9.224***	6.969***	7.713***	5.884***	7.591***	9.511***
			(0.054)	(0.178)	(0.234)	(0.582)	(0.201)	(0.056)
Mom employed			3.108***	2.120***	6.713***	7.531***	2.946***	3.488***
			(0.065)	(0.171)	(0.213)	(0.452)	(0.210)	(0.072)
Dad employed			1.786***	2.003***	5.577***	1.908***	1.595***	1.946***
			(0.071)	(0.174)	(0.202)	(0.532)	(0.209)	(0.080)

2nd income quintile (ref= 1st)			2.761***	1.521***	2.924***	2.233***	1.779***	2.950***
			(0.058)	(0.184)	(0.290)	(0.515)	(0.209)	(0.061)
3rd income quintile			4.653***	3.351***	5.076***	4.401***	2.929***	4.788***
			(0.061)	(0.210)	(0.418)	(0.612)	(0.234)	(0.064)
4th income quintile			6.783***	4.654***	6.061***	6.637***	4.115***	6.916***
			(0.064)	(0.239)	(0.616)	(0.700)	(0.248)	(0.067)
5th income quintile			9.856***	7.008***	10.303***	3.886***	7.042***	9.914***
			(0.069)	(0.301)	(0.888)	(0.696)	(0.269)	(0.072)
Constant	67.667***	59.070***	39.088***	45.623***	35.431***	38.937***	47.668***	37.272***
	(0.086)	(0.210)	(0.201)	(0.455)	(0.512)	(1.612)	(0.509)	(0.271)
Observations	1,384,889	1,384,889	1,384,889	104,370	62,897	18,366	93,344	1,280,519
Number of groups	5,980	5,980	5,980	5,340	4,350	4,420	5,915	5,977

Robust standard errors in parentheses

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

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