UNIVERSITÀ DEGLI STUDI DI SALERNO

DIPARTIMENTO DI SCIENZE ECONOMICHE E STATISTICHE

Dottorato di Ricerca in Economia e Politiche dei Mercati e delle Imprese (XXXII Ciclo)

Curriculum in *Economia del Settore Pubblico*

Tesi di Dottorato in

Doomed to Separation or Ready for Integration? Second-Generation Immigrants in the Italian Primary School.

Coordinatore: prof.ssa Alessandra Amendola

Tutor: prof. Giuseppe Russo

Dottorando: Mariagrazia Cavallo

Matr.: 8801000024

Anno Accademico 2019/2020

UNIVERSITÀ DEGLI STUDI DI SALERNO

DOCTORAL THESIS

Doomed to Separation or Ready for Integration? Second-Generation Immigrants in the Italian Primary School

---

Author:
Mariagrazia CAVALLO

Supervisor:
Prof. *Giuseppe* RUSSO

A thesis submitted in fulfillment of the requirements

for the degree of Doctor of Philosophy

Department of Economics and Statistics

DISES Dipartimento di Scienze Economiche e Statistiche

May, 2020

Si chiamava
Moammed Sceab
Discendente
di emiri di nomadi
suicida
perché non aveva più
Patria
Amò la Francia
e mutò nome
Fu Marcel
ma non era Francese
e non sapeva più
vivere
nella tenda dei suoi
dove si ascolta la cantilena
del Corano
gustando un caffè
E non sapeva
sciogliere
il canto
del suo abbandono

Giuseppe Ungaretti, In memoria, Porto Sepolto (1916)

He says: I am from there. I am from here
But neither am I there, nor here.
I have two names. They meet and they depart.....
And two languages, I have forgotten in which I used to dream.

Mahmoud Darwish, Antithesis, translated by George El-Hage, Journal of Arabic Literature, XXXVI, 1

UNIVERSITÀ DEGLI STUDI DI SALERNO

Abstract

Economics

Department of Economics and Statistics

Doctor of Philosophy

Doomed to Separation or Ready for Integration? Second-Generation Immigrants in the Italian Primary School

by *Mariagrazia* CAVALLO

The integration of second generations is crucial for the well-being, the stability and the social cohesion of the receiving societies. However, childhood years can be decisive for the development of a national identity as well as for adult labor market performance. While the former is important for a proper cultural adaptation, the latter can determine future economic and social outcomes. In this work, I study second-generation immigrants in Italy up to the age of 10. First, I analyze the evolution of the educational gap between natives and immigrants. Then, I evaluate the importance of early language acquisition as a prerequisite for satisfactory school performance and the acquisition of further skills. Finally, I focus on the different role of native and non-native peers' age effects in this performance, investigating whether a double disadvantage exists among second-generation children.

Acknowledgements

Molte persone hanno contribuito alla realizzazione di questo lavoro.

Desidero ringraziare innanzitutto il mio supervisor, Prof. Giuseppe Russo, per l'infinita pazienza con cui mi ha seguito in questo percorso, per i continui incoraggiamenti e la fiducia che ha voluto sempre accordarmi. Il mio debito intellettuale verso di lui è enorme.

Sono profondamente grata al Coordinatore del Dottorato, prof.ssa Alessandra Amendola, per il fruttuoso clima di collaborazione che ha saputo creare nel corso del programma di Dottorato.

Sono altresì grata al Direttore del curriculum di Economia del Settore Pubblico, prof. Marcello D'Amato, a tutto il Collegio Dottorale e al Direttore del Dipartimento, prof. Paolo Coccorese.

Ringrazio la prof.ssa Immacolata Marino e il prof. Giuseppe Migali per aver accettato di valutare questa tesi e per i loro preziosi commenti.

Ringrazio il prof. Thierry Verdier per avermi gentilmente guidato nella mia esperienza di studio alla Paris School of Economics.

Sono sinceramente grata ai proff. Antonio Abatemarco, Fausto Galli e Anna Maria Menichini per il loro incoraggiamento, la loro fiducia e il sostegno scientifico.

Ringrazio i proff. Alberto Bennardo, Vincenzo Carrieri, Lionel Fontagné, Francesco Lancia, Hillel Rapoport, Annalisa Scognamiglio, Biagio Speciale per essere stati punti di riferimento fondamentali.

Sono altresì grata al prof. Antonio Cosma, nonostante lo abbia conosciuto solo per transitività.

Ringrazio la prof.ssa Francesca Toscano per aver sempre trovato il tempo di rispondermi con pazienza e gentilezza.

Ringrazio i miei colleghi, con i quali ho condiviso le difficoltà e le ansie di questo percorso. In particolare, ringrazio Annino, Giovanni e Sara per tutte le discussioni avute.

Ringrazio Valentina e Maria per la loro rara amicizia.

Ringrazio Donato per l'insostituibile supporto informatico.

Ringrazio, infine, la mia famiglia che mi ha incoraggiato e supportato nei tanti momenti di difficoltà.

Ringrazio i miei genitori e i miei nonni per avermi insegnato i valori del lavoro e della ricerca.

Ringrazio mio fratello per avermi messo tra le mani il primo libro di economia che ho letto.

Ogni errore o inesattezza presenti in questo lavoro sono da attribuirsi alla sottoscritta.

Preface

In countries with persistent population inflows, the integration of the immigrants is crucial for the well-being, the stability and the long-term social cohesion. However, the adaptation into a different society is a fragile process that involves many socioeconomic dimensions (Zimmermann, Zimmermann, and Constant (2007); Constant and Zimmermann (2008); Constant, Gataullina, and Zimmermann (2009); Gorinas (2014)). When social integration is successful, immigrants catch up with the natives in terms of employment, income and educational achievements. On the other hand, failed integration may turn immigrant communities into segregated and permanently disadvantaged minorities.

The marginalization of the second generations is the first consequence of a rupture in the integration process. Second generations are a sizeable share of the population in the main regions of destination: they account for 12% of the total population in the US (Trevelyan et al. (2016)), for 6.5% of the total population in the EU (EUROSTAT (2014)) and for 2.4% of the total population in Italy (15% of the population, in the age 0-5, ISTAT (2018b)). These figures are set to increase in the near future, given the raising migration flows and the declining fertility trends of the natives[1]. This is particularly true for Italy, which is a relatively new destination country and whose immigrant population has significantly increased in the last 30 years. What will happen to these generations in the next decades? Will they achieve integration, or stay at the margins of the society?

The recent and worrying phenomenon of second-generation terrorists is one notable example that proves the importance of a satisfactory adaptation to the host society along *all* dimensions. Actually, many second-generation terrorists looked even well-integrated from an economic point of view. For instance, Krueger and Maleckova (2003) and Krueger (2007) find that in some cases there may exist a *positive* association between being above the poverty line, having higher education and participating in terrorist attacks.

This evidence has led many authors to argue that, rather than being a melting pot of different ethnic groups, receiving societies are fragmented and stratified. Immigrants and their descendants are incorporated in specific segments of the host society, often the poorest ones. As a consequence, the literature has introduced the concepts of *downward assimilation* or *segmented assimilation* (Portes and Zhou (1993); Portes and Rumbaut (2001); Alba and Waters (2011)).

We know that integration (or marginalization) starts early in life. Early childhood years can be decisive for the health status, the identity formation and the human capital accumulation, which can determine future integration or

[1] In Italy, native women and immigrant women have 1.24 and 1.98 children per capita, respectively (ISTAT (2018b)).

exclusion. Neal and Johnson (1996), for instance, find that test score differences between black and white children may explain future wage gaps. Similarly, Carneiro, Heckman, and Masterov (2005) point out that gaps in ability across ethnic groups, arised even at a very early age, tend to become permanent and affect labour market opportunities.

A large part of this gap is not migration-specific, but is the result of bad socioeconomic conditions. As suggested by Currie and Thomas (2001), test scores at the end of primary schools have a higher probability to affect future wages for students of lower socioeconomic status. This effect is reduced for students of higher socioeconomic conditions. However, as found by Fryer and Levitt (2013), children between the age of 8 and 12 months belonging to different ethnic groups *do not* show significantly differences in IQ scores.

In other words, what matters is what happens in the childhood. A child's life may inevitably change due to early shocks. The latter come from a variety of sources, such as nutrition (Almond, Mazumder, and Ewijk (2015); Adhvaryu, Fenske, and Nyshadham (2019)), diseases (Almond, Currie, and Hermann (2012); Venkataramani (2012); Bhalotra and Venkataramani (2013)), pollution (Ferrie, Rolf, and Troesken (2012); Isen, Rossin-Slater, and Walker (2017); Black, Bütikofer, and Salvanes (2019)), weather (Rosales-Rueda (2018)), maternal stress (Lee (2014); Aizer, Stroud, and Buka (2016)), abuse, violence and maltreatment (Robst (2008); Robst (2010); Currie and Widom (2010); Barrett, Kamiya, and Sullivan (2014)). These shocks may not only affect the short run but often have long lasting effects.

The likelihood of being exposed to a traumatic event is higher for immigrant and refugee children who often develop post-traumatic stress disorder (Almqvist and Brandell-Forsberg (1997); Sack, Clarke, and Seeley (1995); Jaycox et al. (2002); Kien et al. (2018)). Actually, immigrant and refugee children may be exposed to a variety of pre-migration, migration and post-migration[2] stressors that increase their risk of victimization and, as a consequence, the risk of developing severe psychological disturbances (Pumariega, Rothe, and Pumariega (2005); Fazel, Wheeler, and Danesh (2005); Stevens and Vollebergh (2008); Bronstein and Montgomery (2011); Zwi et al. (2018); Jabbar and Zaza (2019)). Moreover, this greater likelihood persists among *second* generation children as a consequence of their parents' immigration and migration background (Ceri et al. (2017); Bryant et al. (2018); Silwal et al. (2019)).

Individuals who experience an adversity during their infancy, or even in-utero, may never catch-up along their whole life. However, a childhood shock may produce different effects in different ages. According to the literature, it is possible to identify particular ages in the life of an individual that are especially sensitive for a child's psycho-biological development; namely, the so-called *critical periods* (Penfield and Roberts (1959); Lenneberg (1967); Snow and Hoefnagel-Höhle (1978); Newport (2002); Van Den Berg et al. (2014)). For this reason, analyzing what happens in the childhood is a topic of the utmost importance. Policy actions can be very effective within

[2]Pre-migration and migration stressors could be the exposure to war, torture, violence, terrorism, famine, natural disasters, separation from the family, traumatic journey, detention in refugee camps. Post-migration stressors, instead, may include discrimination and prejudice, especially from their peers in class, once they settle in the destination country.

the critical periods. Closing socioeconomic gaps at older ages is still possible, but more expensive and more uncertain.

Education is one dimension that deserves particular attention in the early stage of the life of an individual. The importance of education for human capital formation, at the micro level, and economic growth, at the macro level, is unquestionable (Griliches (1997); Goldin and Katz (2008); Hanushek and Woessmann (2012)).

This thesis studies second-generation immigrants in the Italian Primary School. There are many reasons that motivate this choice. The first is that, if, as stressed above, early school years are crucial, then it is necessary to understand what happens to the educational gap between natives and immigrants at the end of the Primary School.

Chapter 1 focuses on the evolution of this educational gap. Another reason is that, at the age of 10, children are still close to the critical period for language acquisition. Proficiency in the language of the destination country is an essential prerequisite for socioeconomic integration of immigrants. However, for second-generation children it may be crucial in the acquisition of further skills as well as for satisfactory school performance.

Chapter 2 focuses on the causal effect of reading performance on mathematical performance among second-generation children. A further reason is that at early ages the children's performance may be affected by age itself. The effect of age may be due to both biological reasons, accumulated knowledge, and peers' interactions.

Chapter 3 focuses on the different role of native and non-native peers' age effects in the educational outcomes, investigating whether a double disadvantage exists among second-generation children.

This thesis uses confidential data kindly provided by the statistical archives of the Italian Institute for the Evaluation of the Educational System (INVALSI). The views expressed in this thesis are solely those of the author and do not necessarily reflect those of the INVALSI.

Contents

List of Figures

List of Tables

Chapter 1

The Educational Gap of Second-Generation Children in the Italian Primary School.

1.1 Introduction

This chapter studies the evolution of the educational gap between native and second-generation children from the 2nd to the 5th grade of the Italian Primary School.

Second generations account for 12% of the total population in the US (Trevelyan et al. (2016)), and for 6.5% of the total population in the EU (EUROSTAT (2014)). Given the raising immigration flows and the declining fertility of the natives, these figures are set to rapidly increase in all destination areas. In Italy, native women and immigrant women have 1.24 and 1.98 children per capita respectively. In the age 0-5, second generations account for 15% of the population (ISTAT (2018b)). The integration of these generations into the Italian society will be a crucial issue for the next decades, and their educational achievement will be decisive in this process.

Second generations are disadvantaged because on average their parents are poorer and less educated than the natives (Table 1.1).

Socioeconomic hardship is easily conveyed across generations, fostering the birth of permanently disadvantaged minorities into the destination societies.[1]

A failure in the educational progress is a predictor of future difficulties in the labor market (Carneiro, Heckman, and Masterov (2005); Almond, Currie, and Duque (2018)), and is one key mechanism through which the initial disadvantage may become permanent. On the contrary, a successful education can be very effective in order to catch up with the natives.

In this analysis, we study a possible mechanism through which early educational disadvantages accumulate over time. In particular, we study whether a different initial human capital causes the persistence of second-generation children's disadvantage at the end of the Italian Primary School.

The very early years of education are crucial for the second generations, because different mechanisms that can have permanent effects work in the childhood. First, children are still within the "critical period" for language

[1]This process of marginalization is also referred to as "downward assimilation" or "segmented assimilation" (Portes and Zhou (1993); Portes and Rumbaut (2001); Alba and Waters (2011)). Some notable examples are Mexican immigrants (Borjas (1993); Valdez (2006)), African Americans (Hughes and Thomas (1998)), or Native Americans (Yinger and Simpson (1978)), .

TABLE 1.1: Descriptive Statistics

Variable	Natives	Second Generations	Diff.
Female	0.4957	0.5001	-0.0044*
	(0.0007)	(0.0024)	(0.0024)
Math Score 2	59.1339	51.8493	7.2845***
	(0.0741)	(0.2704)	(0.2804)
Math Score 5	58.1370	51.0769	7.0601***
	(0.0757)	(0.2764)	(0.2866)
Italian Score 2	64.5935	56.5395	8.0540***
	(0.0706)	(0.2578)	(0.2673)
Italian Score 5	63.2457	54.5021	8.7436***
	(0.0709)	(0.2586)	(0.2681)
ESCS Student	0.1307	-0.4863	0.6170***
	(0.0048)	(0.0176)	(0.0183)
ESCS Class	0.0435	-0.0631	0.1066***
	(0.0046)	(0.0168)	(0.0174)
ESCS School	0.0304	-0.0050	0.0354**
	(0.0046)	(0.0168)	(0.0174)
Mother's Higher Education	0.1974	0.1211	0.0762***
	(0.0015)	(0.0054)	(0.0056)
Father's Higher Education	0.1516	0.0992	0.0524***
	(0.0013)	(0.0048)	(0.0050)
Mother Unemployed	0.3200	0.5326	-0.2126***
	(0.0022)	(0.0081)	(0.0084)
Father Unemployed	0.0408	0.0896	-0.0488***
	(0.0006)	(0.0023)	(0.0023)
Mother Blue-collar worker	0.1049	0.2221	-0.1172***
	(0.0009)	(0.0033)	(0.0034)
Father Blue-collar worker	0.2364	0.5160	-0.2796***
	(0.0016)	(0.0057)	(0.0059)
Mother White-collar worker	0.3701	0.0564	0.3137***
	(0.0021)	(0.0078)	(0.0081)
Father White-collar worker	0.3573	0.0697	0.2876***
	(0.0019)	(0.0070)	(0.0073)
Mother Self-employed	0.0834	0.0489	0.0345***
	(0.0006)	(0.0021)	(0.0022)
Father Self-employed	0.2275	0.1674	0.0600***
	(0.0011)	(0.0041)	(0.0042)
Obs	648 267	51 097	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Standard Errors in parenthesis clustered at the school-cohort level.

acquisition;[2] then, early disadvantages accumulate over time due to mechanisms like the dynamic complementarity and the self-productivity of skills outlined by Cunha and Heckman (2007). These delicate processes build the basis of human capital accumulation, and their action can have lifetime consequences.

The existence of a native-immigrant educational gap is an empirical regularity in most destination countries (Colding, Husted, and Hummelgaard (2009); Algan et al. (2010); Dustmann et al. (2012); Ochinata and Van Ours (2012); Kunz (2016)), even though some notable exceptions exist where immigrants *outperform* the natives.[3] Attitude towards education, motivation and aspirations are crucial elements to explain this success (Xu and Wu (2017); Burgess and Heller-Sahlgren (2018); Carlana, La Ferrara, and Pinotti (2018)).

We study the impact of the initial human capital on the evolution of the educational gap between native and second-generation children from the age of 7 to the age of 10. We want to know whether the initial gap in favor of the natives is reduced or not at the end of the Primary school. Borrowing from the growth literature, we say that second generations "converge" to the natives if the educational disadvantage declines over time.

[2]This period is related to the psychological and biological development of children. In the childhood, the brain's elasticity and neural plasticity are particularly high. The way and the time within abilities are still manipulable depend on the type of ability itself. For instance, IQ score could be influenced until the age of 10 (Schuerger and Witt (1989)). It is still controversial what should be the critical age for language acquisition; however, there is enough consensus on the fact that it could be identified with the period just before puberty, around the age of 12 (Bleakley and Chin (2010); Van Den Berg et al. (2014)).

[3]This phenomenon is known in the literature as the *immigrant paradox*. This is the case, for instance, of immigrant children in Canada and Australia, and in particular of Asian children in the US and Indian children in the UK (Chiswick and DebBurman (2004); Wilson, Burgess, and Briggs (2011); Coll and Marks (2012); Pong and Landale (2012); Burgess (2014); Burgess and Heller-Sahlgren (2018)).

We use test scores in the 2nd grade as a proxy of the initial human capital, and test scores in the 5th grade as the outcome variable. Clearly, testing the effect of the initial human capital may be difficult because of omitted variables such as effort, ability, motivation, and aspirations, which affect scores both in the 2nd and the 5th grade. We deal with this well-known econometric issue through an IV approach. Our results show weak signs of convergence in Math, and none in Italian. In line with the previous literature, the difference between the OLS and 2SLS suggest that unobservable variables, such as effort, ability, motivation, and aspiration of children, rather than observable variables, could be the main drivers to explain the possible catch-up of immigrants.

The rest of the analysis is organized as follows. Section 1.2 reviews the existing literature. Section 1.3 discusses the main mechanisms. Section 1.4 describes the data. Section 1.5 introduces the empirical strategy. Section 1.6 discusses our results, and Section 1.7 concludes.

1.2 Related Literature

This analysis bridges three literatures. The first studies the native-immigrant educational gap (Gang and Zimmermann (2000); Fryer and Levitt (2004); Fryer and Levitt (2006); Colding, Husted, and Hummelgaard (2009); Patacchini and Zenou (2009); Algan et al. (2010); Dustmann et al. (2012); Ochinata and Van Ours (2012); Krause-Pilatus, Rinne, and Schüller (2015); Kunz

(2016)). The second is about the mechanisms of skill formation and human capital development (Heckman (2006); Heckman (2007); Cunha and Heckman (2007)). The third is about the phenomenon of *immigrant paradox* and its possible solutions (Wilson, Burgess, and Briggs (2011); Burgess (2014); Xu and Wu (2017); Burgess and Heller-Sahlgren (2018); Carlana, La Ferrara, and Pinotti (2018)).

The existence of a native-immigrant educational gap is an empirical regularity in most destination countries. The fact that second-generation children inherit their parents' disadvantages is a sign that the integration process of immigrants is arduous and fragile. There are various reasons why the *first* generations could experience difficulties in the labour markets and lower economic outcomes than natives. First, their low language skills may be a significant barrier to increase employment probability (Chiswick (1991); Dustmann and Fabbri (2003); Bleakley and Chin (2004); Miranda and Zhu (2013); Yao and Van Ours (2015)). Second, they could be discriminated by natives (Bertrand and Mullainathan (2004)). Third, they could have lower abilities, or, even when they are high-skilled, high-educated, or over-educated, there could be difficulties in transferring their human capital in the destination country (Friedberg (2000); Cohen-Goldner and Eckstein (2008); Chiswick and Miller (2009); Liu, Palivos, and Zhang (2017)). However, the reasons why these disadvantages are transmitted to *second* (and even further) generations are less clear. In general, the literature identifies two main channels, which are often both in act and, by interacting each others, produce even more severe consequences. The first is given by children's socio-economic environment. The second is related to their ethnic status.

Patacchini and Zenou (2009), for instance, by investigating the sources of the black-white test score gap in Europe, find that though a large part of this gap is explained by *observable* variables, such as family characteristics, neighborhood and school quality, a substantial 33%-38% is still left *unexplained*. This suggests the existence of migration-specific sources. However, Krause-Pilatus, Rinne, and Schüller (2015) find that the native-immigrant educational gap in Germany is explained more by the socio-economic background rather than the immigrant status. Similarly, Fryer and Levitt (2004) find that the black-white test score gap in US is largely explained by a wide range of observable socio-economic variables and school quality differences.

In sum, most of the literature has focused on three main explanations; namely, language skills, socio-economic background and school segregation.

We focus on the educational gap between natives and second generations in Italy. The Italian case looks peculiar for many reasons. Throughout the XX century, Italy has been a sending country, and the immigrant population has been rising only in the last 30 years. Nowadays, a sizable second generation is growing up. However, being a recent destination country, Italy is somehow 'institutionally unprepared' to handle the difficulties related to the cultural and economic integration of this 'new' population.

Our analysis contributes to the literature in three ways. First, though it is well-known that in Italy the divide between natives and immigrants is particularly high, few papers investigate the educational gap between natives and immigrants (Azzolini, Schnell, and Palmer (2012); MIUR (2019)), and even fewer the educational disadvantage of second-generation children.

Second, we study the evolution of this gap from the beginning to the end of the Primary School. Social integration is a delicate process that starts early in life, and education is key in this process. Thus, it is very interesting to analyze how children perform in their first educational cycle.

Third, we focus on the impact of different initial conditions, studying whether early disadvantages accumulate over time. In this respect, our work is related to the literature initiated by Heckman (2006), Heckman (2007), and Cunha and Heckman (2007), which brings to light some fundamental mechanisms that explain the accumulation and the persistence of early disadvantages. These mechanisms, called 'dynamic complementarity' and 'self-productivity of skills', underline that skills produced at one educational stage affect the productivity at later stages. We try to investigate how these mechanisms affect the educational gap between natives and second generations.

Finally, this work is broadly related to the literature on the so-called *immigrant paradox*. Even though the existence of a native-immigrant educational gap is an empirical regularity in most destination countries, there exist some notable exceptions in which immigrants are found to outperform the natives.

This phenomenon is exactly the *immigrant paradox*.[4] Attitudes towards education, motivation and aspirations seem crucial to explain this outcome (Wilson, Burgess, and Briggs (2011); Burgess (2014); Xu and Wu (2017); Burgess and Heller-Sahlgren (2018); Carlana, La Ferrara, and Pinotti (2018)). We relate our analysis to this hypothesis, by discussing whether our findings could predict the existence of similar events.

1.3 Conceptual Framework

This section introduces a simple theoretical framework that sheds light on the potential issues related to the progress of the second generations. Educational outcomes are the result of the endogenous interaction of many factors, such as the family, the school system, the educational policies, and, last but not least, the parents' and children's desire to succeed (De Fraja, Oliveira, and Zanchi (2010); Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018)). As a consequence, identifying the different mechanisms at work may be difficult.

In the following, we outline a tractable conceptual framework that is strictly related to other contributions in the literature (Cunha and Heckman (2007); Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018)). Obviously, modeling a child's behavior is a delicate task: for instance, it

[4] Interestingly, in the case when an educational gap between immigrants and natives exists, it seems that it declines *across generations*; while, in the case when a tendency to outperform the natives by immigrants exists, this does *not differ* between first and second-generation children (Burgess and Heller-Sahlgren (2018)).

would be hard to be perfectly forward-looking at the age of 6/7. Cunha and Heckman (2007) rule out this issue by making parents decide upon their children's educational investments. Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018), instead, let the children decide their own educational effort on the basis of the incentives provided by schools and parents. Here, we build on all these authors: like Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018), we allow children to optimally choose their effort; like Cunha and Heckman (2007), we assume that education features dynamic complementarities (namely, education at one stage raises the productivity of educational efforts at subsequent stages).

Even though we do not impose full rationality on children, we are far from arguing that they are irrational. Children interact with their teachers, peers and parents. They learn, develop expectations, and try to evaluate the costs and benefits of their actions. Thus, we need a not-too-demanding model -in terms, for example, of perfect foresight of future income flows- but otherwise *rational*. Our approach is very intuitive, and, as Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018), we simply assume that each year the child maximizes her score/grades net of the effort she puts in studying[5]. If we think about effort in terms of hours of studying, this is equivalent to optimize the trade-off between educational effort and leisure.

[5]Actually, the only constraint on the child's rationality is the inability to apply backward induction.

In general, educational outcomes can be interpreted as the output of a production process that employs several inputs, like the pupil's effort and the schooling, but where also the family background and the socio-economic environment are decisive (Polachek, Kniesner, and Harwood (1978); Hanushek (1987); Lazear (2001); Todd and Wolpin (2003)). Our measure of educational outcome is the test score in year t, g_t .

The learning process is modelled through the following production function:

$$g_t^i = f(A_t^i, H_{t-1}^i, S_t^i, E_t^i, H_t^{j \neq i}, F_t^i) \tag{1.1}$$

The function f is assumed to exhibit standard features: it is strictly increasing, strictly concave, twice continuously differentiable and satisfies the Inada conditions. In this production function, A_t^i captures the role of the pupil's social environment (institutions, school quality, social capital, and so on). H_{t-1}^i is the human capital accumulated in the previous period. This variable captures a kind of dynamic complementarity, as featured by Cunha and Heckman (2007). S_t^i is the schooling input, measured, for instance, by the hours of classes attended in year t. E_t^i is the pupil's effort. $H_t^{j \neq i}$ is the human capital of the pupil's classmates, and captures possible peer effects. Finally, F_t^i is the family input, that may be thought as the stock of family human capital. Each year, the pupil maximizes her utility, given by her grades/scores minus the cost of the effort:

$$\pi_t^i = g_t^i - \frac{\theta_i}{2}(E_t^i)^2 \tag{1.2}$$

where $\theta_i \in (0, 1]$ depicts the (innate) studying ability. The ability distribution is the same for natives and second generations. Ability reduces the cost of studying. Therefore, the maximization problem is

$$\max_{E_t^i} \pi_t^i = f(A_t^i, H_{t-1}^i, S_t^i, E_t^i, H_t^{j \neq i}, F_t^i) - \frac{\theta_i}{2}(E_t^i)^2 \tag{1.3}$$

And from the first-order condition we find

$$E_t^{i*} = \frac{f_{E_t^i}(A_t^i, H_{t-1}^i, S_t^i, E_t^i, H_t^{j \neq i}, F_t^i)}{\theta_i} \tag{1.4}$$

Equation (1.4) simply states that the pupil studies until the marginal productivity of her effort equalizes her own marginal cost. This first-order condition implicitly defines the optimal effort level[6] E_t^{i*}. A simple comparative static analysis proves that, at the equilibrium, all factors that increase the marginal productivity determine a higher effort (thus a higher grade). This insight may be used to draw some interesting predictions concerning the educational outcomes of natives and immigrants. Actually, several parameters capture the differences between the former and the latter: A_t^i captures the pupil's neighborhood, H_{t-1}^i depicts her previous education, $H_t^{j \neq i}$ the peer effects, F_t^i

[6]Provided that the second-order condition is satisfied; which is the case here because of the assumptions on f.

the family's input into the child's education. These factors may be thought as "environmental inputs". It is fair to assume that, on average, environmental inputs are lower for immigrant children. Since the ability distribution is the same for the natives and the second generations, this model predicts that -on average- second generations exert less effort, get lower grades, and accumulate less human capital. This outcome is basically due to the lower marginal productivity of their effort: other things being equal, second-generations are inevitably penalized by the lack of factors that complement their effort. This conclusion is intuitive. However, the aim of the analysis is to answer another question; namely, what makes it possible for the second generations to reduce the gap with the natives? Is it possible that they *outperform* the natives? We try to answer these questions in the next section.

1.3.1 The evolution of the educational gap

The simple framework developed in the previous section is very useful to analyze the change in the educational gap from the 2nd to the 5th grade of the primary school. The optimization problem (1.3) is the same both in the 2nd and in the 5th grade. Thus, in each period, the child equalizes her marginal benefit to her marginal cost as in equation (1.4). Note that the endowment of environmental inputs is basically the same in the two periods. Thus -*coeteris paribus*- until the immigrants' effort does not get at the least closer to the natives' one, there is no reason for the gap to reduce: the natives will continue to exert a higher effort and obtain better grades. Therefore, the model exemplifies that, if anything, the initial gap is set to increase. Next question is, is it possible that the immigrants significantly increase their equilibrium effort over time? To answer this question, note that, by dynamic complementarity, the equilibrium effort in the 5th grade *depends on the human capital accumulated in the 2nd grade* (H_2^i)[7]. Obviously, this holds for both natives and immigrants. However, this mechanism may reduce the educational gap if, in equilibrium:

1. the immigrants' effort, relative to the natives', increases from the 2nd to the 5th grade; and

2. the marginal returns to the immigrants' effort are higher than the marginal returns to the natives' effort.

In other words, if the natives' effort lies on a "flatter" region of the production function, whereas the immigrants' effort lies in a "steeper" region, the effort is marginally more effective for the immigrants[8]. Summarizing, the educational gap may decrease because the human capital acquired in the 2nd grade (H_2^i) incentivizes the effort in the 5th grade by increasing the immigrants' marginal productivity. The following proposition describes the condition under which this mechanism is effective.

Proposition 1. *(Reduction in the educational gap)*

Let E_5^{M*} (E_2^{M*}) be the equilibrium effort of second-generation children in the 5th

[7] Since H_2^i is an input in the production function 1.1, it affects the educational outcome in the 5th grade.

[8] This possibility rests on the Inada conditions: actually, the marginal effort yields high returns in a neighborhood of zero, and lower returns when it moves away from zero.

(2nd) grade.

Let E_5^{N*} (E_2^{N*}) be the equilibrium effort of the natives in the 5th (2nd) grade.

The educational gap between natives and immigrants reduces from the 2nd to the 5th grade if the following condition holds:

$$f_{E_t^M}(E_5^{M*}(E_2^M))\frac{\partial E_5^{M*}}{\partial E_2^M} > f_{E_t^N}(E_5^{N*}(E_2^N))\frac{\partial E_5^{N*}}{\partial E_2^N} \tag{1.5}$$

Proof. The result easily follows by Inada conditions. □

According to Proposition 1, immigrants reduce their educational gap with natives between the 2nd grade and the 5th grade if the human capital acquired in the 2nd grade incentivizes the effort in the 5th grade more than natives. This circumstance can be decisive in order to avoid the formation of disadvantaged ethnic enclaves and to foster the social cohesion of multicultural societies in the very long run.

Our example highlights the crucial importance of the early years of education for the integration of the second generations. Future integration may be hindered simply because early education determines both current outcomes and future efforts. This is in line with both the theoretical and the empirical literature.

1.4 Data

We use data on the performance in Italian and Math at the standardized test administered by the *Italian National Institute for the Evaluation of the Education System* (INVALSI).

The whole population of students in the 2nd and the 5th grade of the Primary School is evaluated every year.[9] We focus on the subsample of native and second-generation[10] children in the following school years: 2012-13 (2nd grade), 2013-14 (2nd grade), 2015-16 (5th grade) and 2016-17 (5th grade). We select these waves because they contain the exact birthdates of students, which we use in building our instrument. Given the longitudinal structure of the data, we can follow students from the 2nd grade to the 5th grade (2012-13/2015-16 and 2013-14/2016-17). The subsample of natives includes 648 267 observations, while the subsample of second generations includes 51 097 observations.

An important feature of the INVALSI data is that tests are standardized, anonymous and marked outside the school; thus, the measure of performance is as objective as possible. Moreover, since some authors have detected cheating behavior (Quintano, Castellano, and Longobardi (2009); Bertoni, Brunello, and Rocco (2013); Angrist, Battistin, and Vuri (2017)), scores are corrected for this possibility.[11].

[9] Evaluations began in 2005-06. However, participation of the schools to the test is mandatory only from 2009-2010.

[10] We define "second generations" as children born in Italy with both non-Italian parents. Equivalently, we define "natives" all children born in Italy, with both Italian parents.

[11] Cheating behavior is a wide concept that includes both student and teacher cheating (Jacob and Levitt (2003)). Methods to correct for cheating are not always error free, since it is

The data also include detailed information on family characteristics[12] and home environment[13]. This material is summarized in a synthetic index of economic, social and cultural status (ESCS index). Other useful data come from the *Student's Questionnaire*, which is administered to 5th grade students, and contains questions about the student herself, her family, her attitude towards the classes and the test. In particular, pupils are asked whether at home they speak Italian or other languages[14].

The main variables are summarized in Table 1.1. The dependent variable of our regressions is the score in Math or the score in Italian in the 5th grade. The Mathematical section of the test is made of various subsections that include numerical questions, spatial reasoning, mappings, data and forecasting. This means that the test measures a wide range of knowledge, which require quantitative reasoning, logical reasoning, visual-spatial reasoning, as well as the ability to construct arguments. The Reading section, instead, focuses on text comprehension and on the grammatical and lexical structure of sentences.

We consider the corresponding score in the 2nd grade as a proxy for the student's initial human capital. In our data, natives perform better than second-generations both in Math and in Italian (Figure 1.1; Figure 1.2; Figure 1.3;

possible to identify as a cheater someone that actually is not a cheater, or it is possible to fail to identify someone who is actually a cheater. Ferrer-Esteban (2013) and Pereda-Fernández (2019) propose an algorithmic procedure that is alternative to the Invalsi method.

[12]Mainly, father's and mother's employment, and father's and mother's education.

[13]For instance, the availability of a computer, an internet connection, a quiet room, a desk, encyclopediae, the number of books.

[14]Namely, Albanian, Arabic, Chinese, Croatian, French, Greek, Hindi, English, Ladin, Portuguese, Romanian, Slovenian, Spanish, German, or a language not included in the previous ones.

Figure 1.4; Figure 1.5; Figure 1.6; Figure 1.7; Figure 1.8). In particular, in the 2nd grade, the second-generation children's Math score is 7 points less than natives' score and, similarly, their Reading performance is 8 points less than natives' one. This suggests that the initial gap is already substantial.

However, second generations face also worse socioeconomic conditions. Their parents are generally less educated[15], more unemployed, or employed in low-wage jobs (Table 1.1).

1.5 Empirical Strategy

As a first approach to evaluate the progress of the native-immigrant gap, one may use a standard regression model:

$$Score_{ijt} = \beta_0 + \beta_1 Score_{ijt-1} + \beta_2 Score_{ijt-1} * S_i + \beta_3 S_i + \mathbf{W}_{ij}\rho + \vartheta_j + \mu_t + \epsilon_{ijt} \quad (1.6)$$

where $Score_{ijt}$ is the normalized score in Italian or Mathematics in the 5th grade, for student i, in class j, in the school year t; $Score_{ijt-1}$is the normalized score in the 2nd grade, S_i is a dummy coded 1 for the second-generation children; ϑ_j are class fixed effects; μ_t is a dummy for the school year panel cohort; $\mathbf{W}_{ij}$ is a vector of (time-invariant) controls, which includes the main family characteristics and the socio-economic background of the student (summarized by the ESCS index).

[15]Interestingly, mothers are more educated than fathers both in the native and in the second-generation sample.

In this approach, the most important variable that may measure the convergence between immigrants and natives is the interaction between the score in the 2nd grade of the Primary School and the second generation dummy. β_0 measures the effect for a native with a 2nd grade score equal to zero. $\beta_0 + \beta_3$ provides the corresponding effect for second-generation children. Thus, β_3 measures the difference between natives and second generations, when the 2nd grade score is zero. The coefficient β_1 measures the effect on the natives of a 2nd grade score equal to one. $\beta_1 + \beta_2$ provides the corresponding effect for second-generation children. Thus, β_1 measures the difference between natives and second generations, when the 2nd grade score is one.

The coefficient on the 2nd grade score measures the impact of previously accumulated human capital on the score in the 5th grade. This coefficient captures the self-productivity effect (Cunha and Heckman (2007)); namely, the impact that skills produced at a certain stage have on later stages. The interaction of the 2nd grade score with the second-generation dummy reveals whether previous education is more effective for the second generations than for the natives.

This specification is a value-added model that captures the idea of dynamic skill formation. As suggested by Todd and Wolpin (2007), a value added specification that includes information on lagged values of inputs is to be preferred to alternative specifications.

However, any attempt to evaluate the impact of previous scores on the educational performance is subject to important sources of bias, the reason being that scores in *both* the 2nd and 5th grade are driven by unobservable factors such as effort, motivations and ability (Burgess and Heller-Sahlgren (2018); Metcalfe, Burgess, and Proud (2019)). We use an IV approach to overcome these difficulties. In order to identify the causal effect that the initial human capital has on the score in the 5th grade, we use the difference between the age of the student and the maximum age of her classmates as an instrument.[16]

Absolute or relative age would be bad instruments, because they violate the exclusion restriction. There are many potential reasons why age could be endogenous. First, parents may plan (at least) the month of birth of their children (Buckles and Hungerman (2013)). Second, parents may choose to anticipate or postpone school entrance (West, Meek, and Hurst (2000); Aliprantis (2012); Lenard and Peña (2018)). This is particularly relevant for Italy, where parents in many cases can decide to anticipate the enrollment of their children in the Primary School.[17] Finally, age could also capture grade retention, even though retention is very rare in the Italian Primary School.

Our instrument is built in such a way that it captures the exogenous component of the age effect. The first term of the difference is the *absolute* age *in days* of the pupil, which ensures the relevance of the instrument. A vast literature documents that, in the childhood, being born only a few months

[16] Age is computed in days. It is also possible to use as an IV the difference between the age of the student and the *minimum* age of her classmates. We checked both instruments. Besides being not different conceptually, they also provide similar results.

[17] Anticipation is very common in Italy, where, though enrollment is compulsory for all children who are 6 in September, parents can enroll younger children provided that they turn 6 by April 30 of the following year. Since exercising or not this option is a choice, this creates an important source of endogeneity.

before their peers gives the children important advantages: "older" children have had more time for learning, are more mature and have more accumulated experience than their young peers (Bedard and Dhuey (2006); Elder and Lubotsky (2009); Black, Devereux, and Salvanes (2011); Crawford, Dearden, and Greaves (2014); Fredriksson and Öckert (2014); Solli (2017); Peña (2017); Peña and Duckworth (2018)).

The second term of the difference is a correction for the maximum age in class. As a consequence, our instrument is *a kind of* relative age. Notice, however, that we are subtracting the *maximum* age, rather than the *average* age of the classmates. The reason is that the latter could be biased by the strategic behavior of the parents. Thus, to ensure the exogeneity of our instrument, we are subtracting something that is unpredictable by the parents; namely, the age of the oldest student in class.

Our reasoning is related to the identification strategy developed by Brock and Durlauf (2001) for models of social interaction non-linear in means. In that case, the authors solve the reflection problem, which naturally arises in estimating peer effects, by assuming that the agents' behavior is non-linear in peers' behavior. Here, we adopt a similar reasoning to capture the exogenous component of the age effect.

For our instrument to be valid, it is also needed that the difference between the age of student i and the maximum age in her class affects the score in the 5th grade only through its effect on the score in the 2nd grade. In our case, this condition is likely to be satisfied for two reasons: 1) our instrument is a non-linear function of age; 2) age effects decline over time. From this point of view, it should be easier for our instrument to be at least "plausibly exogenous" in the sense of Conley, Hansen, and Rossi (2012)[18]. We can therefore estimate a two-stage least squares model, where the first stages are given by:

$$Score_{ijt-1} = \alpha_0 + \alpha_1 S_i + \alpha_2 (A_{max})_{ijt-1} + \alpha_3 (A_{max})_{ijt-1} * S_i + \mathbf{W}_{ij}\chi + \vartheta_j + \mu_{t-1} + \eta_{ijt-1} \tag{1.7}$$

$$Score_{ijt-1} * S_i = \gamma_0 + \gamma_1 S_i + \gamma_2 (A_{max})_{ijt-1} + \gamma_3 (A_{max})_{ijt-1} * S_i + \mathbf{W}_{ij}\varphi + \vartheta_j + \mu_{t-1} + \omega_{ijt-1} \tag{1.8}$$

where A_{max} is the difference between the age in days of student i and the maximum age in her class; and the second stage is given by:

$$Score_{ijt} = \delta_0 + \delta_1 \widehat{Score}_{ijt-1} + \delta_2 (\widehat{Score_{ijt-1} * S_i}) + \delta_3 S_i + \mathbf{W}_{ij}\psi + \vartheta_j + \mu_t + \xi_{ijt} \tag{1.9}$$

Notice that, in this specification, the coefficient of the second-generation dummy does *not only* capture the causal impact of being in the second generation, but also *all* migration specific-factors, including the omitted variables that are correlated both with the migration history and the educational performance.[19] As a consequence, this coefficient measures the global effect of all aspects that distinguish the immigrant status. The interaction between the

[18]This approach relaxes the exclusion restriction by requiring only some prior knowledge of the range the coefficient of the instrumental variable may take in the reduced form equation. Though we do not develop this method here, the shape of our function should be of help in finding these support restrictions in our framework. We plan this extension in future research.

[19]One example could be risk attitude, which may affect the performance at the test. Since immigrants are self-selected, their behavior toward risk could differ from the natives, and this trait could be transmitted to second generations (Dohmen et al. (2011)).

effect of migration-specific factors and the dynamic complementarity enables us to study the differential effect of the dynamic complementarity between native and second-generation children.[20]

1.6 Results

In Tables 1.2 and 1.6, we report the OLS estimation of equation 1.6, when the outcome variable is, respectively, the score in Math and in Italian. Both regressions show that the score in the 2nd grade has a positive effect on the score in the 5th grade, as suggested by the hypotheses of dynamic complementarity and self-productivity.

An increase of one point in the 2nd grade score increases the performance in the 5th grade by 0.47-0.55 points in Math and by 0.42-0.49 points in Italian. The coefficient of the interaction between the score in the 2nd grade and the second-generation dummy is also positive and significant, though smaller. An increase of one point in the 2nd grade score has an incremental impact of 0.09-0.04 points in Math and 0.10-0.07 points in Italian.

In both cases, the effect of being second-generation is negative and significant. This effect is large in magnitude. The second-generation status reduces the score in the 5th grade by 6-3 points in Math performance, and 8-5 points in Italian.

These estimates suggest that second-generation children can catch up with

[20]Notice that the 2SLS estimate of the impact of the 2nd grade score on the 5th grade score should be unbiased.

the natives. However, given the small differential impact of the previous knowledge, this is only likely to happen in the long run. Of course, OLS results are likely to be biased and do not estimate the true causal impact of the 2nd grade score.

In Tables 1.3, 1.4, 1.5 and in Tables 1.7, 1.8, 1.9 we report the IV estimates when the outcome variable is Math and Italian, respectively. While the OLS do not capture any substantial difference between Math and Italian, this is not the case for the IV. An increase of one point in the 2nd grade score increases the performance in the 5th grade by 0.45-0.48 points in Math, and 0.61-0.64 points in Italian. However, the coefficient of the interaction between the 2nd grade score and the second-generation dummy is 5% statistically significant only for Math. An increase of one point in the 2nd grade score has an incremental impact for second-generation children of 0.07-0.08 points in the 5th grade. The magnitude of this effect is small.

Being in the second-generation, instead, has still a significant negative -and large in magnitude- effect. It goes from 5-6 points in Math to 6-8 points in Italian.

The analysis suggests that there is some weak evidence of convergence between natives and second generations in Math. For what concerns Italian, the evidence points rather to a *divergence*. However, also in Math, convergence looks so slow that the catch-up is never achieved in practice. What really matters is the migrant-specific effect. The differential impact of previously accumulated knowledge is not enough to help second generations to converge to the natives.

Comparing the OLS and the IV estimates suggests that, since the OLS predict a possible converge also in Italian, the unobservable variables induce an upward bias in the coefficients. Thus, variables like effort and motivation are more likely to drive the evolution of the gap between natives and second generations than skills self-production and accumulated experience.

1.7 Conclusions

We studied the evolution of the educational gap between second-generation and native children from the 2nd to the 5th grade of the Italian Primary School. In particular, we investigated whether the mechanisms of dynamic complementarity and self-productivity of skills (Cunha and Heckman (2007)) foster the convergence in school performances between natives and second-generations. Though we confirm that these mechanisms are at work, there is no evidence indicating that second-generation children benefit from differential effects in their functioning. Convergence effects are weak in the case of Math and absent in the case of Italian. Thus, the evidence points to a stable gap in Math, and an *increasing* gap in Italian.

Overall, these results indicate that the integration of second-generation children is at risk since the age of 10. The major source of disadvantage is still the migrant-specific effect, and these children cannot rely solely on the self-productive mechanism to reduce their gap.

This finding has profound policy implications. First, it confirms the importance of *early* educational investments in order to tackle the persistence of disadvantages. In addition, it suggests that being born in an immigrant family determines a large and persistent penalization, and that the integration of second generations can be more difficult than expected. Thus, policies targeted to integrate the first generations have a sizable spillover on second generations as well.

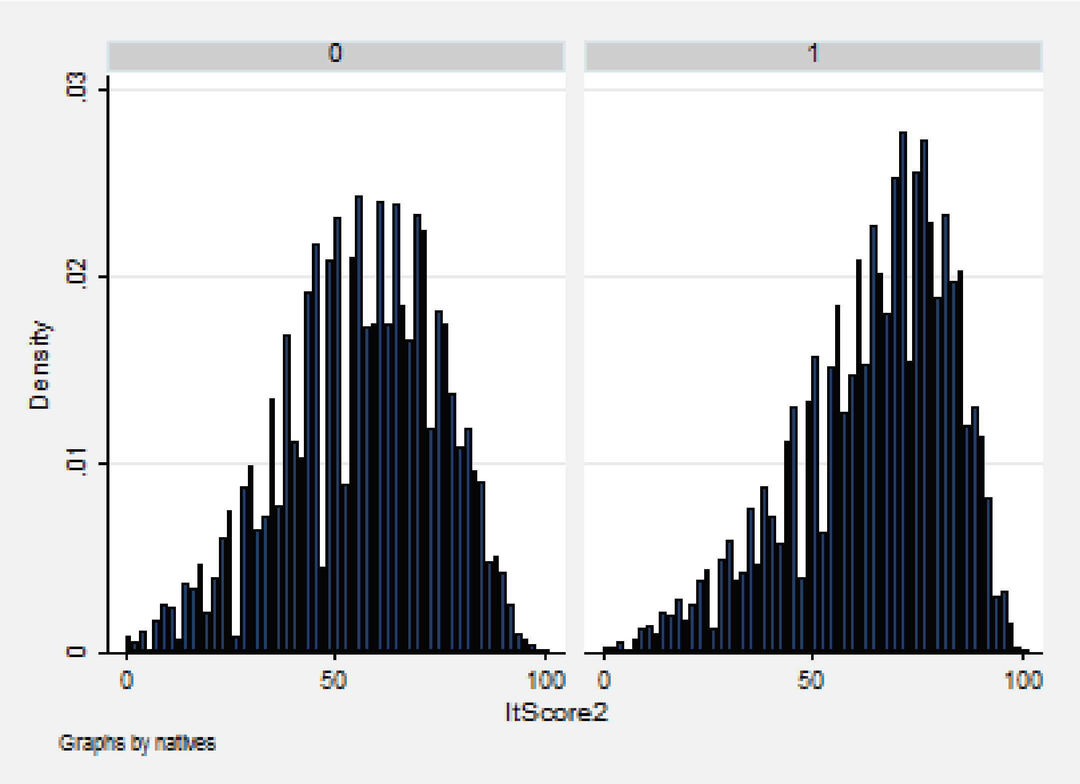

FIGURE 1.1: Histogram Score in Italian in the 2nd Grade

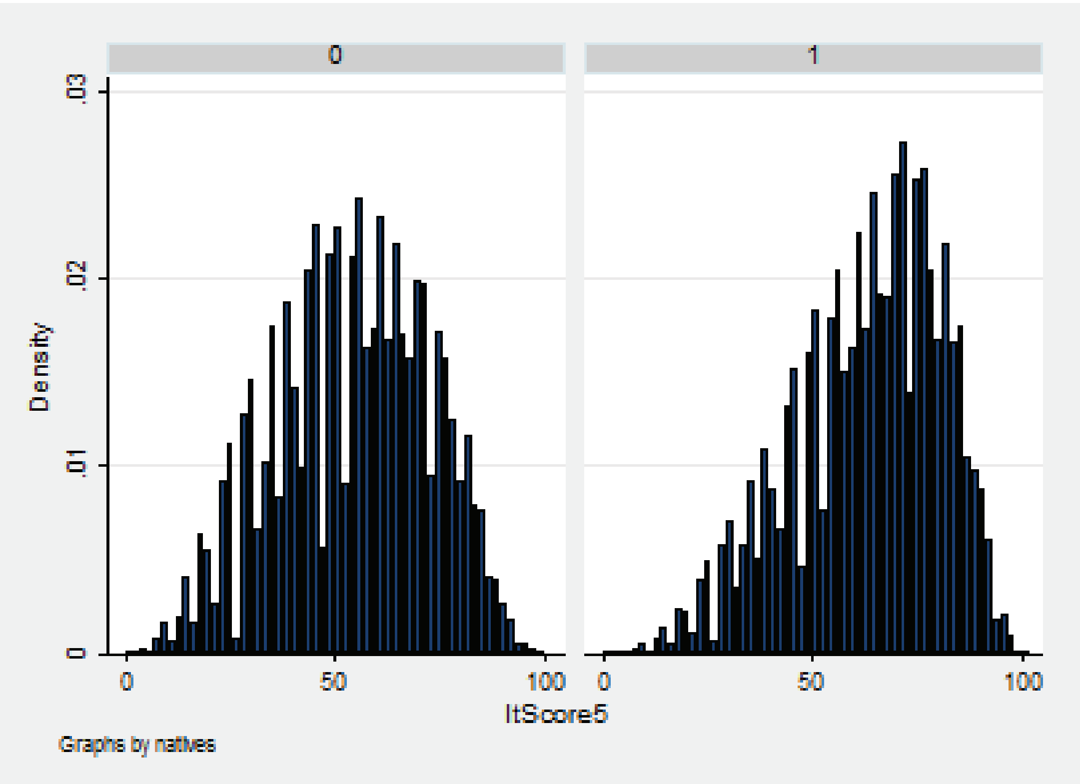

FIGURE 1.2: Histogram Score in Italian in the 5th Grade

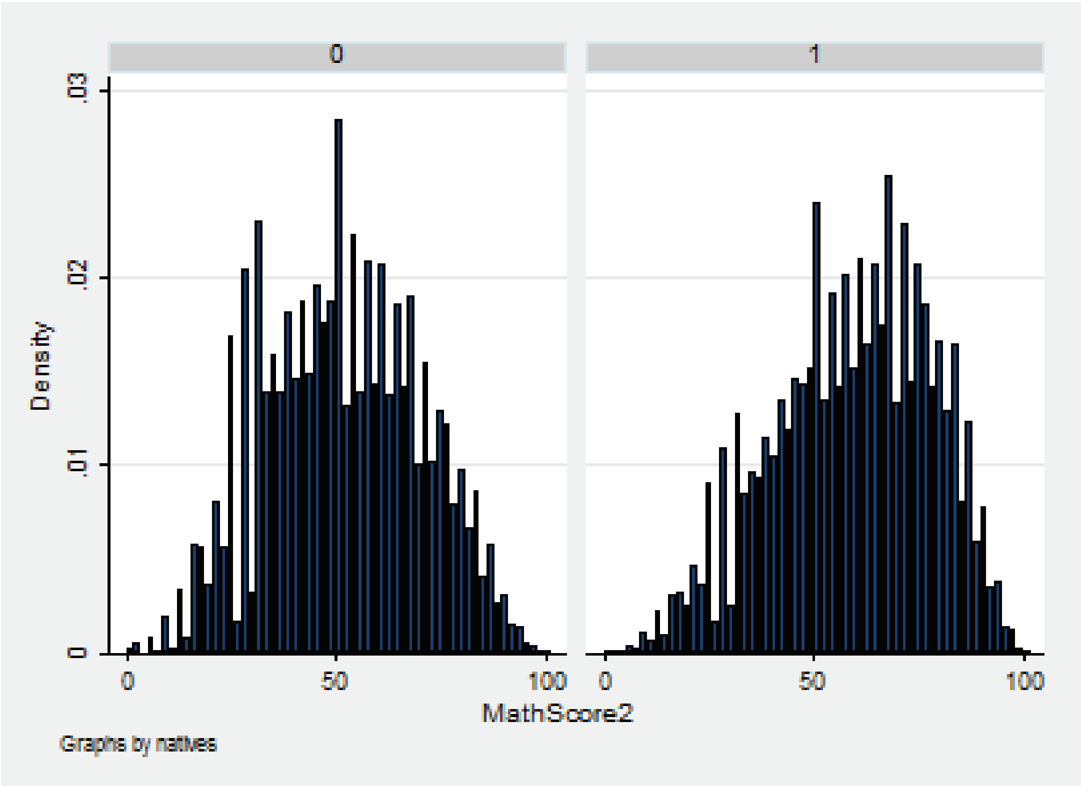

FIGURE 1.3: Histogram Score in Mathematics in the 2nd Grade

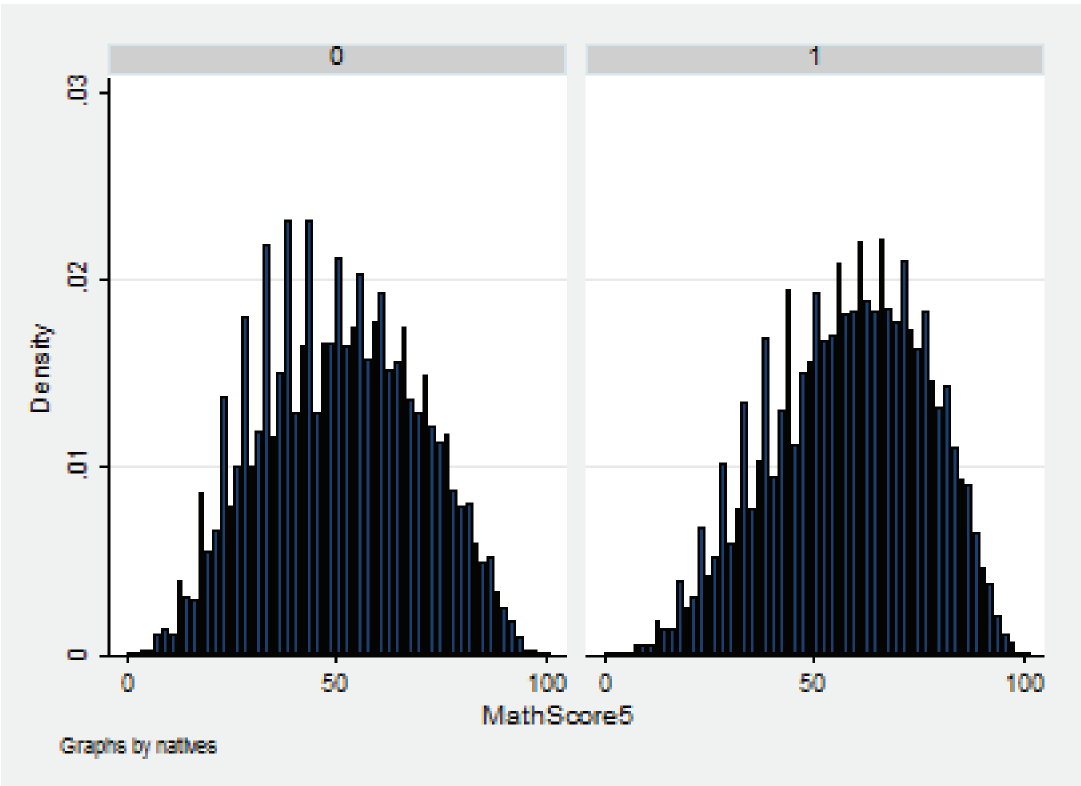

FIGURE 1.4: Histogram Score in Mathematics in the 5th Grade

1.8 Figures and Tables

1.8.1 Immigrant-native Gap. Histograms and Kernel Densities.

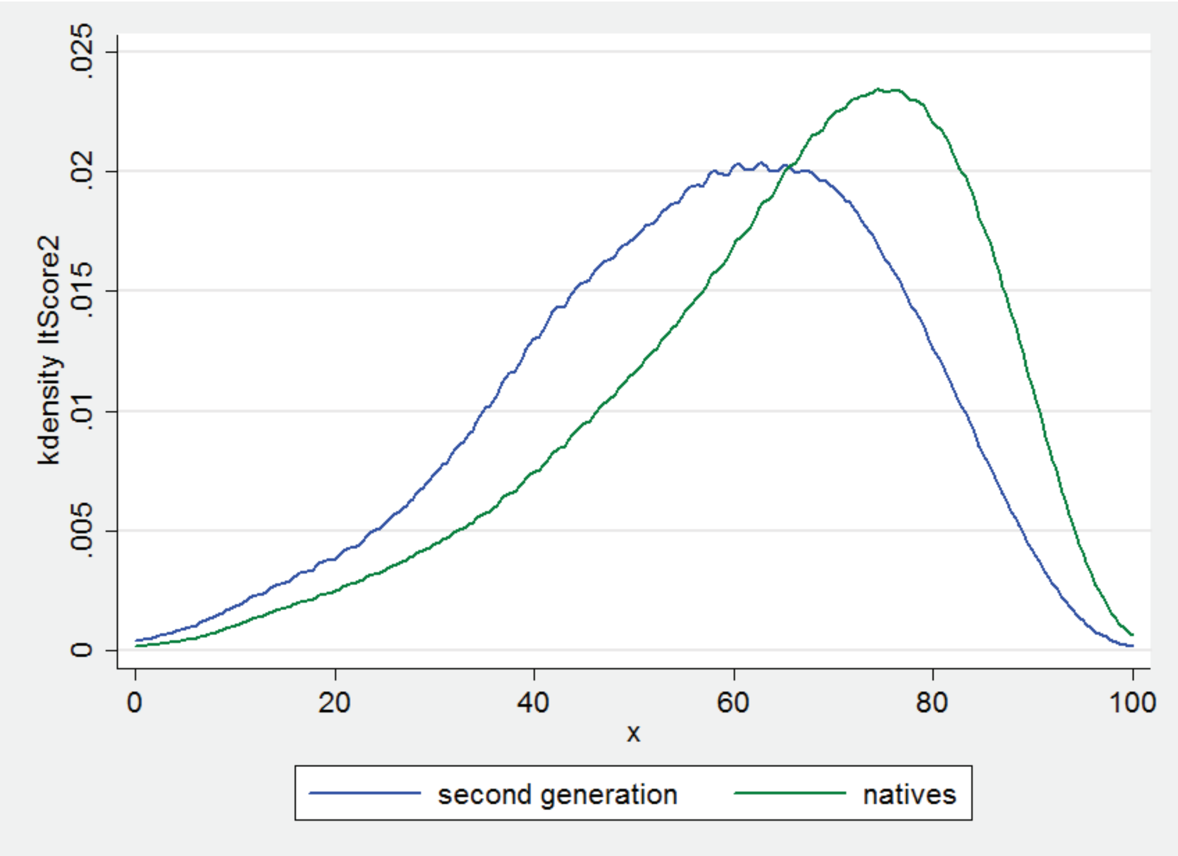

FIGURE 1.5: Kernel Density Score in Italian in the 2nd Grade

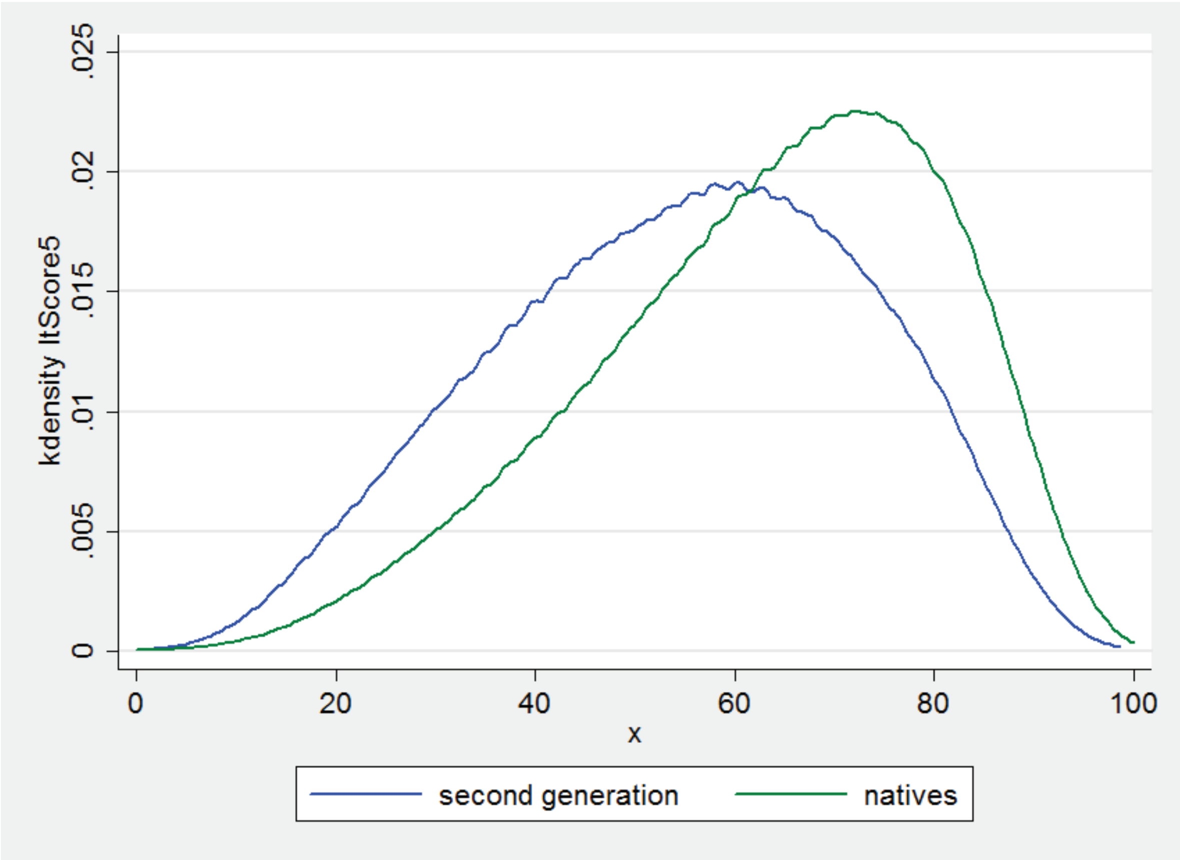

FIGURE 1.6: Kernel Density Score in Italian in the 5th Grade

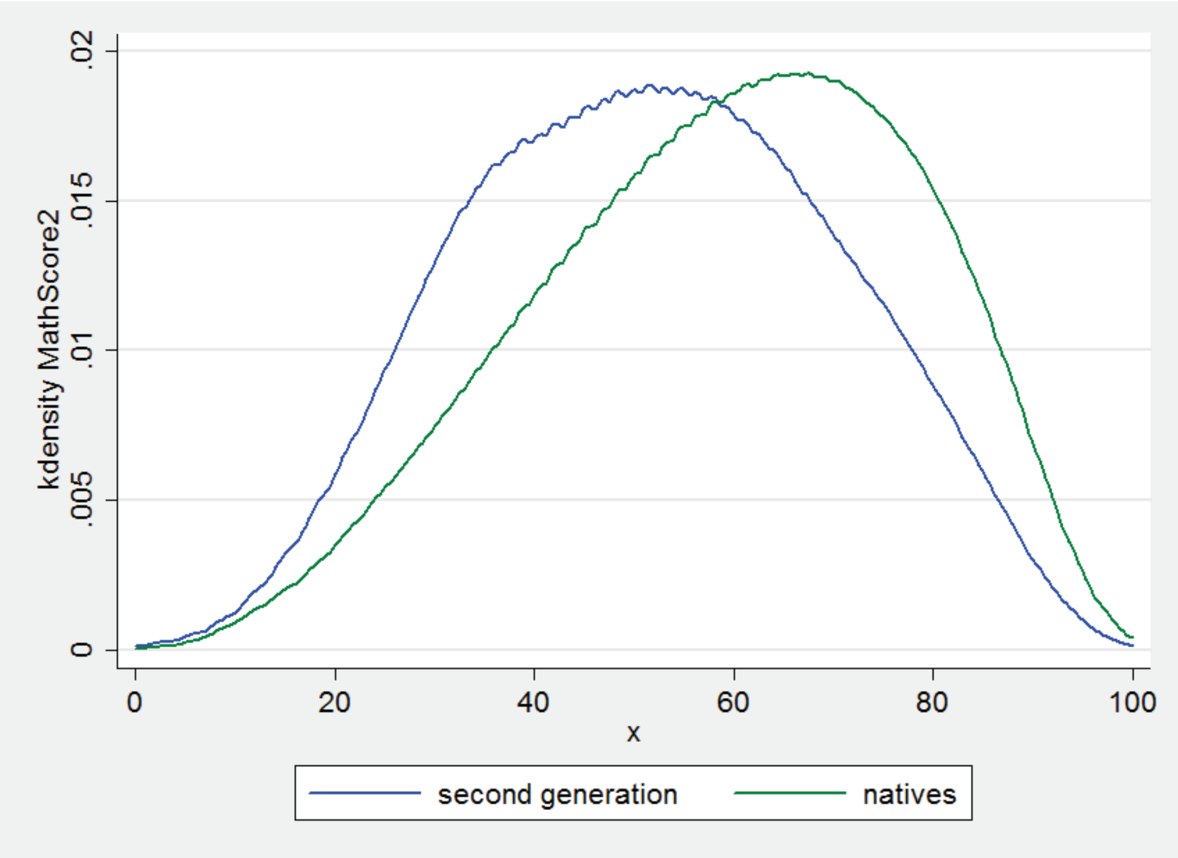

FIGURE 1.7: Kernel Density Score in Mathematics in the 2nd Grade

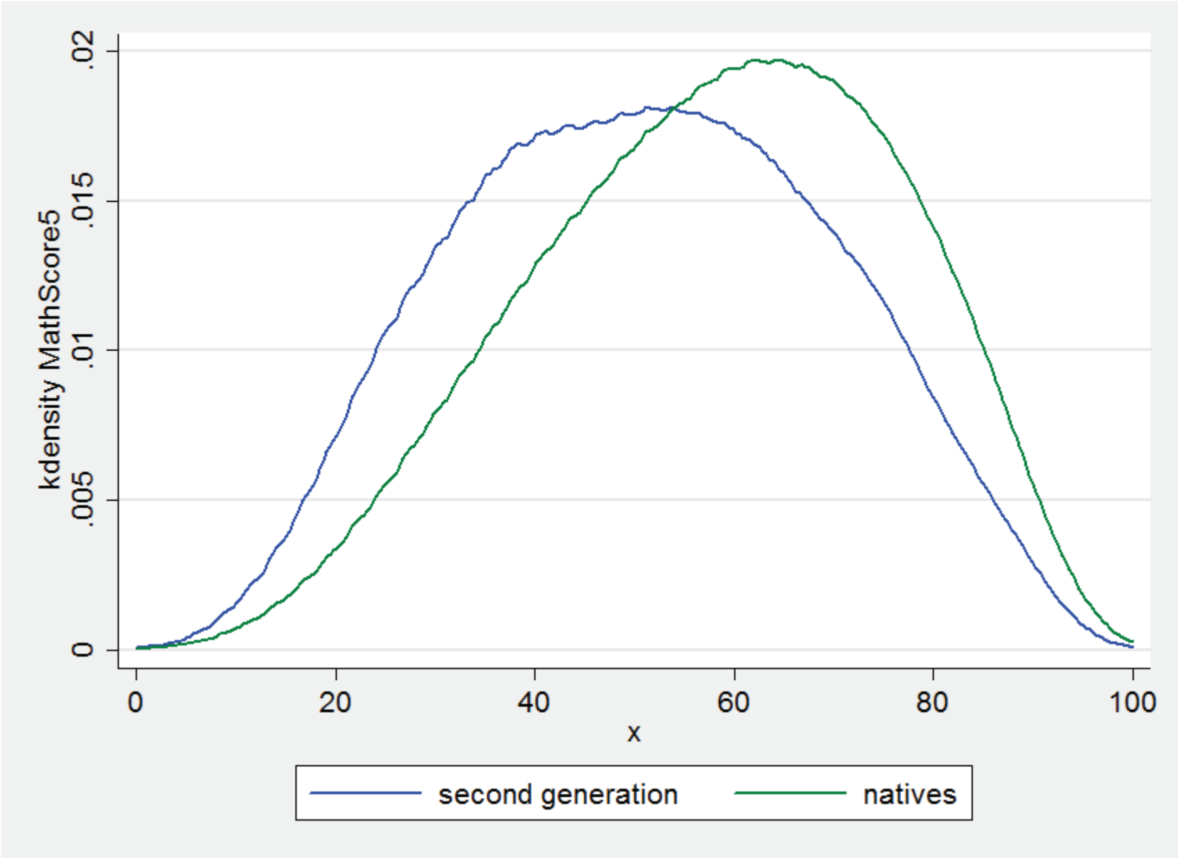

FIGURE 1.8: Kernel Density Score in Mathematics in the 5th Grade

1.8.2 Results.

In the following we report the OLS and 2SLS estimations.

IV regressions with class-by-cohort fixed effects are performed by using the recent Stata module IVREGHDFE[21] by Correia (2018).

[21]In these specifications, the constant term is absorbed. The corresponding coefficient could be easily estimated subsequently from residuals.

TABLE 1.2: Dependent Variable: Score in Mathematics in the 5th Grade

Variable	OLS (1)	OLS (2)	OLS (3)
Math 2nd	0.470***	0.554***	0.554***
	(0.0011)	(0.0014)	(0.0019)
Second	-6.640***	-3.142***	-3.142***
	(0.216)	(0.213)	(0.223)
Math 2nd x Second	0.091***	0.039***	0.039***
	(0.0038)	(0.00377)	(0.0039)
Constant	30.036***	26.02***	26.02***
	(0.114)	(0.086)	(0.109)
Obs	699 335	699 335	699 335
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in Parenthesis (OLS (1))
Clustered Standard Errors at the class-cohort level (OLS (2))
Clustered Standard Errors at the school-cohort level (OLS (3))

TABLE 1.3: First Stage. Score in Math in the 2nd Grade (*IV: Relative Age with Respect to the Max*)

Math Score 2nd	(1)	(2)	(3)
Rel Age wrt Max	0.013***	0.017***	0.017***
	(0.0002)	(0.0002)	(0.0002)
Second	-5.110***	-4.885***	-4.885***
	(0.146)	(0.143)	(0.149)
Rel Age wrt Max x Second	0.0012*	0.0012*	0.0012*
	(0.00065)	(0.00063)	(0.0006)
Constant	61.315***		
	(0.118)		
Obs	699 324	698 449	698 449
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES
Weak Identification Test:			
Kleibergen-Paap rk Wald F statistic	2560.35	353.87	348.24

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in Parenthesis (2SLS (1))
Clustered Standard Errors at the class-cohort level (2SLS (2))
Clustered Standard Errors at the school-cohort level (2SLS (3))

TABLE 1.4: First Stage. Score in Math in the 2nd Grade x Second (*IV: Relative Age with Respect to the Max x Second*)

Math Score 2nd x Second	**(1)**	**(2)**	**(3)**
Rel Age wrt Max	0.0001***	0.0003***	0.0003***
	(0.000)	(0.000)	(0.000)
Second	54.587***	54.732***	54.732***
	(0.141)	(0.150)	(0.162)
Rel Age wrt Max x Second	0.014***	0.015***	0.015***
	(0.0006)	(0.0007)	(0.0007)
Constant	0.152***		
	(0.035)		
Obs	699 324	698 449	698 449
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES
Weak Identification Test: Kleibergen-Paap rk Wald F statistic	2560.35	353.87	348.24

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in Parenthesis (1)
Clustered Standard Errors at the class-cohort level (2)
Clustered Standard Errors at the school-cohort level (3)

TABLE 1.5: Second Stage (*IV: Relative Age with Respect to the Max, Relative Age with Respect to the Max x Second*)

Math Score 5th	**(1)**	**(2)**	**(3)**
Math 2nd	0.483***	0.450***	0.450***
	(0.012)	(0.009)	(0.009)
Second	-5.339***	-5.976***	-5.976***
	(2.056)	(1.821)	(1.854)
Math 2nd x Second	0.068*	0.083**	0.083**
	(0.039)	(0.035)	(0.035)
Cons	29.324***		
	(0.703)		
Obs	699 324	698 449	698 449
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in Parenthesis (1)
Clustered Standard Errors at the class-cohort level (2)
Clustered Standard Errors at the school-cohort level (3)

TABLE 1.6: Dependent Variable: Score in Italian in the 5th Grade

Variable	OLS (1)	OLS (2)	OLS (3)
Italian 2nd	0.415***	0.492***	0.492***
	(0.001)	(0.0015)	(0.0018)
Second	-7.788***	-4.898***	-4.898***
	(0.250)	(0.264)	(0.278)
Italian 2nd x Second	0.070***	0.031***	0.031***
	(0.004)	(0.004)	(0.004)
Constant	39.26***	30.22***	30.22***
	(0.116)	(0.100)	(0.115)
Obs	699 335	699 335	699 335
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in Parenthesis (OLS (1))
Clustered Standard Errors at the class-cohort level (OLS (2))
Clustered Standard Errors at the school-cohort level (OLS (3))

TABLE 1.7: First Stage. Score in Italian in the 2nd Grade (*IV: Relative Age with Respect to the Max*)

Italian Score 2nd	(1)	(2)	(3)
Rel Age wrt Max	0.011***	0.014***	0.014***
	(0.0002)	(0.000)	(0.000)
Second	-6.526***	-6.440***	-6.440***
	(0.147)	(0.145)	(0.149)
Rel Age wrt Max x Second	-0.0003	-0.0006	-0.0006
	(0.0007)	(0.0006)	(0.0006)
Constant	65.053***		
	(0.117)		
Obs	699 324	698 449	698 449
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	NO
Weak Identification Test:			
Kleibergen-Paap rk Wald F statistic	163.19	137.58	138.40

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in Parenthesis (1)
Clustered Standard Errors at the class-cohort level (2)
Clustered Standard Errors at the school-cohort level (3)

TABLE 1.8: First Stage. Score in Italian in the 2nd Grade x Second (*IV: Relative Age with Respect to the Max x Second*)

Italian Score 2nd x Second	**(1)**	**(2)**	**(3)**
Rel Age wrt Max	0.0001***	0.0001***	0.0001***
	(0.000)	(0.000)	(0.000)
Second	58.590***	58.709***	58.709***
	(0.142)	(0.150)	(0.157)
Rel Age wrt Max x Second	0.011***	0.0109***	0.0109***
	(0.0006)	(0.0007)	(0.0007)
Constant	0.132***		
	(0.035)		
Obs	699 324	698 449	698 449
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES
Weak Identification Test:			
Kleibergen-Paap rk Wald F statistic	163.19	137.58	138.40

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Robust Standard Errors in Parenthesis (1)
Clustered Standard Errors at the class-cohort level (2)
Clustered Standard Errors at the school-cohort level (3)

TABLE 1.9: Second Stage (*IV: Relative Age with Respect to the Max, Relative Age with Respect to the Max x Second*)

Italian Score 5th	**(1)**	**(2)**	**(3)**
Italian 2nd	0.640***	0.608***	0.608***
	(0.014)	(0.011)	(0.011)
Second	-8.017**	-6.172**	-6.172**
	(3.162)	(2.959)	(0.021)
Italian 2nd x Second	0.100*	0.067	0.067
	(0.055)	(0.050)	(0.052)
Constant	25.065***		
	(0.878)		
Obs	699 324	698 449	698 449
Controls	YES	YES	YES
Province FE	YES	NO	NO
Class-by-cohort FE	NO	YES	YES

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Robust Standard Errors in Parenthesis (1)
Clustered Standard Errors at the class-cohort level (2)
Clustered Standard Errors at the school-cohort level (3)

Chapter 2

Lost in Translation: Reading Performance and Math Performance of Second-Generation Children in Italy.

Who am I? This is a question that others ask, but has no answer.

I am my language, I am an ode, two odes, ten. This is my language.

I am my language. I am words' writ: Be! Be my body![1]

[1]Mahmoud Darwish, A Rhyme for the Odes, Unfortunately, It was Paradise, Selected Poems, Translated and Edited by Munir Akash and Carolyn Forché (with Sinan Antoon and Amira El-Zein), 2013. University of California Press.

2.1 Introduction

Language acquisition is essential for the integration of immigrants. The adaptation to the receiving society is a delicate process that involves several dimensions such as language, culture, social interactions, and economic outcomes (Zimmermann, Zimmermann, and Constant (2007); Constant and Zimmermann (2008); Constant, Gataullina, and Zimmermann (2009); Gorinas (2014)). Lack of integration in one dimension does not necessarily preclude integration along other dimensions; however, proficiency in the destination country language is a prerequisite for integration in *all* dimensions.[2] Analogously, language acquisition is not only an outcome of the educational process but also a prerequisite in the acquisition of further skills (Dustmann and Glitz (2011); Akresh and Akresh (2011); Isphording, Piopiunik, and Rodriguez-Planas (2016)).

The objective of this paper is to identify *the causal effect of language acquisition on Math achievement* for second-generation children at the age of 10.

Identifying this effect is essential to understand the formation of immigrant children's human capital at the very beginning of their integration process. Actually, it is well-known that early educational gaps are likely to persist and may determine major difficulties in adulthood (Almond, Currie, and Duque (2018)). For instance, Carneiro, Heckman, and Masterov (2005) point out that

[2] An extensive literature has found a positive effect of language proficiency on labor market outcomes (Dustmann and Fabbri (2003); Bleakley and Chin (2004); Chiswick and Miller (2010)).

gaps in ability across ethnic groups arisen even at a very early age may become permanent and hinder labor market opportunities. Similarly, Neal and Johnson (1996) find that test score differences between black and white children can explain future wage gaps.

Our work is strictly related to Isphording, Piopiunik, and Rodriguez-Planas (2016) and Aparicio-Fenoll (2018). Both of these contributions measure the causal effect of immigrants' language skills on Math results. While Isphording, Piopiunik, and Rodriguez-Planas (2016) find that language proficiency positively affects Math performance, Aparicio-Fenoll (2018) finds no evidence of such an effect.[3] Our results differ from both of these articles, and suggest that children can improve their Italian only at the cost of reducing their performance in Math. This is a worrying outcome since it points out that, at the end of the Primary School, second generations in Italy have not yet achieved linguistic integration, and they could easily be caught in a poverty trap (see Bleakley and Chin (2004)).

Our analysis adds to the literature in many respects. First, unlike Isphording, Piopiunik, and Rodriguez-Planas (2016) and Aparicio-Fenoll (2018), we focus on second generations.[4] Thus, all children in our sample are born in Italy. Second, and most importantly, we know the language *actually* spoken at home. While Isphording, Piopiunik, and Rodriguez-Planas (2016)

[3] Isphording, Piopiunik, and Rodriguez-Planas (2016) study a mix of destination-origin countries, and Aparicio-Fenoll (2018) studies immigrants into the US.

[4] Isphording, Piopiunik, and Rodriguez-Planas (2016) consider first-generation students aged 15; Aparicio-Fenoll (2018) puts together both first and second-generation children aged 6-12.

and Aparicio-Fenoll (2018) try to infer this language from information on the country of origin, associating a country to a single language is not possible in many cases, in particular with many North-African countries that are a major source of emigration to Italy. Third, by focusing on Italy, we can study the peculiar situation of a country where immigration is a relatively recent phenomenon,[5] and where the educational gap between natives and immigrants looks high (Azzolini, Schnell, and Palmer (2012); MIUR (2019)).

Notice also that we study children aged 10-11. This ensures that they are within -or at least still close to- the critical period for language acquisition so that being "older" does not hinder the acquisition of Italian[6] (Lenneberg (1967); Snow and Hoefnagel-Höhle (1978); Newport (2002); Van Den Berg et al. (2014)).

Estimating to what extent language proficiency (*i.e.* test scores in Italian) determines Math achievement (*i.e.* test scores in Math) is subject to well-known econometric issues. Both Math and language scores can be affected by omitted variables such as ability and motivation. In the case of immigrants, other unobservable mechanisms -like family self-selection along dimensions that are relevant for school performance- may be at work, making causal estimation even harder. Then, by the simple fact that second generations

[5]Actually, even though in the last 20 years Italy has become an important destination country, only few papers concern second generations in Italy (Algan et al. (2012); Azzolini, Schnell, and Palmer (2012)).

[6]In other words, since children at 10 are still within the critical period for language acquisition, age does not produce any obstacle to the learning process, and only captures the benefit of a longer exposition to the destination country. It is still controversial what should be the critical age for language acquisition; however, there is enough consensus on the period just before puberty, around the age of 12 (Bleakley and Chin (2010); Van Den Berg et al. (2014)).

usually suffer from a socioeconomic disadvantage, it might be difficult to disentangle the effects on educational performance due to language barriers from the effects due to the immigrant status (Schnepf (2007); Dustmann et al. (2012); Ochinata and Van Ours (2012); Kunz (2016)). The educational performance originates from the endogenous interaction of many factors, such as the family, school, educational policy, as well as parents' and children's desire to succeed (Albornoz, Cabrales, and Hauk (2018); Albornoz, Berlinski, and Cabrales (2018)). In some cases, immigrant children can even *outperform* the natives. This phenomenon is known in the literature as the *immigrant paradox*[7] (Chiswick and DebBurman (2004); Wilson, Burgess, and Briggs (2011); Coll and Marks (2012); Pong and Landale (2012); Burgess (2014); Burgess and Heller-Sahlgren (2018)). As a consequence, no general conclusions are possible, and the literature is still in the making.

In order to overcome the econometric difficulties we have outlined, many authors rely on instrumental variables. For instance, in an influential paper, Bleakley and Chin (2004) measure the causal effect of immigrants' language skills on earnings through an IV given by the interaction between age at arrival and a dummy for non-English speaking countries. Aparicio-Fenoll (2018) and Isphording, Piopiunik, and Rodriguez-Planas (2016) measure the causal effect of immigrants' language skills on Math results. The former uses the same IV as Bleakley and Chin (2004), and the latter modify Bleakley and

[7]This is the case of immigrant children in Canada and Australia and, in particular, of Asian children in the US and Indian children in the UK.

Chin by using the interaction between a continuous measure of linguistic distance and age at arrival as their IV.

We use the interaction between the linguistic distance from Italian and age as our instrumental variable for proficiency in Italian, which is closely related to Bleakley and Chin (2004) and Isphording, Piopiunik, and Rodriguez-Planas (2016). The age captures the length of exposure to the language and linguistic distance the difficulty of adaptation with respect to the language spoken at home. The interaction of these two variables gives the difference in the exposure to the destination language across the different linguistic distances. While the linguistic distance can be endogenous because of destination country choice, and age can be endogenous because of family planning, the exposure to the destination language across the different linguistic distances is in all likelihood uncorrelated with unobservable Math determinants like ability or motivation.

Our results show a *negative* effect of proficiency in Italian on the performance in Math. Thus, it seems like children have to trade knowledge of Italian against knowledge of Math.

In order to shed light on this puzzle, we conjecture that there may exist a threshold beyond which further progress in Italian is irrelevant for understanding Math class. In order to test for this effect, we consider a threshold equal to the score for attaining Proficiency Level 3, which the Italian National Institute for the Evaluation of the Education System (henceforth INVALSI) considers as a "sufficient" command of Italian [8] and split our sample between students below and above this threshold. The estimates on the subsamples clarify that the negative effect is led by children below the threshold. For the other children, our instrument is weak: once a sufficient command of Italian is achieved, further exposure to the language does not increase the score. Our conclusion is that immigrants with poor linguistic performance are still struggling to catch-up with language at the age of 10, and they are able to do so only at the cost of reducing their performance in other subjects. This outcome looks particularly worrying since ten years should be enough to acquire proficiency. In the absence of appropriate education policies, the future integration of these children already looks at risk at the age of 10.[9]

In general, our findings suggest that destination countries should promote linguistic integration in the very first years of education. Moreover, investing in the linguistic integration of first generations should be a priority since its benefits spillover to the second generations.

The rest of the paper is organized as follows. Section 2 reviews some related literature. Section 3 describes our data. Section 4 introduces the empirical strategy. Section 5 discusses the results, and Section 6 concludes.

[8]This refers to the widely adopted scale that evaluates proficiency on a range from Level 1 (lowest) to 5 (highest). Level 3 is defined by scores in the range of (95%; 110%] of the natives' average. According to the National Educational Criteria (*Indicazioni Nazionali e Linee Guida* stated in the *D.M. n. 254 del 16/11/2012*) and the INVALSI framework, (INVALSI (2018)) this level defines a sufficient command of Italian.

[9]These children account for 65.70% of the second generations in the school year 2014-15, 51.23% in the school year 2015-16, 66.13% in the school year 2016-17, and 54.27% in the school year 2017-18.

2.2 Related Literature

This analysis bridges two groups of literature. The first studies the relationship between the acquisition of language proficiency and the development of further skills (Barwell (2005a); Barwell (2005b); Dustmann and Glitz (2011); Akresh and Akresh (2011); Isphording, Piopiunik, and Rodriguez-Planas (2016)). The second concerns the economics of language and migration (Chiswick and Miller (2007), Chiswick and Miller (2015)).Our contribution is also broadly related to the research about skill formation and early childhood interventions (Heckman (2006), Cunha and Heckman (2007), Heckman and Masterov (2007), Almond and Currie (2011) Fryer and Levitt (2013), Almond, Currie, and Duque (2018)).

Chiswick and Miller (2001) and Chiswick and Miller (2015) argue that language is perhaps the most important form of human capital for the immigrants. Therefore, its acquisition and degree of proficiency are, to some extent, the result of an investment decision. According to Chiswick and Miller, the economics of language proficiency is governed by factors that include the exposure to the destination country language, the efficiency of the investment, and the economic incentives. The latter include, for instance, higher wages, lower probability of unemployment, and increased participation in the social, cultural and political environment of the receiving society.

Language proficiency is essential not only on its own but also as a factor that helps the acquisition of other skills[10](Chiswick and Miller (2003); Berman, Lang, and Siniver (2003)). We try to identify similar mechanisms; however, unlike Chiswick and Miller, who focus on first-generation adults in the labor market, we focus on second-generation children who are exposed to the destination country since their birth and are young enough to conserve a high psycho-biological elasticity in acquiring languages.

As we argued in the previous section, this also differentiates our analysis with respect to Bleakley and Chin (2004), Isphording, Piopiunik, and Rodriguez-Planas (2016), and Aparicio-Fenoll (2018). The first consider first-generation adults aged 25-38; the second consider first-generation students aged 15; the third considers a mix of first and second-generation children aged 6-12.

Focusing on 10-year-old children allows us to examine an age where possible policy interventions are likely to be most effective. This is even more important since the lack of language proficiency inherited by the second generations can have permanent effects unless the school does not neutralize it.[11] Thus, analyzing the outcomes of fifth-grade students is important not only because their age is critical for human capital formation but also because it provides a broad assessment of the Italian Primary School in integrating the second generations.

[10] In the case of the first generation , it is also crucial to transfer initial human capital in the destination country (Chiswick and Miller (2009); Dustmann and Glitz (2011)).

[11] Many authors show that early childhood can be decisive for the long-term performance of individuals (Almond, Currie, and Duque (2018)). This occurs because disadvantages accumulate over time due to mechanisms like the dynamic complementarity and the self-productivity outlined by Cunha and Heckman (2007).

2.3 Data

We use data on the performance in Italian and Math on the standardized test administered by INVALSI. The whole population of students in the 2nd (7-year-old) and 5th (10-year-old) grade of the Primary School is evaluated every year.[12] We focus on second-generation children in the 5th grade, which is the last Primary School grade.[13]

The INVALSI tests are standardized, anonymous, and marked outside the schools; thus, the measure of performance is as objective as possible. Moreover, since some authors have detected cheating behavior (Quintano, Castellano, and Longobardi (2009); Bertoni, Brunello, and Rocco (2013); Angrist, Battistin, and Vuri (2017)), scores are corrected for this possibility.[14]

The "Student's Questionnaire," which is administered to 5th-grade students, includes detailed information on family characteristics and home environment.[15] This material is summarized in a synthetic index of economic, social, and cultural status (ESCS index[16]). Additional useful information comes from questions about the student herself, her family, and her attitude towards the classes and the test. In particular, pupils are asked whether they

[12]Evaluations began in 2005-06. However, mandatory participation of the schools to the test started in 2009-2010.

[13]We define "second generations" as children born in Italy with both non-Italian parents. Equivalently, we define "natives" as children born in Italy with both Italian parents.

[14]Cheating is a broad concept that denotes any attempt to alter the results both by students and teachers (Jacob and Levitt (2003)).

[15]For instance, the availability of a computer, an internet connection, a quiet room, a desk, encyclopediae, and the number of books.

[16]This indicator considers parents' occupation, education, as well as educational resources available at home. See Campodifiori et al. (2010).

speak Italian or other languages at home.[17] We consider a repeated cross-section of 5th-grade students for the school years 2014-15, 2015-16, 2016-17, and 2017-18. We start with 2014 because the question that identifies the linguistic origin of pupils was introduced then. The subsample of second generations includes 99,952 pupils.[18] The linguistic distance from Italian is a continuous variable computed through the Automated Similarity Judgment Program (ASJP) database, which is commonly used in linguistic analyses.[19] A major advantage of our analysis is that the linguistic distance refers to the language *actually* spoken. Though most authors (like Isphording, Piopiunik, and Rodriguez-Planas (2016) and Bleakley and Chin (2004)) try to infer this language from information on the country of origin, associating a country to a single language is not always possible since different languages may be spoken. This is the case of many North-African countries that are a major source of emigration to Italy.[20]

[17]Namely, Albanian, Arabic, Chinese, Croatian, French, Greek, Hindi, English, Ladin, Portuguese, Romanian, Slovenian, Spanish, German, or a language not included in the previous list.

[18]This number excludes second-generation children who speak languages not included in the list. In order to avoid errors in data, it also excludes all children who are at least two years younger or older than 10. In Italy, it is not possible to start school before 5, and all children must finish Primary School by the age of 12. Classes with INVALSI observers have also been excluded because external observers may affect the chilren's behavior.

[19]See Wichmann, Holman, and Brown (eds.), 2018. The ASJP Database (version 18). This measure of linguistic distance is built by comparing the inner structure of 40 words in all the world's languages and gives a continuous measure that ranges from a minimum distance of 58.77 (Romanian-Italian) to a maximum distance of 101.14 (Chinese-Italian). It compares the phonetic similarity between pairs of words in two languages that have the same meaning. This should capture the existence of common ancestries that can affect the ease of learning Italian (Isphording and Otten (2013)).

[20]For instance, immigrants from Morocco can speak Arabic, French, or Spanish; immigrants from Egypt speak Arabic, French or English; immigrants from Tunisia speak Arabic or French, and immigrants from India speak Hindi or English. Immigrant stocks from these countries are sizable in Italy: on December 31, 2018, we observe 422,980 immigrants from Morocco, 126,733 from Egypt, 95,071 from Tunisia, and 157,965 from India. Source: ISTAT (2018a)

The main variables are summarized in Table 2.1. The dependent variable of our regressions is the score in Math. The mathematical section of the test is made of various subsections that include numerical questions, geometry, mappings, data, and forecasting. The test of Italian focuses on text comprehension and on the grammatical and lexical structure of the sentence. This test of language proficiency is much more reliable than self-reported assessments.

In the data, the natives perform better than second generations, both in Math and in Italian. However, second generations also face worse socioeconomic conditions, so this result is expected. Their parents are generally less educated, more unemployed, or employed in low-wage jobs.

2.4 Empirical Strategy

In this work, we try to assess the importance of linguistic skills for the acquisition of Math skills. Before proceeding, it is necessary to clarify why linguistic skills should be important for understanding Math. After all, it is generally acknowledged that Math is a symbolic language of its own. However, it is also widely accepted that it depends to a large extent on oral language and cannot be viewed as a non-verbal subject (Cuevas (1984); Lager (2006); Vukovic and Lesaux (2013); Naziev (2018); Wilkinson (2019)).

In other words, language skills are the vehicles through which students learn

TABLE 2.1: Descriptive Statistics

Variable	Natives	Second Generations	Diff.
Female	0.4948	0.4965	-0.0016
	(0.0005)	(0.0017)	(0.0018)
Age in Months	129.3924	130.2242	-0.8318***
	(0.0083)	(0.0308)	(0.0319)
Math Score	57.2472	50.097	7.1501***
	(0.0554)	(0.2048)	(0.2123)
Italian Score	62.809	54.232	8.5775***
	(0.0498)	(0.1840)	(0.1919)
ESCS student	0.135	-0.490	0.6257***
	(0.0035)	(0.0130)	(0.0134)
Mother's Higher Education	0.200	0.116	0.0843***
	(0.0011)	(0.0040)	(0.0041)
Father's Higher Education	0.154	0.095	0.0592***
	(0.0010)	(0.0036)	(0.0037)
Mother Unemployed	0.314	0.518	-0.2042***
	(0.0016)	(0.0058)	(0.0060)
Mother Blu-collar worker	0.106	0.221	-0.1150***
	(0.0006)	(0.0024)	(0.0024)
Mother Self-employed	0.084	0.057	0.0269***
	(0.0004)	(0.0015)	(0.0016)
Mother White-collar worker	0.374	0.056	0.3172***
	(0.0015)	(0.0056)	(0.0059)
Father Unemployed	0.042	0.090	-0.0479***
	(0.0005)	(0.0017)	(0.0017)
Father Blu-collar worker	0.235	0.499	-0.2642***
	(0.0011)	(0.0041)	(0.0042)
Father Self-employed	0.226	0.174	0.0519***
	(0.0008)	(0.0030)	(0.0031)
Father White-collar worker	0.359	0.069	0.2900***
	(0.0014)	(0.0051)	(0.0053)
Obs	1,304,886	99,952	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Standard Errors in parenthesis clustered at the school-cohort level.

and apply Math and are used in testing Math skills.[21] The ability to participate in classroom interactions, ask questions, and express doubts is crucial in order to benefit from the Math classes. All these reasons clarify why language proficiency is a prerequisite to learn Math.[22]

As a first approach to evaluate the relationship between the performance in Math and the performance in Italian, one may use a standard regression:

$$ScoreMath_{ijt} = \beta_0 + \beta_1 ScoreItalian_{ijt} + \beta_2 Dist_{ijt} + \beta_3 Age_{ijt} + \mathbf{X}_{ij}\lambda + \vartheta_j + \mu_t + \epsilon_{ijt}, \quad (2.1)$$

where *ScoreMath* is the score in Math of student i in class j, *ScoreItalian* is the score in Italian, *Dist* is the linguistic distance between the language spoken at home and Italian, *Age* is the student's age in months, $\mathbf{X}_{ij}$ is a vector of socioeconomic controls, ϑ_j are class fixed effects, and μ_t are wave fixed effects. However, this specification suffers from an omitted variable bias because students' motivation and ability are not observable but are crucial for their educational results. To identify the causal effect of linguistic proficiency in Math, we use an instrumental variable for the score in Italian. Usually, the literature about the effects of language proficiency adopts instruments given by the interaction between the immigrants' age at arrival and the linguistic distance or a dummy for non-English speaking countries (see Bleakley and Chin (2004); Isphording, Piopiunik, and Rodriguez-Planas (2016); and

[21]Notice that special Math textbooks exist for children who do not speak the mother tongue. For Italy, see Arici and Maniotti (2010).

[22]See section 2 for the economics of language literature.

Aparicio-Fenoll (2018)). Since, unlike these authors, we focus on second generations, it is not possible to use these authors' instruments for our purposes. Our individuals are born in Italy; thus we cannot use variation in age at arrival.

However, differences in age are still a good proxy of exposure to Italian. Actually, as suggested by the vast literature on age effects, being born only a few months before her peers gives a child considerable advantages because "older" children have had more time for learning and benefit from their higher psycho-biological maturity (Black, Devereux, and Salvanes (2011); Crawford, Dearden, and Greaves (2014); Dee and Sievertsen (2018); Duckworth and Peña (2018)). In our case, an "older" age gives the children more time to learn Italian.[23] As a consequence, we use the interaction between age and linguistic distance from Italian as our instrumental variable. Notice that we do not use either linguistic distance or age as an instrument because both could be endogenous.

In the case of age, there are many potential causes of endogeneity. First, parents may plan the birth of their children (Buckles and Hungerman (2013)). Second, parents may choose to anticipate or postpone school entrance (West, Meek, and Hurst (2000); Aliprantis (2012); Lenard and Peña (2018)). This is particularly relevant for Italy, where parents, in many cases, can decide to

[23]In principle, since the ability in the acquisition of language is inversely related to age, there could be a confounding effect that goes in the opposite direction. This critique does not apply to our case because our sample is made of children within the critical period for language acquisition. This ensures a precise direction of the effect of age on language performance.

anticipate the enrollment of their children in Primary School.[24] Finally, age could also capture grade retention even though retention is very rare in the Italian Primary School. As a consequence, age does not fit as an instrumental variable. Similarly, linguistic distance may be endogenous because different linguistic origins may induce a different selection in the migration decision. This kind of selection can depend on unobservable characteristics that could be transmitted to the children. If these characteristics affect scores, they could induce endogeneity as well.

On the other hand, the interaction of age and linguistic distance captures the exposure to Italian *across different languages* and can be used as our instrument. In other words, given the heterogeneity in birthdays and origin countries, we can isolate the effect on the score in Italian given by differences in the exposure across different linguistic distances.

Problems of endogeneity could arise, for instance, if exposure to Italian were determined by the *natives*, who could discriminate against second generations in social interactions. If the natives discriminate against the second generations, the mechanism of the exposure could fail. However, discrimination is *not* based on *language*. Rather, it applies to ethnicity, gender, race, and so on. Discrimination on the *sole* basis of language is very unlikely. Yet, this could still be a concern if language were perfectly correlated with ethnicity. This is not the case for our sample, where an individual speaking French

[24] Anticipation is very common in Italy, where, though enrollment is compulsory for all children who are 6 in September, parents can enroll younger children provided that they turn 6 by April 30 of the following year. Since exercising or not this option is a choice, this creates an important source of endogeneity.

could be either African or European; an individual speaking English could be European, African, Indian, and so on. As a consequence, in the absence of perfect correlation between languages and ethnicity, this concern does not apply.

Family self-segregation could be another source of endogeneity: parents could decide to reduce the exposure to the Italian culture in order to preserve their traditional norms and customs. However, the choice of separation from the receiving society may happen at *any* level of linguistic distance. To the extent that there is no perfect correlation between the level of linguistic distance and family self-segregation, this concern does not apply either. Thus, we conclude that the interaction between age and linguistic distance is likely to be exogenous.

As a supplement to our analysis, we also use an alternative instrument inspired by Bleakley and Chin (2004). This instrument is given by the interaction between age and a dummy coded 1 if the child does *not* speak Italian at home. This interaction captures the exposure to Italian as if all languages had the same distance from Italian. As a consequence, it is a much rougher instrument with respect to the one we have chosen. Nonetheless, we think it is a useful check.

In what follows, we estimate a two-stage least squares model, where the first stage is given by

$$ScoreItalian_{ijt} = \alpha_0 + \alpha_1 Age_{ijt} * Dist_{ijt} + \alpha_2 Dist_{ijt} + \alpha_3 Age_{ijt} + \mathbf{X}_{ij}\lambda + \vartheta_j + \mu_t + \eta_{ijt}, \quad (2.2)$$

and the second stage is given by

$$ScoreMath_{ijt} = \gamma_0 + \gamma_1 Score\hat{I}talian_{ijt} + \gamma_2 Dist_{ijt} + \gamma_3 Age_{ijt} + \mathbf{X}_{ij}\rho + \varphi_j + \chi_t + \xi_{ijt}. \quad (2.3)$$

The results of our regressions are reported in the following Section.

2.5 Results

In Table 2.2, we report the OLS estimation of Equation 2.1 on the whole sample of second-generation students. OLS regressions find a sizable positive relationship between the score in Italian and the score in Math. Actually, increasing the score in Italian by one point, the score in Math increases by 0.6 points. However, this relationship can hardly capture a causal effect.

In Tables 2.3 and 2.4, we report the 2SLS estimation[25] of equations 2.2 and 2.3. Specification (1) uses our main instrument, and specification (2) the instrument *à la* Bleakey and Chin. In the next sections, we present the first and the second stage, respectively .

[25] IV regressions with class-by-cohort fixed effects are performed by using Stata module IVREGHDFE (Correia (2018)).

2.5.1 First stage

Our main instrument -the exposure to the destination country's language across the different linguistic origins- is the interaction between age (measured in months) and the linguistic distance from Italian, which are both continuous variables. As a consequence, the coefficient on their interaction measures how the effect of the exposure to Italian on the score in Italian changes as the linguistic distance changes.[26] A higher linguistic distance makes exposure less effective; thus the negative sign we find is expected.[27]

The coefficient of age is positive and significant at the 1% level. Notice that since in the first-stage regression we have the interaction age*distance, this coefficient does *not* represent the main effect of age but gives the absolute age effect *when the linguistic distance is zero.*[28] This only holds for second-generation children who speak Italian at home. For non-Italian speakers, the effect of age is given by $\alpha_1 + \alpha_3 * (Distance)$. For instance, in the case of the Chinese, who are the most linguistically distant, it is -0.125 score points. In other words, *the effect* of age (namely, exposure) decreases as the linguistic distance increases.

The coefficient of the linguistic distance is also positive and significant at the 1% level. Again, since we have the interaction age*distance, by itself, it only gives the effect of the linguistic distance *when age is zero*. When we consider

[26]This coefficient can also be interpreted as how the effect of the linguistic distance on the score in Italian changes when the exposure to Italian changes.

[27]Similarly, the effect of linguistic distance decreases as the exposure to Italian increases.

[28]See Jaccard and Turrisi (2003) for a useful review.

this effect conditioned on a more plausible age, it becomes negative as expected. For instance, at the age of 123 months (10.25 years), it is -0.051. At the age of 132 months (11 years), it is -0.078 score points. Thus, *the effect* of the linguistic distance decreases as the exposure increases.

Finally, the F-statistic of the instrument is above the Stock and Yogo threshold; thus it is considered relevant.

We obtain analogous results with the instrument *à la* Bleakey and Chin.

2.5.2 Second stage

Turning to the second stage, we note that the coefficient of the instrumented score in Italian is negative and significant at the 1% level. Increasing the score in Italian by one point *decreases* by 0.55 points the score in Math. At first sight, this result looks unexpected since it seems to contradict the idea that language proficiency is a prerequisite for understanding Math classes taught in Italian. However, at a closer look, the negative coefficient simply suggests that the children still have to sacrifice their performances in other subjects if they want to improve their score in Math.

We should also remark on the large difference between the OLS and IV estimates. In other words, the OLS estimator looks heavily biased. This is not surprising since the naïve relationship between the score in Italian and the score in Mathematics is driven by omitted variables such as ability and motivation. These omitted variables should generate an *upward* bias in the

OLS coefficient, which we actually find. Previous literature, such as Isphording, Piopiunik, and Rodriguez-Planas (2016), and Aparicio-Fenoll (2018), also identifies an upward bias, though less considerable. In our case, the ability bias seems to be higher in absolute value than the negative value of the instrumented coefficient, which is the reason why the OLS coefficient is positive. This outcome is in line with the literature and confirms the crucial importance of unobserved cognitive and non-cognitive abilities for educational and economic performances (Heckman, Stixrud, and Urzua (2006); Borghans et al. (2016); Hitt, Trivitt, and Cheng (2016); Peña and Duckworth (2018); Zamarro, Hitt, and Mendez (2019)).

We try to shed further light on the trade-off we have uncovered. Our idea is that the causal relationship between proficiency in Italian and scores in Math may be nonlinear. Once the threshold for understanding a Math class is attained, further progress in Italian could be irrelevant for the Math performance. Therefore, we expect that the negative effect of the performance in Italian on the performance in Math could be particularly relevant for children who under-perform in Italian. In order to test this idea, we first have to identify a proper threshold. Since the INVALSI approves Proficiency Level 3 as a "sufficient" knowledge of Italian, we compute the threshold accordingly,[29] and then we split our sample between children below the threshold and children on or above the threshold.

[29] Proficiency Level 3 is defined as a score belonging to a range that goes from 95% to 110% of the natives' average score. Thus, we take the lower bound, namely 95%, as our threshold.

2.5.3 Second Generations under Proficiency Level 3

In table 2.5, we report the first-stage estimation for second-generation children whose performance in Italian is under Proficiency Level 3. Again, we may note that the effect of exposure to Italian decreases as the linguistic distance increases, and the effect of the linguistic distance decreases as the exposure increases.

The F-statistic of the instrument is above the Stock and Yogo threshold; thus, it is considered relevant. In table 2.6, we report the second-stage estimation. The effect of the Italian score on the Math score is negative and statistically significant at the 1% level. Increasing the score in Italian by one unit, decreases the score in Math by 1.37 or 1.46 points, depending on the specification. This suggests that the negative effect we uncover is driven by the subsample of children under Proficiency Level 3.

The same estimation strategy for second-generation children who perform beyond the sufficiency threshold does not work as well. In tables 2.7 and 2.8, we report two-stage least squares estimations for this subsample. Both instruments are weak, suggesting that exposure to Italian *per se* does not explain the performance in Italian beyond sufficiency. As a consequence, we cannot use our instruments to estimate the causal effect of the Italian score on the Math score for students on or above Proficiency Level 3.

2.6 Conclusions

In this study, we estimated the effect of language acquisition on the performance in Math of second-generation children at the end of Italian Primary school. This age deserves special attention because a vast literature suggests that 1) early educational gaps may have lifetime effects and, in any case, are hard to recover in later years; 2) language proficiency is required to acquire other forms of human capital; 3) language proficiency is crucial for the social and economic integration of the second generations.

The existing literature is still in the making, and the results are somewhat contrasting. While Isphording, Piopiunik, and Rodriguez-Planas (2016) find a positive effect of linguistic performances on Math outcomes, Aparicio-Fenoll (2018) finds no evidence of such an effect.

Using Italian data on second-generation children, we found that a higher test score in Italian *reduces* the score in Math.

This result reveals that second generations are still struggling to learn Italian at the age of 10, and they can do so only at the cost of reducing their performance in other subjects. Actually, the effect is driven by children with insufficient knowledge of Italian who account for 59% of our sample. Thus, it seems that the large majority of the second generation is already being left behind. These children cannot benefit from the complementarity between language proficiency and other forms of human capital as other children do. They look doomed to poor future educational performances and, therefore, to poor labor market outcomes. This penalization evokes scaring long-term scenarios.

Overall, our findings have profound policy implications. First, they suggest that primary education should consider linguistic integration as a priority, and avoid leaving behind children with poor linguistic backgrounds.[30] Second, they stress that investing in the linguistic integration of the first generation can generate positive spillovers on the second generation. Overall, we confirm that efforts to linguistically integrate immigrants should be of the greatest importance because these efforts yield high social returns not only in the short run (by improving the economic possibilities of newcomers) but also in the very long run (by intergenerational spillovers). Unlike policies that take place later in life, achieving linguistic integration in the Primary School is simpler and has permanent effects.

[30]The awareness of this issue is increasing in Italy: since 2012, the Ministry of Education has introduced the possibility of adopting customized study plans *(piani di studio personalizzati)* for children with limited proficiency in Italian. These plans may be adopted by the schools after a linguistic assessment of the child. They replace the most linguistically demanding subjects with easier ones, or simply reduce the educational objectives the student has to meet to pass her grade. There also exist some Math textbooks for children with limited command of Italian. However, these measures are not yet a systematic approach to the linguistic integration of the minorities.

TABLE 2.2: OLS regression

Math Score	**OLS (1)**	**OLS (2)**	**OLS (3)**
Score Italian	0.644***	0.628***	0.627***
	(0.00273)	(0.00544)	(0.00544)
Age in months	0.205***	0.211***	0.212***
	(0.0118)	(0.0204)	(0.0204)
Distance	0.0108***	0.0103***	
	(0.00111)	(0.00200)	
Non Italian			0.646***
			(0.174)
Obs	99,917	99,917	99,917
Controls	YES	YES	YES
Class-by-cohort FE	NO	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Robust Standard Errors in parenthesis (OLS (1))
Clustered Standard Errors at the school-cohort level (OLS (2) and OLS (3))
Controls: student's gender, socioeconomic background (ESCS index)
Math score, total and first section of the Italian test score are corrected for cheating.

TABLE 2.3: Two-stage least square regression. First Stage

Score Italian	**(1)**	**(2)**
Age in months	0.178***	0.152***
	(0.02659)	(0.02718)
Distance	0.318***	
	(0.05009)	
Non Italian		24.250***
		(4.62195)
Age in months* Distance	-0.003***	
	(0.00039)	
Age in months* Non Italian		-0.214***
		(0.03556)
Kleibergen-Paap rk Wald F statistic	53.355	36.19
Obs	77,457	77,457
Controls	YES	YES
Class-by-cohort FE	YES	YES

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

TABLE 2.4: Two-stage least square regression. Second Stage

Math Score	**(1)**	**(2)**
Score Italian	-0.552***	-0.555**
	(0.192)	(0.235)
Age in months	0.241***	0.238***
	(0.0255)	(0.0256)
Distance	-0.0467***	
	(0.00945)	
Non Italian		-3.622***
		(0.863)
Obs	77,457	77,457
Controls	YES	YES
Class-by-cohort FE	YES	YES

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

TABLE 2.5: Two-stage least square regression. First Stage (Score Italian < Level 3)

Score Italian	(1)	(2)
Age in months	0.008	-0.018
	(0.02741)	(0.02819)
Distance	0.233***	
	(0.04937)	
Non Italian		17.090***
		(4.64034)
Age in months*Distance	-0.002***	
	(0.00038)	
Age in months*Non Italian		-.148***
		(0.03568)
Kleibergen-Paap rk Wald F statistic	27.94	17.14
Obs	38,759	38,759
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

TABLE 2.6: Two-stage least square regression. Second Stage (Score Italian < Level 3)

Math Score	(1)	(2)
Score Italian	-1.369***	-1.457***
	(0.423)	(0.561)
Age in months	0.0170	0.00359
	(0.0598)	(0.0744)
Distance	-0.0374***	
	(0.0124)	
Non Italian		-3.200**
		(1.253)
Obs	38,759	38,759
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

TABLE 2.7: Two-stage least square regression. First Stage (Score Italian ≥ Level 3)

Score Italian	(1)	(2)
Age in months	0.143***	0.140***
	(0.02496)	(0.02560)
Distance	0.106**	
	(0.04911)	
Non Italian		8.662*
		(4.46891)
Age in months*Distance	-0.0009**	
	(0.00038)	
Age in months*Non Italian		-0.073**
		(0.03428)
Kleibergen-Paap rk Wald F statistic	5.78	4.55
Obs	22,185	22,185
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

TABLE 2.8: Two-stage least square regression. Second Stage (Score Italian ≥ Level 3)

Math Score	(1)	(2)
Score Italian	-1.179	-1.063
	(1.058)	(1.149)
Age in months	0.323***	0.311**
	(0.114)	(0.123)
Distance	-0.0185	
	(0.0130)	
Non Italian		-1.385
		(1.055)
Obs	22,185	22,185
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Clustered Standard Errors at the school-cohort level
Controls: student's gender, socioeconomic background (ESCS index)

Chapter 3

Absolute and Relative Age Effects in Children's Performance. A Double Disadvantage for Second Generations?

3.1 Introduction

The *double disadvantage hypothesis* suggests that the interaction between two disadvantages may generate a new, and possibly stronger, one (Raijman and Semyonov (1997); De Jong and Madamba (2001); Ludemann and Schwerdt (2013); Durand, Massey, and Pren (2016)). For instance, ethnic minority women may experience disadvantages in the labour market both because they are women and because they belong to a minority group (Raijman and Semyonov (1997)). Another example is given by illegal immigrants. This subset of immigrants experiences an additional penalty in the labour market, earning lower wages than natives and *legal* migrants (Durand, Massey, and Pren (2016)).

This study investigates whether a double disadvantage exists among second-generation children in the Italian Primary School.

The first disadvantage of second generations is specific to their immigrant status, which is supposed to impose a penalty on language skills and, more generally, on the socioeconomic condition. Actually, many authors find that second generations perform worse than their native peers, suggesting that an early disadvantage may easily arise in the educational process (Van Ours and Veenman (2003); Schnepf (2007); Dustmann et al. (2012); Ochinata and Van Ours (2012)).

Another possible source of disadvantage, not connected to the immigrant status, concerns age. Age can affect educational outcomes through two channels: the absolute age effect (henceforth AAE), and the relative age effect (henceforth RAE). The former occurs because older children are more mature or have more experience, thus are more prepared to formal learning in school. The latter comes from peer effects that could, for instance, hinder self-esteem in pupils who feel weaker and more vulnerable than their older peers in the classroom[1].

[1]Various evidences, for instance, show that relative older students have a higher self-esteem (Fenzel (1992); Thompson, Barnsley, and Battle (2004)), less psychological problems (Thompson, Barnsley, and Dick (1999); Goodman, Gledhill, and Ford (2003); Matsubayashi and Ueda (2015); Chen, Fortin, and Phipps (2016)), are less likely to be victimized (Mühlenweg (2010); Ballatore, Paccagnella, and Tonello (2020)), and more likely to undertake competitive and leadership activities Dhuey and Lipscomb (2008).

Both the AAE and the RAE imply that younger students tend to perform worse than their older peers in the classroom[2] (Bedard and Dhuey (2006); Elder and Lubotsky (2009); Black, Devereux, and Salvanes (2011); Crawford, Dearden, and Greaves (2014); Fredriksson and Öckert (2014); Solli (2017); Peña (2017); Peña and Duckworth (2018)). This is mainly due to differences in psycho-biological maturity, accumulated experience and interactions with peers in the classroom.

However, it is less clear whether age effects can determine a double disadvantage for immigrant children. In our case, a double disadvantage appears if the AAE or the RAE reinforces the (negative) effect of the immigrant status. The possible existence of a double disadvantage has worrying long-term consequences for the stability and the social cohesion of the receiving societies. Social integration is a fragile process that moves along many socioeconomic dimensions (Berry (1980); Zimmermann, Zimmermann, and Constant (2007); Constant and Zimmermann (2008); Constant, Gataullina, and Zimmermann (2009); Gorinas (2014)). For instance, in spite of a satisfactory economic integration, an immigrant could not achieve (or even not pursue at all) the cultural integration in the receiving country, and stay separated from its society. When social integration fails, immigrant communities may turn into segregated and possibly permanently disadvantaged minorities.[3]

[2]However, some studies find that possible opposite effects could be at work in particular environments. For instance, Pellizzari and Billari (2012) find that younger first-year university students perform *better* at cognitive tests.

[3]The recent and worrying phenomenon of second-generation terrorists is one major example that proves the importance of a satisfactory integration along *all* dimensions in order to prevent anti-social attitudes. Education is crucial in this respect.

Early education can be decisive in determining the future outcomes of second generations (Doyle et al. (2009); Heckman, Pinto, and Savelyev (2013); Elango et al. (2015); Garcia, Heckman, and Ziff (2019)). Actually, mechanisms like the dynamic complementarity and the self-productivity outlined by Cunha and Heckman (2007) tend to reproduce and amplify early educational gaps, making it harder and harder to catch up with the natives. In other words, initial disadvantages are hard to recover and may persist over the whole life. On the contrary, a possible advantage generated by age effects for second-generation children could be helpful in reducing the disadvantage given by their migrant status.

Thus, testing for the existence of a double disadvantage may be essential to understand a possible understudied side effect that may make the integration of second-generation children even more difficult.

However, the literature that studies the interaction between age effects and immigration status is still reduced. We contribute to this literature in various way.

First, we provide additional evidences of the possible existence of a double disadvantage among *second*-generation immigrant children. Second, by adopting the strategy introduced by Peña and Duckworth (2018), which exploits the heterogeneity in children's birthdays and the repeated observations of test scores, we are able to distinguish between relative and absolute age effects. Actually, we find that AAE can hinder the linguistic performance of second-generation children at the end of the Primary School, while the performance in Math is not further affected by this effect. However, we find that the RAE can be helpful for second-generation children. This is even more important since the (positive) effect of relative age offsets the (negative) effect of absolute age. Third, we analyze children at the crucial age of 10, which is by many aspects a critical period, when the basis of human capital accumulation is built, and a break in these delicate process may have lifetime consequences.

The rest of the analysis is organized as follows. Section 3.2 reviews the existing literature. Section 3.3 describes the data. Section 3.4 introduces the empirical strategy. Section 3.5 discusses our results. Section 3.6 concludes.

3.2 Related Literature

Our contribution is related to two strands of literature. The first is the literature on the double disadvantage (Raijman and Semyonov (1997); De Jong and Madamba (2001); Ludemann and Schwerdt (2013); Durand, Massey, and Pren (2016)). The second is the literature on age effects (Bedard and Dhuey (2006); Elder and Lubotsky (2009); Black, Devereux, and Salvanes (2011); Fredriksson and Öckert (2014); Solli (2017); Peña (2017); Peña and Duckworth (2018)).

The idea of the double disadvantage hypothesis is that two different disadvantages may generate a new, and possibly stronger, one. Raijman and

Semyonov (1997), for instance, study the relation between being an ethnic minority woman and labour market outcomes. Ethnic minority women may experience disadvantages in the labour market *both* because they are women *and* because they belong to a minority group. Moreover, these disadvantages could differ across different ethnic groups. This may generate a *triple disadvantage* for women belonging to some particular ethnic groups, as for immigrant women coming from Asian and African less developed countries in the Israeli labor market. A similar result is found by De Jong and Madamba (2001) for Asian women in the US labour market. Another example is given by Durand, Massey, and Pren (2016) who focus on illegal Mexican immigrants in the US. They find that this subset of immigrants experience an additional penalty in the labor market, by earning lower wages than natives and *legal* immigrants.

Another strand of literature has focused on immigrant students and educational outcomes. For instance, Ludemann and Schwerdt (2013) investigate whether second-generation immigrant students may experience additional disadvantages which are not directly related to their performance and abilities, such as worse grades or teacher recommendations for secondary school tracks.

This work has much in common with this literature. However, we investigate a peculiar relationship between AAE, RAE and the migration status of second-generation immigrant children, finding that, while the first can be a source of double disadvantage, the second can exert a positive effect on the school performance.

An established literature has investigated the effect of age on educational performance.[4] Older students generally perform better than younger students. The idea is that being born only a few months before her peers gives the child considerable advantages, since "older" children have had more time for learning and benefit from their higher psycho-biological maturity (Bedard and Dhuey (2006); Elder and Lubotsky (2009); Black, Devereux, and Salvanes (2011); Crawford, Dearden, and Greaves (2014); Fredriksson and Öckert (2014); Solli (2017); Peña (2017); Peña and Duckworth (2018)). However, the literature that investigates whether AAEs or RAEs may generate a double disadvantage for second-generation children is still in its infancy. Only a few papers study whether the interaction between age effects and immigrant status may generate further disadvantages.

Dicks and Lancee (2018) analyze whether RAEs generate a double disadvantage for 15 years old immigrant students in France. They find that both socioeconomic characteristics and immigrant-specific disadvantages may explain the immigrant-native gap in grade retention rates. However, a large part of immigrants' disadvantage is due to their poorer parental resources. Moreover, they do not distinguish between relative and absolute age effects. Lenard and Peña (2018) study the difference in parental strategic behavior between the minorities and the majority in North Carolina. They find that a part of the native-immigrant achievement gap is due to the higher frequency

[4] Outcomes in other fields have also been analyzed, such as in sport Allen and Barnsley (1993), politics Muller and Page (2016), and management Du, Gao, and Levi (2012).

of redshirting among the natives.

We provide further evidence by showing that age differentials can generate both a double disadvantage and an advantage for second-generation children in the Italian Primary School, depending on the age effect we are considering.

This analysis complements the previous literature in various ways. First, we study second-generation children at the age of 10; namely, at the end of Primary School, which is crucial for the second generations, because different mechanisms that can have permanent effects work in the childhood. Children are still within a "critical period"; thus, early disadvantages easily accumulate over time due to mechanisms like the dynamic complementarity and the self-productivity of skills (Cunha and Heckman (2007)). These delicate processes build the basis of human capital accumulation, and their action can have lifetime consequences.

Second, we provide further evidence of this process by linking two different disadvantages; namely, the age effect and the immigrant status. By disentangling the differential impacts of relative and absolute age in creating a possible double disadvantage, we provide novel evidence on the very different nature of these two effects. Actually, we find that only AAE has a detrimental effect for second-generation children, while RAE has a positive impact.

Since a student who is older at the moment of the test is also older with respect to her peers in class, an issue of collinearity between RAE and AAE naturally arises. As a consequence, this decomposition has rarely been achieved in the literature (Elder and Lubotsky (2009); Cascio and Schanzenbach (2016); Peña (2017); Peña and Duckworth (2018)). We use the methodology developed by Peña and Duckworth (2018) to disentangle these effects, by exploiting the heterogenity in students' birthdays and the fact that we observe the test outcomes of the same individuals two times (in the 2nd and 5th grade of Primary School). This enables us to capture the different components of age effect.

3.3 Data

We use data on the performance in Italian and Math on the standardized test administered by the Italian National Institute for the Evaluation of the Education System (INVALSI). The whole population of students in the 2nd and the 5th grade of the Primary School is evaluated every year.[5] We focus on the subsample of native and second-generation[6] children in the following school years: 2012-13 (2nd grade), 2013-14 (2nd grade), 2015-16 (5th grade) and 2016-17 (5th grade). The initial subsample of natives includes 648 267 observations, while the subsample of second generations includes 51 097 observations. We select these waves because they contain the exact birthdates of students, which we use to disentangle RAE and AAE. Given the longitudinal structure of the data, we can follow students from the 2nd grade to the 5th

[5]Evaluations began in 2005-06. However, participation of the schools to the test is mandatory only from 2009-2010.

[6]We define "second generations" as children born in Italy with both non-Italian parents. Equivalently, we define "natives" all children born in Italy, with both Italian parents.

grade (2012-13/2015-16 and 2013-14/2016-17)[7]. As suggested by Peña and Duckworth (2018), the combination of information on children's birthdates and the longitudinal dimension of our data provides a way to decompose absolute and relative age. This because the heterogeneity in birthdates gives a variation to identify the relative age, while the availability of test scores at two different points in time, gives a variation to identify absolute age.

An important feature of the INVALSI data is that tests are standardized, anonymous and marked outside the school; thus, the measure of performance is as objective as possible. Moreover, since some authors have detected cheating behavior (Quintano, Castellano, and Longobardi (2009); Bertoni, Brunello, and Rocco (2013); Angrist, Battistin, and Vuri (2017)), scores are corrected for this possibility.[8].

The data also include detailed information on family characteristics[9] and home environment[10]. This material is summarized in a synthetic index of economic, social and cultural status (ESCS index). Other useful data come from the *Student's Questionnaire*, which is administered to 5th grade students, and contains questions about the student herself, her family, her attitude towards the classes and the test.

The main variables are summarized in Table 3.1.

[7]We have two cohorts, observed two times.

[8]Cheating behavior is a wide concept that includes both student and teacher cheating (Jacob and Levitt (2003)). Methods to correct for cheating are not always error free, since it is possible to identify as a cheater someone that actually is not a cheater, or it is possible to fail to identify someone who is actually a cheater. Ferrer-Esteban (2013) and Pereda-Fernández (2019) propose an algorithmic procedure that is alternative to the Invalsi method.

[9]Mainly, father's and mother's employment, and father's and mother's education.

[10]For instance, the availability of a computer, an internet connection, a quiet room, a desk, encyclopediae, the number of books.

TABLE 3.1: Descriptive Statistics

Variable	Natives	Second Generations	Diff.
Female	0.4957	0.5001	-0.0044*
	(0.0007)	(0.0024)	(0.0024)
Math Score 2	59.1339	51.8493	7.2845***
	(0.0741)	(0.2704)	(0.2804)
Math Score 5	58.1370	51.0769	7.0601***
	(0.0757)	(0.2764)	(0.2866)
Italian Score 2	64.5935	56.5395	8.0540***
	(0.0706)	(0.2578)	(0.2673)
Italian Score 5	63.2457	54.5021	8.7436***
	(0.0709)	(0.2586)	(0.2681)
ESCS Student	0.1307	-0.4863	0.6170***
	(0.0048)	(0.0176)	(0.0183)
ESCS Class	0.0435	-0.0631	0.1066***
	(0.0046)	(0.0168)	(0.0174)
ESCS School	0.0304	-0.0050	0.0354**
	(0.0046)	(0.0168)	(0.0174)
Mother's Higher Education	0.1974	0.1211	0.0762***
	(0.0015)	(0.0054)	(0.0056)
Father's Higher Education	0.1516	0.0992	0.0524***
	(0.0013)	(0.0048)	(0.0050)
Mother Unemployed	0.3200	0.5326	-0.2126***
	(0.0022)	(0.0081)	(0.0084)
Father Unemployed	0.0408	0.0896	-0.0488***
	(0.0006)	(0.0023)	(0.0023)
Mother Blue-collar worker	0.1049	0.2221	-0.1172***
	(0.0009)	(0.0033)	(0.0034)
Father Blue-collar worker	0.2364	0.5160	-0.2796***
	(0.0016)	(0.0057)	(0.0059)
Mother White-collar worker	0.3701	0.0564	0.3137***
	(0.0021)	(0.0078)	(0.0081)
Father White-collar worker	0.3573	0.0697	0.2876***
	(0.0019)	(0.0070)	(0.0073)
Mother Self-employed	0.0834	0.0489	0.0345***
	(0.0006)	(0.0021)	(0.0022)
Father Self-employed	0.2275	0.1674	0.0600***
	(0.0011)	(0.0041)	(0.0042)
Obs	648 267	51 097	

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Standard Errors in parenthesis clustered at the school-cohort level.

The dependent variable of our regressions is the score in Math or the score in Italian in the 5th grade. The Mathematical section of the test is made of various subsections that include numerical questions, spatial reasoning, mappings, data and forecasting. This means that the test measures a wide range of knowledge, which require quantitative reasoning, logical reasoning, as well as the ability to construct arguments. The test of Italian, instead, focuses on text comprehension and on the grammatical and lexical structure of sentences.

Absolute age (AA_{it}) is defined as the age in days of the student on the test date. It varies across students and across years. Relative age (RA_i) is defined as the difference between the student's absolute age and the absolute age of the youngest student in class. It only varies across students but not across time.

In our data, natives perform better than second-generations both in Math and in Italian. However, second generations face also worse socioeconomic conditions, and this result is expected. Their parents are generally less educated, more unemployed, or employed in low-wage jobs.

3.4 Empirical Strategy

We follow Peña and Duckworth (2018) to disentangle relative and absolute age effects. The absolute age is defined as the age in days on the day of the test; it captures the effects due to the psycho-biological development of the child and her accumulated experience. The relative age is defined as the difference between the child's own age and the age of the hypothetical youngest student in the class. It captures peer effects among the classmates.

Trying to disentangle the differential impacts that relative and absolute age have in creating this double disadvantage is not easy. Since a student who is older at the moment of the test is also older with respect to her peers in class, an issue of collinearity between RAE and AAE naturally arises. As a consequence, this decomposition has rarely been achieved in the literature (Elder and Lubotsky (2009); Cascio and Schanzenbach (2016); Peña (2017); Peña and Duckworth (2018)). The idea is that we need something that is able to generate indipendent variations in the relative and the absolute age. By exploiting information given by the heterogenity of the exact birthdays of students with the fact that we observe the test scores of the same individuals two times, this issue may be overcome.

However, we also want to evaluate how these effects differ between natives and second-generation children. In order to single out the possible consequences of the RAE and the AAE, and evaluate whether they generate a double disadvantage for second generations, one would like to estimate the following equation:

$$Score_{it} = \beta_0 + \beta_1 RA_i + \beta_2 AA_{it} + \beta_3 Second_i + \beta_4 RA * Second_i + \beta_5 AA * Second_{it} + \mathbf{X}_{it}\rho + \epsilon_{it} \tag{3.1}$$

where *Second* is a dummy equal to 1 if the child belongs to the second generation, and **X** is a vector of controls (gender, parents' education, parents' employment, home environment,[11] class fixed effects and cohort fixed effects). However, the coefficients of interest could be biased due to the endogeneity induced by grade retention or by the practice of anticipation in children's enrollment. Anticipation is very common in Italy, where, though enrollment is compulsory for all children who are 6 in September, parents can enroll younger children provided that they turn 6 by April 30 of the following year. This creates an important source of endogeneity, since exercising or not this option is a choice.

In order to avoid this issue, a possible way could be to instrument relative and absolute ages with the *expected* relative and absolute ages. However, this approach is found to be problematic because in most cases the monotonicity condition is violated (Barua and Lang (2016)).

Therefore, before estimating equation 3.1, we impose the following restrictions[12] to tackle endogeneity issues:

1. we consider only students born *after* April 30;

2. we consider only students born in the expected year.

[11]These questions concern, for instance, the number of books at home, the availability of a quiet room for studying, the availability of a computer, an internet connection, a desk for studying, and so on.

[12]This procedure is not too restrictive since we can extrapolate the linear trend found for children born from May to December to the children born from January to April (see *e.g.* Aparicio-Fenoll, Campaniello, and Monzon (2019)).

This leaves us with a sub-sample of 437 736 natives and 34 895 second-generation immigrants. For each of these students, we have observations in two periods; thus, in the long format our final database is made of a total of 945 262 observations.

In Figure 3.1 and in Table 3.2, we may note that in the months we consider there is virtually no difference between natives and second generations.

3.5 Results

In Table 3.3, we report the OLS estimates of Equation 3.1 for the Italian performance. In the first column, we report the estimation for the whole sample of natives and second-generation children. These coefficients should be biased, because of family planning, anticipated and postponed enrollment, or (though rare in Italian Primary School) grade retention. In the second column, we report the corresponding estimates after restricting the sample. The results show that, in the case of Italian, second-generation children are affected by a double disadvantage. The first disadvantage is given by their immigrant status and is captured by the coefficient of the second-generation dummy, which is negative and significant. This effect looks substantial. Being second-generation determines a 4.5 point reduction of the score in Italian. The second disadvantage is given by the AAE. For native children, AAE is *negative*. By increasing the absolute age of 1 day, the child reduces her performance by 0.00112 points. Assuming that the impact of age is linear, this means that a difference of one year induces a reduction of 0.4 points. A negative effect for absolute age could seems counter-intuitive. Absolute age is supposed to capture the psycho-biological maturity of the child and her accumulated experience; thus, by increasing the absolute age at the test, we would expect a better performance. However, notice that older children, by definition, start school later. As argued by Black, Devereux, and Salvanes (2011), delaying school starting age could have a negative effect when children learn more at school than at home. Our results suggest that this could be the case. The negative effect seems to be amplified for second generations. This can be easily explained, since, for an immigrant child, it could well be more difficult to learn Italian at home. As a consequence, time spent at school is quite more effective than time spent at home for second-generations. By increasing their absolute age by one year, they *reduce* their performance by 0.6 points. Thus, they experience a greater penalization of 0.000554 points per day.

This does not seem to be the case for relative age. Relative age has a positive effect on the performance of both native and second-generation children. This comes with no surprise, since the positive effect captures, for instance, a higher self-esteem in pupils who feel stronger and less vulnerable to victimization than their younger peers in the classroom (Ballatore, Paccagnella, and Tonello (2020)). For the natives, increasing the relative age of 1 year increases the performance in Italian by 6.716 points. For second-generation children, the positive effect is even higher. This could be explained by the additional victimization experienced by these children. By increasing the relative age of 1 year, their performance in Italian increases by 8.4 points.

Actually, since the RAE has a greater impact than the AAE, the overall impact of *both* effects is positive and significant for second generations. The total impact implies that by increasing by one day their age, they increase their performance by 0.019 points (one year implies an increase of 6.9 points).

In conclusion, the disadvantage experienced in absolute age is more than compensated by the advantage experienced in relative age. This result has profound policy implications. Second-generation children' performance in Italian could be fostered *not* by delaying school entrance but by taking into account the age of their peers in class. Class composition is more fundamental than age *per se*.

In Table 3.4, we report the estimation results when the dependent variable is the result in Math. In this case, it seems that a double disadvantage does not exist, even for absolute age. However, second-generation children are still affected by the disadvantage given by their migration status, which induces a reduction of 5.5 points in their performance.

For native children, the AAE is still negative. By increasing the absolute age of 1 day, the child reduces her performance by 0.000651 points. However, the effect of the absolute age seems to be more penalizing in Italian than in Math.

For second-generation children, absolute age has a milder (negative) effect with respect to natives. This may be due to the less negative effect of time spent at home in acquiring Math knowledge. In general, immigrant parents could find easier to help their children in acquiring Math skills rather than Italian skills. By increasing the absolute age of 1 day, they experience a reduction in their performance of only 0.000405 points. Thus, they have an advantage of 0.000246 points over the natives (0.09 points per year).

However, the relative age effect is substantial. For native children, RAE is positive. By increasing the relative age of 1 day, the child increases her performance by 0.0181 points. Thus, having 1 year more gives an increase in the performance of 6.6 points. For second-generation children the effect is even higher. By increasing the relative age of 1 day, the child increases her performance by 0.020 points; with an advantage over natives of 0.00221 points. Thus, having 1 year more gives an increase in the performance of 7.4 points.

In conclusion, both the performance in Italian and the performance in Math of second-generation children could be fostered by taking into account the age of peers in class. Having younger peers could be helpful, while delaying school entrance could be detrimental.

3.6 Conclusions

In this study, we investigated whether a double disadvantage exists for second-generation children in the Italian Primary School. We considered the effects given by the second-generation status, age, and their interaction. We further distinguished between the absolute and the relative age components. Following Peña and Duckworth (2018), we were able to disentangle these two effects. This is useful to better understand the nature of second-generation children disadvantages, since these two components capture different mechanisms. While the AAE is related to the biological maturity of the child and to accumulated experience, the RAE is related to peer effects.

Our results show that a double disadvantage induced by absolute age exists in Italian, but not in Math. Furthermore, the relative age effect seems to be more powerful for second-generation children than for the natives, offsetting the negative effect of the absolute age (when present). These findings have important policy implications. First, they suggest that delaying school enrollment should not benefit children. Second, they suggest that controlling the class composition could be a simple and effective way to improve the achievement of second-generation children. Having younger peers in class could be helpful for these children, and increase their performance both in Italian and Math.

3.7 Figures and Tables

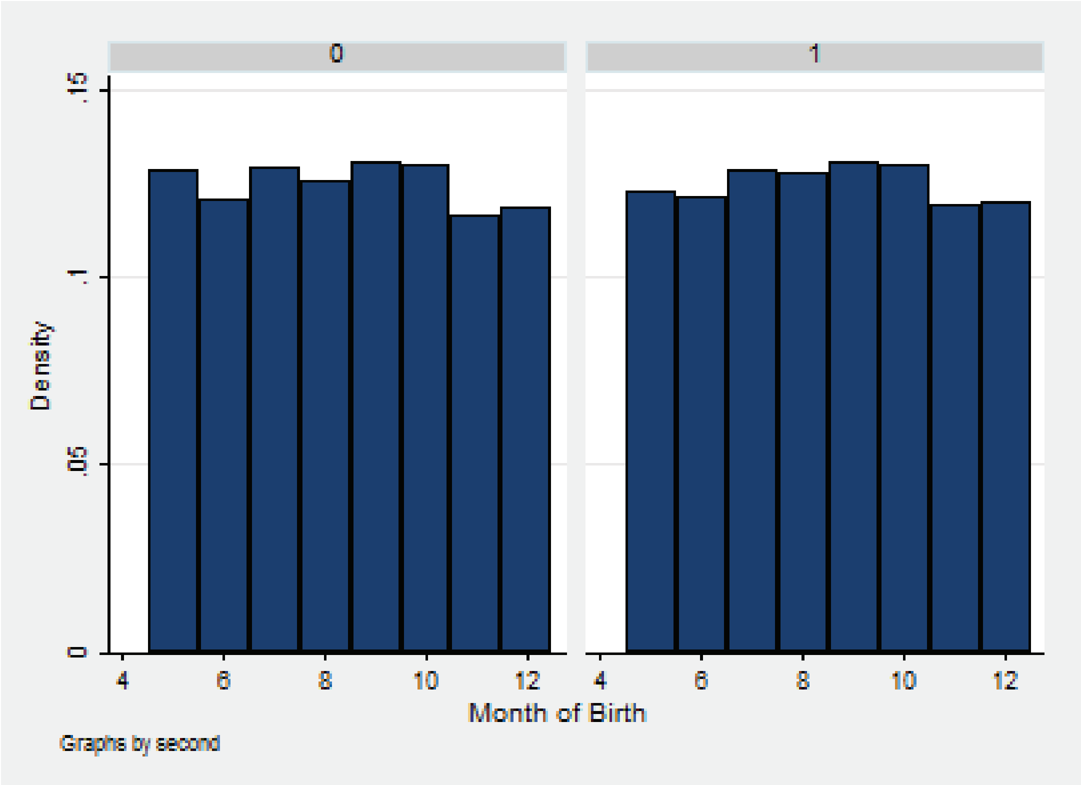

FIGURE 3.1: Histogram Month of Birth

TABLE 3.2: Month of Birth

Variable	Natives	Second Generations	t-stat
May	0.128	0.123	-2.985***
	(0.001)	(0.002)	
June	0.1209	0.1213	0.246
	(0.001)	(0.002)	
July	0.129	0.1287	-0.205
	(0.001)	(0.002)	
August	0.126	0.128	1.110
	(0.001)	(0.002)	
September	0.1309	0.1306	-0.125
	(0.001)	(0.002)	
October	0.130	0.1299	-0.111
	(0.001)	(0.002)	
November	0.117	0.119	1.378
	(0.001)	(0.002)	
December	0.118	0.1197	0.719
	(0.001)	(0.002)	
Obs	437 736	34 895	

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Standard Errors in parenthesis

TABLE 3.3: Dependent Variable: Score in Italian

Variable	(1)	(2)
AA	-0.00123***	-0.00112***
	(2.17e-05)	(2.68e-05)
RA	0.0129***	0.0184***
	(0.000155)	(0.000300)
AA*Second	-0.000674***	-0.000554***
	(7.88e-05)	(9.71e-05)
RA*Second	-0.00129**	0.00230**
	(0.000570)	(0.00101)
Second	-3.750***	-4.515***
	(0.285)	(0.357)
Constant	64.41***	63.18***
	(0.0794)	(0.102)
Obs	1,398,234	939,806
Controls	YES	YES
Class-by-cohort FE	YES	YES

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
Standard Errors in Parenthesis Clustered at the Student Level

TABLE 3.4: Dependent Variable: Score in Math

Variable	**(1)**	**(2)**
AA	-0.000909***	-0.000651***
	(2.12e-05)	(2.61e-05)
RA	0.0131***	0.0181***
	(0.000158)	(0.000304)
AA*Second	0.000162**	0.000246***
	(7.40e-05)	(9.08e-05)
RA*Second	0.000761	0.00221**
	(0.000570)	(0.00103)
Second	-5.212***	-5.543***
	(0.269)	(0.337)
Constant	59.98***	58.24***
	(0.0781)	(0.100)
Obs	1,398,234	939,806
Controls	YES	YES
Class-by-cohort FE	YES	YES

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$
Standard Errors in Parenthesis Clustered at the Student Level

Bibliography

Adhvaryu, Achyuta, James Fenske, and Anant Nyshadham (2019). "Early Life Circumstance and Adult Mental Health". *Journal of Political Economy* 127.4, pp. 1516–1549.

Aizer, Anna, Laura Stroud, and Stephen Buka (2016). "Maternal Stress and Child Outcomes: Evidence from Siblings". *Journal of Human Resources* 51.3, pp. 523–555.

Akresh, Richard and Ilana R. Akresh (2011). "Using Achievement Tests to Measure Language Assimilation and Language Bias among the Children of Immigrants". *Journal of Human Resources* 46.3, pp. 647–667.

Alba, Richard and Mary C. Waters (2011). "The Next Generation: Immigrant Youth in a Comparative Perspective." *NYU Press*, pp. 1–378.

Albornoz, Facundo, Samuel Berlinski, and Antonio Cabrales (2018). "Motivation, resources, and the organization of the school system". *Journal of the European Economic Association* 16.1, pp. 199–231.

Albornoz, Facundo, Antonio Cabrales, and Esther Hauk (2018). "Immigration and the school system". *Economic Theory* 65.4, pp. 855–890.

Algan, Yann et al. (2010). “The Economic Situation of First and Second-Generation Immigrants in France, Germany and the United Kingdom”. *The Economic Journal* 120.542, F4–F30.

Algan, Yann et al. (2012). “Cultural integration of immigrants in Europe”. *Oxford. Oxford University Press*, pp. 1–360.

Aliprantis, Dionissi (2012). “Redshirting, Compulsory Schooling Laws, and Educational Attainment”. *Journal of Educational and Behavioral Statistics* 37.2, pp. 316–338.

Allen, Jeremiah and Roger Barnsley (1993). “Streams and Tiers: The Interaction of Ability, Maturity, and Training in Systems with Age-Dependent Recursive Selection”. *The Journal of Human Resources* 28.3, pp. 649–659.

Almond, Douglas and Janet Currie (2011). “Human capital development before age five”. *Handbook of Labor Economics* 4.B, pp. 1315–1486.

Almond, Douglas, Janet Currie, and Valentina Duque (2018). “Childhood Circumstances and Adult Outcomes: Act II”. *Journal of Economic Literature* 56.4, pp. 1360–1446.

Almond, Douglas, Janet Currie, and Mariesa Hermann (2012). “From Infant to Mother: Early Disease Environment and Future Maternal Health”. *Labour Economics* 19.4, 475–483.

Almond, Douglas, Bhashkar Mazumder, and Reyn van Ewijk (2015). “In Utero Ramadan Exposure and Children’s Academic Performance”. *The Economic Journal* 125.589, pp. 1501–1533.

Almqvist, Kjerstin and Margareta Brandell-Forsberg (1997). "Refugee children in Sweden: Post-Traumatic Stress Disorder in Iranian preschool children exposed to organized violence". *Child Abuse & Neglect* 21.4, pp. 351–366.

Angrist, Joshua D., Erich Battistin, and Daniela Vuri (2017). "In a Small Moment: Class Size and Moral Hazard in the Italian Mezzogiorno". *American Economic Journal: Applied Economics* 9.4, pp. 216–49.

Aparicio-Fenoll, Ainhoa (2018). "English proficiency and mathematics test scores of immigrant children in the US". *Economics of Education Review* 64, pp. 102–113.

Aparicio-Fenoll, Ainhoa, Nadia Campaniello, and Ignacio Monzon (2019). "Parental Love Is Not Blind: Identifying Selection into Early School Start". *Working Paper*.

Arici, Maria and Paola Maniotti (2010). "Studiare matematica e scienze in italiano L2. Unità di apprendimento per alunni stranieri della scuola primaria". *Erickson*.

Azzolini, Davide, Philipp Schnell, and John RB Palmer (2012). "Educational Achievement Gaps between Immigrant and Native Students in Two "New Immigration Countries": Italy and Spain in comparison". *The Annals of the American Academy of Political and Social Science* 643.1, pp. 46–77.

Ballatore, Rosario Maria, Marco Paccagnella, and Marco Tonello (2020). "Bullied because younger than my mates? The effect of age rank on victimization at school". *Labour Economics* 62.101772.

Barrett, Alan, Yumiko Kamiya, and Vincent O. Sullivan (2014). “Childhood sexual abuse and later-life economic consequences”. *Journal of Behavioral and Experimental Economics* 53.C, pp. 10–16.

Barua, Rashmi and Kevin Lang (2016). “School Entry, Educational Attainment, and Quarter of Birth: A Cautionary Tale of a Local Average Treatment Effect”. *Journal of Human Capital* 10.3, pp. 347–376.

Barwell, Richard (2005a). “Working on arithmetic word problems when English is an additional language”. *British Educational Research Journal* 31.3, pp. 329–348.

— (2005b). “Language in the Mathematics Classroom”. *Language and Education* 19.2, pp. 96–101.

Bedard, Kelly and Elizabeth Dhuey (2006). “The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects”. *The Quarterly Journal of Economics* 121.4, pp. 1437–1472.

Berman, Eli, Kevin Lang, and Erez Siniver (2003). “Language-skill complementarity: returns to immigrant language acquisition”. *Labour Economics* 10.3, pp. 265–290.

Berry, John W (1980). “Acculturation as varieties of adaptation”. *Padilla, A., Ed., Acculturation: Theory, Models and Findings, Westview, Boulder*, pp. 9–25.

Bertoni, Marco, Giorgio Brunello, and Lorenzo Rocco (2013). “When the cat is near, the mice won’t play: The effect of external examiners in Italian schools”. *Journal of Public Economics* 104.C, pp. 65–77.

Bertrand, Marianne and Sendhil Mullainathan (2004). "Are Emily and Greg More Employable Than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination". *American Economic Review* 94.4, pp. 991–1013.

Bhalotra, Sonia and Atheendar Venkataramani (2013). "Cognitive Development and Infectious Disease: Gender Differences in Investments and Outcomes". *IZA Discussion Papers* 7833.

Black, Sandra, Paul Devereux, and Kjell G. Salvanes (2011). "Too Young to Leave the Nest? The Effects of School Starting Age". *The Review of Economics and Statistics* 93.2, pp. 455–467.

Black, Sandra E., Alina Bütikofer, and Kjell G. Salvanes (2019). "This Is Only a Test? Long-Run and Intergenerational Impacts of Prenatal Exposure to Radioactive Fallout". *The Review of Economics and Statistics* 101.3, pp. 531–546.

Bleakley, Hoyt and Aimee Chin (2004). "Language Skills and Earnings: Evidence from Childhood Immigrants". *The Review of Economics and Statistics* 86.2, pp. 481–496.

— (2010). "Age at Arrival, English Proficiency, and Social Assimilation Among U.S. Immigrants". *American Economic Journal: Applied Economics* 2.1, pp. 165–192.

Borghans, Lex et al. (2016). "What grades and achievement tests measure". *Proceedings of the National Academy of Sciences* 113.47, pp. 13354–13359.

Borjas, George J (1993). "The Intergenerational Mobility of Immigrants". *Journal of Labor Econonomics* 11.1, pp. 113–135.

Brock, William A. and Steven N. Durlauf (2001). "Interactions-based models". *Handbook of Econometrics, Volume 5, Edited by JJ Heckman and E Leader* Chapter 54.

Bronstein, Israel and Paul Montgomery (2011). "Psychological Distress in Refugee Children: A Systematic Review". *Clinical Child and Family Psychology Review* 14.1, pp. 44–56.

Bryant, Richard et al. (2018). "The effect of post-traumatic stress disorder on refugees' parenting and their children's mental health: a cohort study". *THE LANCET Public Health* 3.5, pp. 249–258.

Buckles, Kasey S. and Daniel M. Hungerman (2013). "Season of Birth and Later Outcomes: Old Questions, New Answers". *Review of Economics and Statistics* 95.3, pp. 711–724.

Burgess, Simon (2014). "Understanding the success of London's schools". *CMPO WP* 14.333.

Burgess, Simon and Gabriel Heller-Sahlgren (2018). "Motivated to Succeed? Attitudes to Education Among Native and Immigrant Pupils in England". *IZA Discussion Paper* 11678.

Campodifiori, Emiliano et al. (2010). "Un indicatore di status socio-economico-culturale degli allievi della quinta primaria in Italia". *INVALSI WP* 02.

Carlana, Michela, Eliana La Ferrara, and Paolo Pinotti (2018). "Goals and Gaps: Educational Careers of Immigrant Children". *CReAM Discussion Paper Series* 1812.

Carneiro, Pedro, James J. Heckman, and Dimitriy Masterov (2005). "Labor Market Discrimination and Racial Differences in Premarket Factors". *Journal of Law and Economics* 48.1, pp. 1–39.

Cascio, Elizabeth U. and Diane Whitmore Schanzenbach (2016). "First in the Class? Age and the Education Production Function". *Education Finance and Policy* 11.3, pp. 225–250.

Ceri, Veysi et al. (2017). "Mental health problems of second generation children and adolescents with migration background". *International Journal of Psychiatry in Clinical Practice* 21.2, pp. 142–147.

Chen, Kelly, Nicole Fortin, and Shelley Phipps (2016). "Young in class: Implications for inattentive/hyperactive behaviour of Canadian boys and girls". *Canadian Journal of Economics* 48.5, pp. 1601–1634.

Chiswick, Barry R (1991). "Speaking, Reading, and Earnings among Low-Skilled Immigrants". *Journal of Labor Economics* 9.2, pp. 149–170.

Chiswick, Barry R. and Noyna DebBurman (2004). "Educational attainment: Analysis by immigrant generation." *Economics of Education Review* 23.4, pp. 361–379.

Chiswick, Barry R. and Paul W. Miller (2001). "A model of destination-language acquisition: Application to male immigrants in Canada". *Demography* 38.3, pp. 391–409.

— (2003). "The complementarity of language and other human capital: immigrant earnings in Canada". *Economics of Education Review* 22.5, pp. 469–480.

Chiswick, Barry R. and Paul W. Miller (2007). "The Economics of Language. International Analysis." *Routledge Studies in the Modern World Economy*, pp. 1–595.

— (2009). "The international transferability of immigrants' human capital". *Economics of Education Review* 28.2, pp. 162–169.

— (2010). "Occupational language requirements and the value of English in the US labor market". *Journal of Population Economics* 23.1, pp. 353–372.

— (2015). "International Migration and the Economics of Language". *Handbook of the Economics of International Migration* 1.5, pp. 211–269.

Cohen-Goldner, Sarit and Zvi Eckstein (2008). "Labor Mobility of Immigrants: Training, Experience, Language, and Opportunities". *International Economic Review* 49.3, pp. 837–872.

Colding, Bjorg, Leif Husted, and Hans Hummelgaard (2009). "Educational progression of second-generation immigrants and immigrant children". *Economics of Education Review* 28, pp. 434–443.

Coll, Cynthia García and Amy Kerivan Marks (2012). "The Immigrant Paradox in Children and Adolescents: Is Becoming American a Developmental Risk?" *American Psychological Association*.

Conley, Timothy G., Christian B. Hansen, and Peter E. Rossi (2012). "Plausibly Exogenous". *Review of Economics and Statistics* 94.1, pp. 260–272.

Constant, Amelie, Liliya Gataullina, and Klaus Zimmermann (2009). "Ethnosizing Immigrants". *Journal of Economic Behavior & Organization* 69.3, pp. 274–287.

Constant, Amelie F. and Klaus F. Zimmermann (2008). "Measuring Ethnic Identity and Its Impact on Economic Behavior". *Journal of the European Economic Association* 6.2-3, pp. 424–433.

Correia, Sergio (2018). "IVREGHDFE: Stata module for extended instrumental variable regressions with multiple levels of fixed effects". *Statistical Software Components. Boston College Department of Economics.* S458530.

Crawford, Claire, Lorraine Dearden, and Ellen Greaves (2014). "The drivers of month-of-birth differences in children's cognitive and non-cognitive skills". *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 177.4, pp. 829–860.

Cuevas, Gilberto J (1984). "Mathematics Learning in English as a Second Language". *Journal for Research in Mathematics Education* 15.2, pp. 134–144.

Cunha, Flavio and James J. Heckman (2007). "The Technology of Skill Formation". *American Economic Review* 97.2, pp. 31–47.

Currie, Janet and Duncan Thomas (2001). "Early test scores, school quality and SES: Longrun effects on wage and employment outcomes". *Worker Wellbeing in a Changing Labor Market (Research in Labor Economics)* 20, pp. 103–132.

Currie, Janet and Cathy Spatz Widom (2010). "Long-Term Consequences of Child Abuse and Neglect on Adult Economic Well-Being". *Child Maltreatment* 15.2, pp. 111–120.

De Fraja, Gianni, Tania Oliveira, and Luisa Zanchi (2010). "Must Try Harder: Evaluating the Role of Effort in Educational Attainment". *The Review of Economics and Statistics* 92.3, pp. 577–597.

De Jong, Gordon F. and Anna B. Madamba (2001). "A Double Disadvantage? Minority Group, Immigrant Status, and Underemployment in the United States". *Social Science Quarterly* 82.1, pp. 117–130.

Dee, Thomas S. and Hans H. Sievertsen (2018). "The gift of time? School starting age and mental health". *Health Economics* 27.5, pp. 781–802.

Dhuey, Elizabeth and Stephen Lipscomb (2008). "What makes a leader? Relative age and high school leadership". *Economics of Education Review* 27.2, pp. 173–183.

Dicks, Alexander and Bram Lancee (2018). "Double Disadvantage in School? Children of Immigrants and the Relative Age Effect: A Regression Discontinuity Design Based on the Month of Birth". *European Sociological Review* 34.3, pp. 319–333.

Dohmen, Thomas et al. (2011). "The Intergenerational Transmission of Risk and Trust Attitudes". *The Review of Economic Studies* 79.2, pp. 645–677.

Doyle, Orla et al. (2009). "Investing in early human development: Timing and economic efficiency". *Economics & Human Biology* 7.1, pp. 1 –6.

Du, Qianqian, Huasheng Gao, and Maurice D. Levi (2012). "The relative-age effect and career success: Evidence from corporate CEOs". *Economics Letters* 117.3, pp. 660–662.

Duckworth, Angela L and Pablo A Peña (2018). "The effects of relative and absolute age in the measurement of grit from 9th to 12th grade". *Economics of Education Review* 66, pp. 183 –190.

Durand, Jorge, Douglas S. Massey, and Karen A. Pren (2016). "Double Disadvantage: Unauthorized Mexicans in the U.S. Labor Market". *The ANNALS of the American Academy of Political and Social Science* 666.1, pp. 78–90.

Dustmann, Christian and Francesca Fabbri (2003). "Language proficiency and labour market performance of immigrants in the UK". *The Economic Journal* 113.July, pp. 695–717.

Dustmann, Christian and Albrecht Glitz (2011). "Migration and Education". *Handbook of the Economics of Education, Edited by Hanushek E. A., Machin S., Woessmann L.* 4.4, pp. 327–439.

Dustmann, Christian et al. (2012). "Educational achievement of second-generation immigrants: an international comparison". *Economic Policy* 27.69, pp. 145–185.

Elango, Sneha et al. (2015). "Early Childhood Education". *NBER Working Papers* 21766.

Elder, Todd E. and Darren H. Lubotsky (2009). "Kindergarten Entrance Age and Children's Achievement: Impacts of State Policies, Family Background, and Peers". *Journal of Human Resources* 44.3, pp. 641–683.

EUROSTAT (2014). "First and second-generation immigrants - a statistical overview". *EUROSTAT Online Publications*.

Fazel, Mina, Jeremy Wheeler, and John Danesh (2005). "Prevalence of serious mental disorder in 7000 refugees resettled in western countries: a systematic review". *The LANCET* 365.9467, pp. 1309–1314.

Fenzel, L. Mickey (1992). "The Effect of Relative Age on Self-Esteem, Role Strain, GPA, and Anxiety". *The Journal of Early Adolescence* 12.3, pp. 253–266.

Ferrer-Esteban, Gerard (2013). "Rationale and incentives for cheating in the standardised tests of the Italian assessment system". *FGA WORKING PAPER* 50.

Ferrie, Joseph, Karen Rolf, and Werner Troesken (2012). "Cognitive disparities, lead plumbing, and water chemistry: Prior exposure to water-borne lead and intelligence test scores among World War Two U.S. Army enlistees". *Economics & Human Biology* 10.1, pp. 98–111.

Fredriksson, Peter and Björn Öckert (2014). "Life-cycle Effects of Age at School Start". *The Economic Journal* 124.579, pp. 977–1004.

Friedberg, Rachel M (2000). "You Can't Take It with You? Immigrant Assimilation and the Portability of Human Capital". *Journal of Labor Economics* 18.2, pp. 221–251.

Fryer, Roland G. Jr and Steven D. Levitt (2004). "Understanding The Black-White Test Score Gap in the First Two Years of School". *The Review of Economics and Statistics* 86.2, 447–464.

— (2006). "The Black-White Test Score Gap Through Third Grade". *American Law and Economics Review* 8.2, pp. 249–281.

— (2013). "Testing for Racial Differences in the Mental Ability of Young Children". *American Economic Review* 103.2, pp. 981–1005.

Gang, Ira N. and Klaus F. Zimmermann (2000). "Is Child like Parent? Educational Attainment and Ethnic Origin". *The Journal of Human Resources* 35.3, pp. 550–569.

Garcia, Jorge Luis, James J Heckman, and Anna Ziff (2019). "Early Childhood Education and Crime". *Infant Mental Health Journal* 40.1, pp. 141–151.

Goldin, Claudia and Lawrence Katz (2008). "The Race between Education and Technology". *Harvard University Press, Cambridge*.

Goodman, Robert, Julia Gledhill, and Tamsin Ford (2003). "Child psychiatric disorder and relative age within school year: cross sectional survey of large population sample". *British Medical Journal* 327.7413, pp. 472–475.

Gorinas, Cédric (2014). "Ethnic identity, majority norms, and the native–immigrant employment gap". *Journal of Population Economics* 27.1, pp. 225–250.

Griliches, Zvi (1997). "Education, Human Capital, and Growth: A Personal Perspective". *Journal of Labor Economics* 15.1, pp. 330–344.

Hanushek, Eric and Ludger Woessmann (2012). "Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation". *Journal of Economic Growth* 17, pp. 267–321.

Hanushek, Eric A (1987). "Educational Production Functions". *Economics of Education. Research and Studies*, pp. 33–42.

Heckman, James J. (2006). "Skill formation and the economics of investing in disadvantaged children". *Science* 312.5782, pp. 1900–1902.

Heckman, James J. (2007). "The economics, technology, and neuroscience of human capability formation". *PNAS* 104.33, pp. 13250–13255.

Heckman, James J. and Dimitriy V. Masterov (2007). "The productivity argument for investing in young children". *Applied Economic Perspectives and Policy* 29.3, pp. 446–493.

Heckman, James J., Rodrigo Pinto, and Peter Savelyev (2013). "Understanding the Mechanisms through Which an Influential Early Childhood Program Boosted Adult Outcomes". *American Economic Review* 103.6, pp. 2052–86.

Heckman, James J, Jora Stixrud, and Sergio Urzua (2006). "The effects of cognitive and noncognitive abilities on labor market outcomes and social behavior". *Journal of Labor Economics* 24.3, pp. 411–482.

Hitt, Collin, Julie Trivitt, and Albert Cheng (2016). "When you say nothing at all: The predictive power of student effort on surveys". *Economics of Education Review* 52, pp. 105 –119.

Hughes, Michael and Melvin E Thomas (1998). "The Continuing Significance of Race Revisited: A Study of Race, Class, and Quality of Life in America, 1972 to 1996". *American Sociological Review* 63.6, pp. 785–795.

INVALSI (2018). "Quadro di Riferimento delle Prove INVALSI di Italiano del 30.08.2018". *INVALSI documentation*.

Isen, Adam, Maya Rossin-Slater, and W. Reed Walker (2017). "Every Breath You Take—Every Dollar You'll Make: The Long-Term Consequences of the Clean Air Act of 1970". *Journal of Political Economy* 125.3, pp. 848–902.

Isphording, Ingo and Sebastian Otten (2013). "The Costs of Babylon—Linguistic Distance in Applied Economics". *Review of International Economics* 21.2, pp. 354–369.

Isphording, Ingo E., Marc Piopiunik, and Nuria Rodriguez-Planas (2016). "Speaking in Numbers: The Effect of Reading Performance on Math Performance among Immigrants". *Economics Letters* 139, pp. 52–56.

ISTAT (2018a). "Bilancio Demografico Nazionale". *Statistiche. Report* July 3rd, 2019.

— (2018b). "Natalità e fecondità della popolazione residente". *Statistiche. Report*.

Jabbar, Sinaria Abdel and Haidar Ibrahim Zaza (2019). "Post-Traumatic Stress and Depression (PTSD) and General Anxiety among Iraqi Refugee Children: A Case Study from Jordan". *Early Child Development and Care* 189.7, pp. 1114–1134.

Jaccard, James and Robert Turrisi (2003). "Interaction Effects in Multiple Regression, (2^{nd}*ed*)". *Sage University Papers Series on Quantitative Applications in the Social Sciences* Second Edition.07-072.

Jacob, Brian A and Steven D. Levitt (2003). "Rotten apples: an investigation of the prevalence and predictors of teacher cheating". *Quarterly Journal of Economics* 118.3, pp. 843–877.

Jaycox, Lisa H. et al. (2002). "Violence exposure, posttraumatic stress disorder, and depressive symptoms among recent immigrant schoolchildren".

Journal of the American Academy of Child & Adolescent Psychiatry 41.9, pp. 1104–1110.

Kien, Christina et al. (2018). "Prevalence of mental disorders in young refugees and asylum seekers in European Countries: a systematic review". *European Child & Adolescent Psychiatry*, pp. 1–16.

Krause-Pilatus, Annabelle, Ulf Rinne, and Simone Schüller (2015). "Kick It Like Özil? Decomposing the Native-Migrant Education Gap". *International Migration Review* 49.3, pp. 757–789.

Krueger, Alan B. (2007). "What makes a terrorist: Economics and the roots of terrorism". *Princeton University Press*, pp. 1–232.

Krueger, Alan B. and Jitka Maleckova (2003). "Education, Poverty and Terrorism: Is There a Causal Connection?" *Journal of Economic Perspectives* 17.4, pp. 119–144.

Kunz, Johannes S. (2016). "Analyzing Educational Achievement Differences between Second-Generation Immigrants: Comparing Germany and German-Speaking Switzerland". *German Economic Review* 17.1, pp. 61–91.

Lager, Carl A (2006). "Types of Mathematics-Language Reading Interactions that Unnecessarily Hinder Algebra Learning and Assessment". *Reading Psychology* 27.2-3, pp. 165–204.

Lazear, Edward P. (2001). "Educational Production". *The Quarterly Journal of Economics* 116.3, pp. 777–803.

Lee, Chulhee (2014). "Intergenerational Health Consequences of In Utero Exposure to Maternal Stress: Evidence from the 1980 Kwangju Uprising". *Social Science & Medicine* 119.C, pp. 284–291.

Lenard, Matthew A. and Pablo A. Peña (2018). "Maturity and minorities: the impact of redshirting on achievement gaps". *Education Economics* 26.6, pp. 593–609.

Lenneberg, Eric H. (1967). "Biological foundations of language". *New York: Wiley*.

Liu, Xiangbo, Theodore Palivos, and Xiaomeng Zhang (2017). "Immigration, skill heterogeneity, and qualification mismatch". *Economic Inquiry* 55.3, pp. 1231–1264.

Ludemann, Elke and Guido Schwerdt (2013). "Migration background and educational tracking". *Journal of Population Economics* 26.2, pp. 455–481.

Matsubayashi, Tetsuya and Michiko Ueda (2015). "Relative Age in School and Suicide among Young Individuals in Japan: A Regression Discontinuity Approach." *PLoS ONE* 10.8.

Metcalfe, Robert, Simon Burgess, and Steven Proud (2019). "Students' effort and educational achievement: Using the timing of the World Cup to vary the value of leisure". *Journal of Public Economics* 172.4, pp. 111–126.

Miranda, Alfonso and Yu Zhu (2013). "English deficiency and the native–immigrant wage gap". *Economics Letters* 118.1, pp. 38–41.

MIUR (2019). "Gli alunni con cittadinanza non italiana A.S. 2017/2018". *MIUR - Ufficio Statistica e studi*.

Muller, Daniel and Lionel Page (2016). "Born leaders: political selection and the relative age effect in the US Congress". *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 179.3, pp. 809–829.

Mühlenweg, Andrea M. (2010). "Young and innocent: International evidence on age effects within grades on victimization in elementary school". *Economics Letters* 109.3, pp. 157–160.

Naziev, Aslanbek (2018). "The Role of Language in Teaching and Learning Mathematics". *BRAIN – Broad Research in Artificial Intelligence and Neuroscience* 9.1, pp. 114–124.

Neal, Derek Pedro and William Johnson (1996). "The Role of Pre-Market Factors in Black-White Wage Differences". *Journal of Political Economy* 104.5, pp. 869–895.

Newport, Elissa L. (2002). "Critical Periods in Language Development". *The Encyclopedia of Cognitive Science, In Lynn Nadel (ed.)* Pp. 737–740.

Ochinata, Asako and Jan C. Van Ours (2012). "Young immigrant children and their educational attainment". *Economics Letters* 116.3, pp. 288–290.

Patacchini, Eleonora and Yves Zenou (2009). "On the sources of the black-white test score gap in Europe". *Economics Letters* 102.1, pp. 49–52.

Pellizzari, Michele and Francesco Billari (2012). "The younger, the better? Age-related differences in academic performance at university". *Journal of Population Economics* 25.2, pp. 697–739.

Penfield, Wilder and Lamar Roberts (1959). "Speech and Brain Mechanisms". *Princeton University Press*, pp. 1–302.

Pereda-Fernández, Santiago (2019). "Teachers and Cheaters: Just an Anagram?" *Journal of Human Capital* 13.4, pp. 635–669.

Peña, Pablo A. (2017). "Creating winners and losers: Date of birth, relative age in school, and outcomes in childhood and adulthood". *Economics of Education Review* 56, pp. 152–176.

Peña, Pablo A. and Angela Duckworth (2018). "The effects of relative and absolute age in the measurement of grit from 9th to 12th grade". *Economics of Education Review* 66, pp. 183–190.

Polachek, Solomon W., Thomas J. Kniesner, and Henrick J. Harwood (1978). "Educational Production Functions". *Journal of Educational Statistics* 3.3, pp. 209–231.

Pong, Suet-ling and Nancy S. Landale (2012). "Academic achievement of legal immigrants' children: the roles of parents' pre- and postmigration characteristics in origin-group differences." *Child Development* 83.5, pp. 1543–1559.

Portes, Alejandro and Ruben G. Rumbaut (2001). "Legacies. The Story of the Immigrant Second Generation." *University of California Press*, pp. 1–430.

Portes, Alejandro and Min Zhou (1993). "The New Second Generation: Segmented Assimilation and its Variants". *The ANNALS of the American Academy of Political and Social Science* 530.1, pp. 74–96.

Pumariega, Andrés J., Eugenio Rothe, and JoAnne B. Pumariega (2005). "Mental Health of Immigrants and Refugees". *Community Mental Health Journal* 41.5, pp. 581–597.

Quintano, Claudio, Rosalia Castellano, and Sergio Longobardi (2009). “A fuzzy clustering approach to improve the accuracy of Italian student data : an experimental procedure to correct the impact of outliers on assessment test scores”. *Statistica & Applicazioni. Milano : Vita e Pensiero* VII.2, pp. 149–171.

Raijman, Rebeca and Moshe Semyonov (1997). “GENDER, ETHNICITY, AND IMMIGRATION: Double Disadvantage and Triple Disadvantage among Recent Immigrant Women in the Israeli Labor Market”. *Gender & Society* 11.1, pp. 108–125.

Robst, John (2008). “Childhood sexual abuse and the gender wage gap”. *Economics Letters* 99.3, pp. 549–551.

— (2010). “Childhood sexual victimization, educational attainment, and the returns to schooling”. *Education Economics* 18.4, pp. 407–421.

Rosales-Rueda, Maria (2018). “The impact of early life shocks on human capital formation: evidence from El Niño floods in Ecuador”. *Journal of Health Economics* 62, pp. 13–44.

Sack, William H., Gregory N. Clarke, and John Seeley (1995). “Posttraumatic Stress Disorder across Two Generations of Cambodian Refugees”. *Journal of the American Academy of Child & Adolescent Psychiatry* 34.9, pp. 1160–1166.

Schnepf, Sylke (2007). “Immigrants’ educational disadvantage: an examination across ten countries and three surveys”. *Journal of Population Economics* 20.3, pp. 527–545.

Schuerger, James M. and Anita C. Witt (1989). "The temporal stability of individually tested intelligence". *Journal of Clinical Psychology* 45.2, pp. 294–302.

Silwal, Sanju et al. (2019). "Parental immigration and offspring post-traumatic stress disorder: A nationwide population-based register study". *Journal of Affective Disorders* 249, pp. 294–300.

Snow, Catherine E. and Marian Hoefnagel-Höhle (1978). "The Critical Period for Language Acquisition: Evidence from Second Language Learning". *Child Development* 49.4, pp. 1114–1128.

Solli, Ingeborg Foldøy (2017). "Left behind by birth month". *Education Economics* 25.4, pp. 323–346.

Stevens, Gonneke WJM and Wilma AM Vollebergh (2008). "Mental health in migrant children". *Journal of Child Psychology and Psychiatry* 49.3, 276–294.

Thompson, Angus H., Roger H. Barnsley, and James Battle (2004). "The relative age effect and the development of self-esteem." *Educational Research* 46.3, pp. 313–320.

Thompson, Angus H., Roger H. Barnsley, and Ronald J Dick (1999). "A New Factor in Youth Suicide: The Relative Age Effect". *The Canadian Journal of Psychiatry* 44.1, pp. 82–85.

Todd, Pedra E. and Kenneth I. Wolpin (2003). "On the Specification and Estimation of the Production Function for Cognitive Achievement". *The Economic Journal* 113.485, F3–F33.

Todd, Petra E. and Kenneth I. Wolpin (2007). "The Production of Cognitive Achievement in Children: Home, School, and Racial Test Score Gaps". *Journal of Human Capital* 1.1, pp. 91–136.

Trevelyan, Edward et al. (2016). "Characteristics of the U.S. Population by Generational Status: 2013". *U.S. Census Bureau. Current Population Survey Reports*.

Valdez, Zulema (2006). "Segmented Assimilation Among Mexicans in the Southwest". *The Sociological Quarterly* 47.3, pp. 397–424.

Van Den Berg, Gerard J. et al. (2014). "Critical periods during childhood and adolescence". *Journal of the European Economic Association* 12.6, pp. 1521–1557.

Van Ours, Jan C. and Justus Veenman (2003). "The educational attainment of second-generation immigrants in The Netherland". *Journal of Population Economics* 16.4, pp. 739–753.

Venkataramani, Atheendar S. (2012). "Early life exposure to malaria and cognition in adulthood: Evidence from Mexico". *Journal of Health Economics* 31.5, pp. 767–780.

Vukovic, Rose K and Nonie K Lesaux (2013). "The relationship between linguistic skills and arithmetic knowledge". *Learning and Individual Differences* 23, pp. 87–91.

West, Jerry, Anne Meek, and David Hurst (2000). "Children Who Enter Kindergarten Late or Repeat Kindergarten: Their Characteristics and Later School Performance". *Education Statistics Quarterly* 2, pp. 21–24.

Wilkinson, Louise C (2019). “Learning language and mathematics:A perspective from Linguistics and Education”. *Linguistics and Education* 49, pp. 86–95.

Wilson, Deborah, Simon Burgess, and Adam Briggs (2011). “The dynamics of school attainment of England’s ethnic minorities”. *Journal of Population Economics* 24.2, pp. 681–700.

Xu, Duoduo and Xiaogang Wu (2017). “The rise of the second generation: aspirations, motivations and academic success of Chinese immigrants’ children in Hong Kong”. *Journal of Ethnic and Migration Studies* 43.7, pp. 1164–1189.

Yao, Yuxin and Jan C. Van Ours (2015). “Language skills and labor market performance of immigrants in the Netherlands”. *Labour Economics* 34, pp. 76–85.

Yinger, J. Milton and George Eaton Simpson (1978). “The Integration of Americans of Indian Descent”. *The Annals of the American Academy of Political and Social Science* 436.Mar. Pp. 137–151.

Zamarro, Gema, Collin Hitt, and Ildefonso Mendez (2019). “When Students Don’t Care: Reexamining International Differences in Achievement and Student Effort”. *Journal of Human Capital* 13.4, pp. 519–552.

Zimmermann, Laura, Klaus F. Zimmermann, and Amelie F. Constant (2007). “Measuring Ethnic Identity and Its Impact on Economic Behavior”. *International Migration Review* 41.3, pp. 769–781.

Zwi, Karen et al. (2018). "The impact of detention on the social-emotional wellbeing of children seeking asylum: a comparison with community-based children". *European Child & Adolescent Psychiatry* 27.4, pp. 411–422.