European **E**xpert **N**etwork on
Economics of **E**ducation **(EENEE)**

School Segregation of Immigrants and its Effects on Educational Outcomes in Europe

EENEE Analytical Report No. 30
Prepared for the European Commission

Giorgio Brunello and Maria De Paola
February 2017

30

Erasmus+

School Segregation of Immigrants and its Effects on Educational Outcomes in Europe

by

Giorgio Brunello (Padova, CESifo, IZA and ROA)

Maria De Paola (Calabria and IZA)

*Giorgio Brunello (corresponding author): Department of Economics and Management "Marco Fanno" - University of Padova. Via del Santo 33, 35123 Padova – Italy. Email: giorgio.brunello@unipd.it. Telephone: +39-049-8274223

***Europe Direct is a service to help you find answers
to your questions about the European Union.***

Freephone number (*)**:**
00 800 6 7 8 9 10 11

(*)   The information given is free, as are most calls (though some operators, phone
    boxes or hotels may charge you).

More information on the European Union is available on the Internet (http://europa.eu).

Table of Contents

1

EXECUTIVE SUMMARY (English)

This report reviews the economic literature investigating the effects of the share of immigrants in classes and schools on the school performance of immigrants and natives. The review is organized in four sections. In the first section, we document the recent expansion in the presence of immigrants in European schools, introduce a measure of school segregation and show how this measure correlates with school performance.

The second section looks at the equity and efficiency implications of school segregation. We discuss under what conditions policies that reallocate students from schools with a high share of immigrants to schools with a low share can improve efficiency. In the third section we review the empirical evidence on the effects of the share of immigrants on the school performance of natives and immigrants. Policies that address the school segregation of immigrants are discussed in the final section.

The share of immigrants has increased in most European schools. Since immigrants usually concentrate in less affluent neighbourhoods, this higher share is not evenly distributed across schools. A useful measure of the segregation of immigrants and natives in specific schools is the dissimilarity index. Using multi-country data from the Programme for International Student Assessment (PISA), we compute this index in 2003 and 2012 and show that it has increased in many European countries, suggesting that school segregation has also increased.

Since native students and their families often react to an increased share of immigrants by moving to schools with fewer or no immigrants, school segregation is further exacerbated. In Europe, the flight of natives has been documented mainly for Northern countries. Whether the results based on these countries can be generalized to the rest of Europe is an open issue, that requires additional empirical research.

A key question is whether public authorities should intervene to contrast school segregation. This kind of intervention can be justified both on equity and efficiency grounds. In this report, we focus mainly on efficiency. Our indicator of efficiency is average school performance, that we measure using standardised test scores. Desegregation improves overall efficiency when the gain in terms of school performance from reducing the share of immigrants in schools with many immigrants dominates the loss from increasing this share in schools with few immigrants. Technically, this requires that the (negative) relationship between school performance and the share of immigrants is non-linear and concave.

Our focus on school performance to measure efficiency relies on the idea that human capital affects productivity and is a key engine of economic growth. But of course school stratification can have additional personal and social costs, including xenophobia, social exclusion, radicalisation, insecurity and violence. Since it is often very difficult to measure these costs, looking at school performance provides a useful starting point for policy analysis.

The empirical literature indicates that both native and immigrant students are negatively affected by the share of immigrant students in the class or school, but that the effect tends to be larger in absolute value for immigrants. We show that this asymmetry can also generate efficiency gains from the re-distribution of students across schools.

The empirical studies examining whether peer effects are non-linear and concave finds mainly supportive evidence, suggesting that re-allocation improves efficiency. There is also evidence that tipping points in the effects of the share of immigrants are present. These are thresholds in the share above which the negative effect on school performance increases in absolute value. The presence of tipping points justify policies that introduce caps to the share of immigrants in school. However, at what percentage should these caps be

set? Unfortunately, the estimated values of tipping points vary too broadly across studies, from 5 to 50 percent, to provide useful guidance.

Finally, we discuss a number of de-segregation policies implemented in the US and in Europe (admission lotteries, bussing, additional resources to schools with a high share of immigrants, parental information and the introduction of ceilings to the share of immigrants in classes and schools). It is unfortunate that for some of these policies very little exists to date in terms of evaluating their impact. Even less is available in terms of comparing the costs and benefits of alternative policies. Clearly more research – and adequate data – is required.

EXECUTIVE SUMMARY (GERMAN)

Dieser Bericht fasst Wirtschaftsliteratur zum Einfluss von Migrantenanteilen in Klassen und Schulen auf die Schulleistung von Migranten und Einheimischen zusammen. Der Bericht ist in vier Abschnitte gegliedert. Im ersten Abschnitt dokumentieren wir die neusten Erkenntnisse in europäischen Schulen mit Migranten, stellen ein statistisches Maß für die Segregation in Schulen vor und zeigen wie dieses Maß mit der Schulleis-tung korreliert ist.

Der zweite Abschnitt befasst sich mit den Auswirkungen der Segregation in Schulen auf Gerechtigkeit und Effizienz. Wir erörtern unter welchen Bedingungen Effizienz verbes-sert werden kann indem Schüler von Schulen mit hohem Migrantenanteil zu Schulen mit niedrigem Migrantenanteil umverteilt werden. Im dritten Abschnitt, besprechen wir empirische Belege der Effekte des Migrantenanteils auf die Schulleistung von Migran-ten und Einheimischen. Im letzten Teil werden Politikmaßnahmen zur Migrantensegre-gation in Schulen diskutiert.

Der Migrantenanteil hat in den meisten europäischen Schulen zugenommen. Da Mig-ranten meistens in weniger wohlhabenden Wohngegenden angesiedelt sind, ist dieser Anteil nicht auf alle Schulen gleichverteilt. Ein geeignetes Maß der Segregation von Migranten und Einheimischen in bestimmten Schulen ist der Unähnlichkeitsindex. Mit länderübergreifenden Daten des Programme for International Student Assessment (PI-SA), berechnen wir diesen Index für 2003 und 2012 und zeigen, dass er sich in vielen europäischen Ländern erhöht hat, also die Segregation an Schulen auch zugenommen hat.

Die Segregation von Schulen nimmt weiter zu, da einheimische Schüler auf einen stei-genden Migrantenanteil an Schulen häufig mit einem Umzug zu Schulen mit weniger oder keinen Migranten reagieren. In Europa konzentriert sich dieses Ausweichen der Einheimischen vor allem auf die nördlichen

Länder. Es bleibt ungeklärt, ob die Ursachen für die Fluktuation in diesen Ländern auf den Rest Europas übertragbar sind und bedarf zusätzlicher Forschung.

Eine Schlüsselfrage ist ob die zuständigen Behörden eingreifen sollten um die Schulseg-regation zu verhindern. Dieses Eingreifen könnte sowohl aus Gerechtigkeits- als auch aus Effizienzgründen legitimiert werden. Dieser Bericht fokussiert sich hauptsächlich auf die Effizienzgründe. Die Verminderung von der Segregation steigert die Gesamtef-fizienz, wenn der Nutzen aus der Reduzierung des Migrantenanteils an Schulen mit vie-len Migranten größer ist als die Kosten der Steigerung des Migrantenanteils an Schulen mit wenigen Migranten. Technisch erfordert dies, dass die (negative) Beziehung zwi-schen Schulleistung und dem Migrantenanteil nicht linear und konkav ist.

Unser Fokus bei der Effizienzmessung liegt auf den schulischen Leistungen und beruht auf der Idee, dass Humankapital Produktivität beeinflusst und eine zentrale Kraft für wirtschaftliches Wachstum darstellt. Aber natürlich kann Schulstratifizierung zusätzliche persönliche und soziale Kosten, einschließlich Fremdenfeindlichkeit, soziale Aus-grenzung, Radikalisierung, Unsicherheit und Gewalt haben. Da es häufig sehr schwierig ist diese Kosten zu messen, bietet das Betrachten der Schulleistungen einen nützlichen Startpunkt für Politikanalysen.

Die empirische Literatur legt nahe, dass sich ein größerer Migrantenanteil sowohl auf Einheimische als auch auf Schüler mit Migrationshintergrund negativ auswirkt, wobei der Effekt bei Migranten zu größeren absoluten Werten tendiert. Wir zeigen, dass diese Asymmetrie auch zu Effizienzgewinnen führen kann, wenn Schüler über Schulen hin-weg umverteilt werden.

Empirische Studien, die den nicht linearen, konkaven Gruppeneffekt untersuchen, fin-den größtenteils Belege für Umverteilungseffizienzen. Es gibt auch Hinweise auf einen Wendepunkt bei den Effekten des Migrantenanteils. Das sind Schwellenwerte des Pro-zentsatzes, über denen der negative Effekt auf die Schulleistung in absoluten Werten ansteigt. Das Auftreten dieser Wendepunkte legitimiert eine Politik, die eine Deckelung des Migrantenanteils einführt. Aber bei welchem Prozentsatz soll dieses Limit festgelegt werden? Leider variieren die Schätzwerte des Wendepunktes über die Studien zu stark, von 5 bis 50 Prozent, um als sinnvolle Orientierungshilfe zu dienen.

Abschließend, diskutieren wir Politikmaßnahmen zur Verminderung der Schulsegrega-tion aus den Vereinigten Staaten und in Europa (Lotterien bei der Schulzulassung, Bus-beförderung von Schulkindern in andere Stadtteile, zusätzliche Mittel für Schulen mit hohem Migrantenanteil, Aufklärung der Eltern und die Einführung einer Deckelung des Migrantenanteils in Klassen und Schulen). Jedoch gibt es noch wenige verlässliche Da-ten zur Beurteilung der Effekte dieser Maßnahmen. Noch weniger Evidenz gibt es zu Kosten und Nutzen dieser Politikmaßnahmen. So ist mehr Forschung - und adäquates Datenmaterial - erforderlich.

EXECUTIVE SUMMARY (FRENCH)

Ce rapport passe en revue la littérature économique traitant la question des effets de la part d'enfants immigrés dans les classes et les écoles à la fois sur leur performance scolaire et sur celle des natifs. La revue s'organise en quatre parties. Dans la première, nous montrons la récente augmentation du nombre d'immigrés dans les écoles européennes, introduisons une mesure de la ségrégation scolaire et montrons comment cet indicateur est corrélé à la performance scolaire.

La deuxième partie s'intéresse aux implications en termes d'équité et d'efficacité de la ségrégation scolaire. Nous montrons sous quelles conditions des politiques visant à relocaliser des élèves d'écoles avec une forte présence d'enfants immigrés vers d'autres où elle est moindre peut améliorer l'efficacité du système scolaire. Dans la troisième partie, nous passons en revue les résultats empiriques concernant les effets de la part d'enfants immigrés sur la performance scolaire des natifs et des immigrés. Enfin, des politiques visant à réduire la ségrégation scolaire des enfants immigrés sont présentées dans la dernière partie.

La part d'enfants immigrés s'est accrue dans la plupart des écoles européennes. Dans la mesure où les immigrés ont tendance à se concentrer dans des quartiers modestes, cette augmentation n'a pas été uniformément distribuée sur le territoire. L'indice de dissimilarité est une mesure utile de la ségrégation entre enfants immigrés et natifs dans une école donnée. En utilisant une base de données comprenant plusieurs pays issue du Programme international pour le suivi des acquis des élèves (PISA), nous calculons cet indice en 2003 et 2012 et montrons qu'il a augmenté dans de nombreux pays européens, suggérant que la ségrégation scolaire s'y est accrue.

La ségrégation scolaire se trouve d'autant plus exacerbée que les élèves natifs et leurs familles réagissent souvent à l'accroissement du nombre d'immigrés dans l'école d'origine en changeant pour une école où cette présence est moindre. En Europe, ce mouvement des natifs a été documenté principalement

dans les pays du Nord. Il reste encore à prouver empiriquement si des résultats basés sur ces pays peuvent être généralisés au reste de l'Europe.

Une question clé demeure sur l'opportunité pour les pouvoirs publics d'agir contre la ségrégation scolaire. Une telle intervention peut se justifier à la fois par des motifs d'équité et d'efficacité. Dans ce rapport, nous nous concentrons principalement sur l'efficacité. Un recul de la ségrégation scolaire est positif sur le plan de l'efficacité si les gains en termes de performance scolaire découlant d'une diminution de la part d'immigrés dans une école en comptant beaucoup surpassent les pertes engendrées par une augmentation de cette part dans une école qui en comptait peu. Sur le plan technique, ceci requiert que la relation (négative) entre performance scolaire et part d'enfants immigrés soit non-linéaire et concave.

Nous avons choisi de nous concentrer sur la performance scolaire pour mesurer l'efficacité des politiques en nous basant sur l'idée que le capital humain affecte la productivité et constitue donc un facteur clé de croissance. Bien entendu la stratification scolaire peut avoir des coûts individuels et collectifs supplémentaires, tels que la xénophobie, l'exclusion sociale, la radicalisation, l'insécurité et la violence. Mais dans la mesure où il est souvent très difficile de mesurer ces coûts, s'intéresser aux performances scolaires est un point de départ intéressant pour l'analyse des politiques publiques.

La littérature empirique semble indiquer que les natifs et les immigrés sont tous impactés négativement par la part d'enfants immigrés dans la classe ou l'école, mais que cet effet tend à être plus important en valeur absolue pour les enfants immigrés. Nous montrons que cette asymétrie peut aussi générer des gains d'efficacité par la redistribution des élèves entre écoles.

Les études empiriques qui examinent si les effets de pairs sont non-linéaires et concaves aboutissent en majorité à des conclusions allant dans ce sens, ce qui suggère que la réallocation peut améliorer l'efficacité du système scolaire. Les résultats suggèrent également la présence de seuils critiques dans la part d'enfant immigrés au-dessus desquels l'effet négatif sur la performance

scolaire augmente en valeur absolue. La présence de tels seuils plaide en faveur de politique de plafonnement de la part d'immigrés dans les écoles. Mais dès lors, à quel taux fixer le plafond ? Malheureusement, les valeurs estimées de ces seuils critiques varient trop fortement d'une étude à l'autre – de 5 à 50 pourcents – pour être utilement mobilisables.

Pour finir, nous présentons un certain nombre de politiques mises en place aux Etats-Unis et en Europe visant à faire reculer la ségrégation scolaire (tirage au sort des admissions, transport scolaire, ressources supplémentaires pour les écoles présentant une forte présence d'enfants immigrés ou encore introduction de plafonds pour la part d'immigrés par classe et par école). Il est malheureux de constater que pour certaines de ces politiques, très peu de travaux d'évaluation existent pour quantifier leur impact. Et encore moins d'études sont disponibles pour comparer les coûts et bénéfices de politiques alternatives. Davantage de recherche – et de données pertinentes – sont clairement nécessaires sur ces questions

Introduction

Immigration flows have changed the composition of students in the classes and schools of Europe. The integration of immigrants is often problematic, and these flows have triggered in some countries the flight of natives from schools with a high share of immigrants.

A key question is whether the increased share of immigrants in schools and classes has a negative effect on the school performance of immigrants and natives. In the economics literature, this type of effect is called "peer effect". The influence of immigrant students on their native classmates is a particular type of peer effect: immigrants are peers with a different culture, a different way to interact with others and, most often, limited language proficiency.

Due to economic conditions, immigrant pupils[1] usually concentrate in less affluent neighbourhoods, where housing prices are lower. Typically, the schools in these neighbourhoods are attended both by immigrants with limited language proficiency and by natives with a relatively poor parental background. Since some natives with better parental background may leave from schools and neighbourhoods with a high share of immigrants, school segregation is likely to increase, with some schools attracting mainly natives and other schools attracting immigrants. If a higher share of immigrants has a negative effect on the school performance of natives and immigrants, school segregation is bound to increase the dispersion of educational outcomes.

Equality considerations suggest that appropriate policies should be designed to reduce segregation and improve equality of opportunity. But are de-segregation policies also justified on efficiency grounds? Re-distributing students from schools with a high share of immigrants to schools with a lower

---

[1] In this report we use the term "immigrant pupil or student" as synonymous to "pupil or student with an immigrant background" and "native pupil or student" as synonymous to "pupil or student with a native background". Pupils with an immigrant background are first and second generation immigrants. Pupils with a native background are individuals born in the country from native parents. For a definition of first and second generation immigrants see Eurostat, 2011.

share may improve the performance of the former at the price of reducing the performance of the latter. Efficiency increases if adding up gains and losses results in a net gain, for instance because average performance increases.

This report addresses these questions from an economic perspective. We focus on school performance to measure efficiency because of the widespread belief that human capital affects productivity and is a key engine of economic growth. But of course school stratification can have additional personal and social costs, including xenophobia, social exclusion, radicalisation, insecurity and violence. Since it is often very difficult to measure these costs, looking at school performance provides a useful starting point for policy analysis.

We start in Section 1 by documenting both the recent expansion in the presence of immigrants in European schools, as compared to US and Australian schools, and by introducing a measure of school segregation, the index of dissimilarity. We show how segregation has changed during the last decade (between 2003 and 2012) and how it relates to school performance, measured by standardized test scores. We briefly discuss how an increased inflow of immigrant pupils can trigger the flight of natives from schools, thereby exacerbating school segregation by immigrant status. This flight is clearly encouraged when school enrolment is not based exclusively on residence criteria.

Section 2 looks in some detail to both the equity and the efficiency implications of school segregation. We are particularly interested in establishing under what conditions policies that reallocate students from schools with a high share of immigrants to schools with a low share can improve efficiency, that we measure here with total (or average) school performance. We show that these conditions require that immigrant peer effects are not only negative but also non-linear and concave, meaning that the marginal gain from reducing the share of immigrants in a school with many immigrants dominates the marginal loss from increasing the share in a school

with few immigrants. Concavity obtains for instance when peer effects are negative and linear but higher for immigrant than for native pupils.

Section 3 reviews the empirical evidence on the effects of the share of immigrants on the school performance of natives and immigrants. We start with some methodological considerations, and argue that empirical evidence can inform policy-making if it succeeds in establishing causal effects. Next, we review both US and European evidence, but place much more emphasis on the latter than on the former. We discuss in some detail the existing evidence on the non-linearity and concavity of peer effects and conclude the section by considering the scarce literature that distinguishes immigrant pupils on the basis of the country of origin.

In the final section of this report, we review current policies that address the school segregation of immigrants.[2] We consider the following policies: admission lotteries, bussing, improving the quality of schools with a high share of immigrants, parental information and ceilings on the share of immigrants in classes or schools. Unfortunately, for some of these policies very little exists to date in terms of the evaluation of their impact. Even less is available in terms of comparing the costs and benefits of alternative policies. Clearly more research − and adequate data − is required in this area. Conclusions follow.

---

[2] Important policy guidelines on the education of migrants were set at the European level in the Council conclusions of 26 November 2009. See European Union, 2009.

1 Immigrant Students and School Segregation in Europe

1.1 What the international data show

The flow of immigrants into Europe has increased sharply in recent years. During 2015, close to one million asylum seekers reached Europe (OECD, 2015). Migration is also affecting classrooms and schools. An estimate of the share of immigrant pupils in European (secondary) schools can be obtained using the Programme for International Student Assessment (PISA).[3]

At the time when this report was produced, PISA latest data are for 2012, well before the recent acceleration in the wave of immigrants. Alternative international data sources, including The Trends in International Mathematics and Science Study (TIMSS) and The Progress in International Reading Literacy Study (PIRLS), comprise more recent waves – 2015 and 2016 – but the relevant databases have not yet been released to the public.

Table 1 shows the average share of immigrant students in the schools of several European countries, Australia and the US, both in 2003 and 2012.[4] In 2003, this share was highest in Australia (21.7 percent) and Switzerland (20 percent), and lowest in Finland (1.9 percent) and Italy (2.1 percent). Nine years later, the share of immigrants has increased everywhere, with the exception of Germany, Hungary, Latvia and the Netherlands. The percentage increase has been highest in the US, Ireland, Spain and Italy - see Figure 1.

By using TIMSS 1999 and 2011, we can compute the share of immigrants in schools for eight graders, generally two grades earlier than PISA, albeit for a much smaller sample of countries than in PISA. Table 2 reports the average

---

[3] The share is calculated using the final student weights supplied with the PISA data in order to derive the appropriate estimates of the population values. The weights take into account both the sampling of schools with probability proportional to size and the simple random sampling of students. They also take into account levels of response by both schools and pupils within schools. See Jenkins, Micklewright and Schnepf, 2006.
[4] We exclude from the table a few Eastern European countries (Poland, Romania and Bulgaria) because the average share of immigrants in these countries is tiny (less than 1 percent).

share of immigrants in schools both for 1999 and for 2011. With the exception of Hungary and Slovenia, where the share of immigrants in schools has slightly decreased, the general trend is an increase in the share in Europe, Australia and the US.

Using national sources, we find that in 2015 this share in Italy was equal to 12.6 percent in the second grade of primary schools, to 9.0 percent in the fifth grade and to 6.2 percent in the third grade of lower secondary schools.[5]

1.2 Measures of school segregation by immigrant status

An important issue, and one particularly relevant for this report, is how the increasing share of immigrants is distributed across schools. Due to economic conditions, immigrants usually concentrate in less affluent neighbourhoods, where housing prices are lower. In the traditional catchment area model, students are assigned to a school in their neighbourhood. Thus, whenever housing is highly segregated, schools tend to be segregated as well. The schools perceived to be of better quality are often located in areas where property prices and rents are higher. Good quality schooling has an implicit price in the housing market and migrant students from low socio-economic backgrounds may not have access to it (OECD, 2009).

Typically, the schools in poorer neighbourhoods are attended both by immigrant students with limited language proficiency and by native students with a relatively poor parental background. School segregation by immigrant status occurs when immigrants and natives concentrate in specific schools. A measure of segregation is the un-evenness of the distribution of the share of immigrant pupils among schools. A popular indicator for an uneven or imbalanced distribution is the *dissimilarity index* (or Duncan index), which measures the proportion of a certain group of students who would have to be

---

[5] Source: INVALSI data.

reassigned to other schools in order to achieve the same proportion in each school as for the whole area (Duncan & Duncan, 1955).[6]

Compared to alternative indices of polarization, which are closely related to the Herfindhal index, the dissimilarity index is a natural choice in the current context, characterized by two complementary groups. We compute the dissimilarity index using data from PISA 2012, that focus on 15 years old students. As for the share of immigrants, we use final student weights. Figure 2 plots the dissimilarity index against the contemporaneous average share of immigrants in schools. The correlation between these two variables is negative,[7] indicating that, when immigrant students are more numerous, they are more evenly distributed across schools. The figure excludes a few European countries where the share of immigrant students was very low in 2012 (Romania, Poland and Bulgaria). We find that the dissimilarity (or Duncan) index is highest in Lithuania and lowest in Ireland, Bosnia and Switzerland.

Figure 3 shows instead how our measure of segregation changes between 2003 and 2012. We find that the dissimilarity index has increased substantially in Hungary and Latvia and decreased in the majority of sampled countries, especially in Italy, Greece and the Czech Republic, in spite of the general increase in the share of immigrants.

---

[6] The dissimilarity index D is defined as :

$$D = \frac{1}{2} \sum_s \left| \frac{M_s}{M} - \frac{N_s}{N} \right|$$

where M_s and N_s are the number of immigrants and natives in school *s* and M and N are the total number of immigrant and native students. This index adds across schools the absolute difference between the share of immigrants $\frac{M_s}{M}$ and the share of natives $\frac{N_s}{N}$, and is equal to 0 in the case of equal distribution and to 1 with full segregation.

[7] Brunello and Rocco, 2013, point out that the correlation is negative by construction.

1.3 Segregation and School Performance

A key question discussed in this report is whether school segregation, and in particular the concentration of immigrants in some schools, affects both total student achievement – an important predictor of economic growth according to Hanushek and Woessmann, 2010 - and the average achievement of immigrants and natives. Figure 4 looks at the simple correlation between the dissimilarity index and average math test scores at age 15 in 2012. The evidence suggests absence of correlation: for instance, Ireland and the Czech Republic exhibit very similar average test scores but substantially different indices of segregation. However, if we remove from the sample two clear outliers – Greece and Croatia – the correlation turns negative and statistically significant.

We hasten to stress that correlation is not causation, because many factors are likely to affect both average test scores and the distribution of immigrants in schools. For instance, countries with higher test scores – and possibly higher income – may attract more immigrants, which is likely to reduce the index of segregation and to induce a negative bias in the estimated correlation. Identifying the causal effect of segregation on average test scores would require sources of exogenous variation which affect the allocation of immigrants in schools without any direct effect on test scores. For instance, an unexpected event that changes the share of immigrant pupils and its distribution. Finding this variation using cross country data is a difficult task, as discussed in Section 3 of this report.

There are several factors that could affect ethnic segregation in schools. One is the combined effect of demographic trends and residential segregation (see OECD, 2009). Since the 1970s, the number of immigrants in most industrialised countries has been increasing in metropolitan areas and in certain districts within those areas. At the same time, the number of native residents has been falling. As a consequence, the proportion of immigrant

students has increased, and the proportion of native students has fallen. Second, parental choice matters. Two dimensions of this choice are discussed in the rest of this section: the flight of natives from schools with a high immigrant share, and the removal of residence-based admission criteria.

1.4 The flight of natives from schools

One of the consequences of the increased share of immigrants in local schools is that natives may abandon these schools and choose institutions with fewer or no immigrant, and by so doing exacerbate school segregation. This phenomenon has been denoted by Betts and Fairlie, 2003, as "native flight", or the tendency of native-born Americans to leave public schools for private alternatives following an influx of immigrants, who are perceived to affect the school performance of natives. This flight does not necessarily involve only moves from public to private schools, as is typical of the United States, but could occur also from the local public school to another public school within the same municipality or even outside it.

In a recent study focusing on California, Cascio and Lewis, 2012, examine whether low-skilled immigration to the United States has contributed to immigrants' residential isolation by reducing native demand for public schools. They estimate that between 1970 and 2000, the average California school district lost more than 14 non-Hispanic households with children to other districts in its metropolitan area for every 10 additional Hispanic households enrolling their children in its public schools.

The flight of natives from schools with a high share of immigrants has also been investigated in the European context. Using data from Copenhagen school registers and other sources, Rangvid, 2010, asks whether Danes are more likely to opt out of their local public school if it has a large concentration of immigrant pupils. She finds that the opting out decisions of natives are not affected until the immigrant concentration reaches the 35 percent tipping point. Above that point, however, Danes opt out to a private school or to

another public school within the municipality. Interestingly, Danish speaking immigrants also opt out of schools with high immigrant concentrations, but to a much lower extent than natives. She concludes that ethnic segregation in schools is increased by the differential behaviour of natives and immigrants.

In another study focusing on Denmark, Gerdes, 2013, looks at the effects of the changes in the immigrant population in Danish municipalities between 1992 and 2004, a period characterised by a substantial influx of refugees, on the propensity of native Danes to enrol their children in free private schools. He estimates that a 10 percentage points increase in the share of pupils with parents coming from countries outside the EU and OECD generates a 1.14 percentage points increase in private school attendance rate by native Danes.

Farre, Ortega and Tanaka, 2016, investigate the effects of immigration on the schooling decisions of natives in Spain, using household-level data for years 2000-2012, a period characterized by substantial immigration, and find that Spanish households responded by increasing their educational expenditures, mainly as a result of their flight from tuition-free schools toward private ones. They also find strong evidence that only better educated native households switched to private schools in response to immigration. Finally, Karsten, 2006, reports that in the Netherlands, according to school principals, a percentage of minority pupils exceeding 50-60% causes Dutch parents to take their children to other schools.

Since the evidence for Europe is mainly drawn from studies focusing on Scandinavian countries, it is difficult to extend it to other EU countries. Clearly, additional research in this area is warranted.

1.5 School Choice and School Segregation

School choice, which allows students to apply for admission to schools located outside their neighbourhood, can increase efficiency by making local schools more responsive to parental preferences. However, this may come at the cost of increasing school segregation, as students get sorted by ability, ethnicity

and parental background, with the most disadvantaged students becoming isolated in the worst schools.

In countries allowing for school choice, the concentration of students along socio-demographic lines is sometimes reinforced by the choices parents make regarding the school in which they enrol their children. Research shows that native parents are more likely than migrant parents to use school choice and opt out of schools with high concentration of migrants, thus reinforcing segregation between schools (OECD, 2009).

Soderstrom and Uusitalo, 2010, investigate the effects of a large-scale admission reform that occurred in Stockholm upper secondary schools in 2000. Even prior to the reform, students could apply to any school within Stockholm, but if the school was over-subscribed, school assignment was based on residence. The 2000 reform abolished all residence-based admission criteria, and admission became based on previous grades only. The intention was to undo the effects of residential segregation, and to give the opportunity of attending the most prestigious schools in downtown Stockholm to all students, irrespective of where they lived.

Their key finding is that the distribution of students among schools changed dramatically after the reform, with an increase both of the sorting of students into schools by ability and of the segregation between immigrants and natives. These results are similar to those by Burgess et al, 2007, who use British data and report that sorting according to ability, ethnicity, and income is positively related to school choice.

In another study focusing on Sweden, Böhlmark et al, 2015, examine the evolution of school segregation in Sweden in the aftermath of the 1992 universal school voucher reform, which spurred the establishment of new independent voucher schools and introduced parental choice. They document that, in the regions where school choice has become more important, school

segregation between immigrants and natives has increased more than in regions where choice remained limited.

More inconclusive evidence on the effects of school choice on school segregation by ethnicity is presented by Schneider et al, 2011, who look at a German reform that abolished in 2008 school districts in North Rhine-Westphalia. They find that the dissimilarity index did not change significantly after the abolition of school districts when considering Muslim (mostly Turkish) and non-Muslim (mostly German) students. This finding, however, may be due to the fact that the authors consider only the first school year after the reform, perhaps too early for the entire adjustment process to unfold.

2 School Segregation: Efficiency and Equity Issues

Should public policy intervene to de-segregate schools? This question can be answered from different perspectives. From an economic perspective, the one we care about in this report, public intervention is typically justified in the presence of "market failures", that limit individual choice and hinder the possibility of attaining the optimal allocation of (scarce) resources. At least since Milton Friedman, it has been widely recognised that disadvantaged individuals may lack the economic resources to fully implement school choice, and may therefore remain trapped in the worst schools.

In several OECD countries, the access of migrant students to high quality education tends to be restricted by residential segregation, liquidity constraints and poor parental background (or long – term liquidity constraints in the parlance of Carneiro and Heckman, 2002). In addition, their education is often interrupted as they tend to drop out and leave school before completion more frequently than natives.

An important question is whether desegregating schools improves efficiency, defined as total student achievement. The answer to this question depends on

the nature of the interactions between natives and immigrants in school. It seems clear that if the share of immigrants (natives) in a school has negative effects *only* on native (immigrant) students, total segregation may improve average performance. On the other hand, if each group has positive effects only on members of the other group, having mixed classes is likely to be optimal. When the share of immigrants has negative effects on the school performance of both immigrants and natives, that is to say, when peer effects are negative, two concepts are important to establish whether desegregation improves average school performance (see Andersen and Thomsen, 2011): non-linear peer effects and asymmetric peer effects. We describe these two concepts in turn.[8]

2.1 Non-linear peer effects

Consider a prototype society with two schools, 1 and 2, that differ in their share of immigrant pupils, s_1 and s_2, and assume that $s_1 > s_2$. Let average pupil performance in each school p_i, i=1,2, be a linearly decreasing function of the share s_i, so that $p_i = \beta_0 - \beta_1 s_i$, where the peer effect β_1 is constant across schools. This is equivalent to assuming that a higher share of immigrants negatively affects school performance, something that we shall examine at length in the next section of this report. In this setup, reducing the share of immigrants in school 1 by ten percent (0.1) increases performance in that school by $0.1\beta_1$. On the other hand, increasing the share in school 2 by 10 percent reduces performance in that school by $0.1\beta_1$.

Further denote $T_i = I_i + N_i$ as the total number of students in school *i*, with I for immigrants and N for natives, and let $T = T_1 + T_2$ and $t = T_1 / T$. With this notation, total student performance in the two schools, W, is given by

---

[8] See also Epple and Romano, 2011, Winston and Zimmermann, 2004, Schapiro, 1990, and the references therein.

$$W = T_1 p_1 + T_2 p_2 = T[t p_1 + (1-t) p_2] = T\{\beta_0 - \beta_1 [t s_1 + (1-t) s_2]\} \qquad (1)$$

where $[t s_1 + (1-t) s_2]$ is the weighted share of immigrant students.

Consider a policy that reallocates immigrant students from school 1 to school 2 up to the point when the share of immigrants in each school is equal to $t s_1 + (1-t) s_2$. It is clear from (1) that by reallocating students in this way, the policy eliminates segregation without any effect on total performance: by reducing the share of immigrants in school 1, performance in that school increases, but this increase is equal to the reduction in the performance of pupils in school 2, where the share of immigrants has increased.

In this case, desegregating schools does not lead to efficiency gains, because total performance is unchanged, since peer effects are linear, but generates equity gains, because equality between schools increases. Figure 5 illustrates by plotting average school performance W/T against the share of immigrants in the two schools. Average performance $\{\beta_0 - \beta_1 [t s_1 + (1-t) s_2]\}$, obtained by averaging the performance of the two schools, is equal to average performance when each school has the average share of immigrants $t s_1 + (1-t) s_2$.

Assume now that the negative effects of the share of immigrants on student performance increase with the share itself, or, alternatively, that the negative peer effect of an extra immigrant student is not constant as before but higher in school 1, that has many immigrants, than in school 2. Under this assumption, peer effects are non-linear, and the function relating school performance to the share of immigrants, $p_i = f(s_i)$, is concave in s_i.[9] As in the previous thought experiment, consider a reallocation of immigrants from school 1 to school 2, such that the share of immigrants in the two schools becomes equal to $t s_1 + (1-t) s_2$. Before reallocation, total school performance was equal to

---

[9] An example a performance as concave function of the share of immigrants is $p_i = \beta_0 - \beta_1 s_i^2$

$T\big[tf(s_1)+(1-t)f(s_2)\big]$. After reallocation, it is given by $T\big[f(ts_1+(1-t)s_2)\big]$. A property of the concavity of $f(s_i)$ is that

$$T\big[f(ts_1+(1-t)s_2)\big] > T\big[tf(s_1)+(1-t)f(s_2)\big] \tag{2}$$

In this case, desegregating schools improves not only equality but also overall school performance, because the gain to school 1 induced by the reduction in its share of immigrants is larger than the loss to school 2 due to the increase in its share. Desegregation benefits the school with many immigrants at the expense of the school with few immigrants but the balance of gains and losses is positive.[10] Under the assumption that higher total performance is conducive to higher output per head and higher GDP growth, the entire economy benefits from redistribution. Figure 6 illustrates this case. Concavity of the relationship between school performance and the share of immigrants implies that average performance when both schools have the average share of immigrants is higher than average performance when schools have different shares of immigrants.

Finally, consider the case when the negative peer effect of an extra immigrant student is lower in school 1, that has many immigrants, than in school 2. In this case, we say that the function $f(s_i)$ associating school performance to the share of immigrants is convex, and school desegregation, that redistributes immigrants from school 1 to school 2, reduces overall performance, because school 2 loses more than what school 1 gains from the reallocation of students. Figure 7 illustrates this final case.[11]

The above discussion clarifies why it is important not only to establish whether the share of immigrants reduces school performance but also to

---

[10] The net gain could be used to compensate the school that loses from redistribution.

[11] An example of convex function is $p_i = \beta_0 - \beta_1 \ln s_i$

understand the nature of this relationship, in particular whether it is linear or non-linear. We stress that evidence that peer effects are linear precludes the efficiency gains of re-distribution but does not rule out desegregation policies, that can still be justified on equity grounds. To illustrate, assume that the objective function of the policy maker is increasing in total school performance and decreasing in the variance of performance across schools. In this case, although de-segregation with linear peer effects may be not justified on sole efficiency reasons – no effect on total performance – it is still justified on equity reasons, as it reduces the variance of school performance.

A special case (see Andersen and Thomsen, 2010, and Figure 8 below) is when the negative effect of the share of immigrants in the school on average school performance occurs only above a threshold or tipping point s_t. In this case, when both s_1 and s_2 are below the threshold, the share of immigrants has no effect on school performance and desegregation policies have no impact on efficiency. On the other hand, if s_1 is above the threshold and s_2 is below it, reallocating immigrants from school 1 to school 2 so that both schools are below the tipping point improves both school performance in school 1 and total performance.

2.2 Asymmetric linear peer effects

In the discussion of the previous section, we have assumed that the relationship between pupil performance in the school and the share of immigrants $p_i = \beta_0 - \beta_1 s_i$ does not vary across different groups of students. Yet one cannot exclude that the educational performance of immigrant students is more affected by the concentration of immigrants than the performance of natives. Assume for instance that immigrants suffer more than natives because of the higher share of immigrants, that is, $\beta_{II} > \beta_{IN}$. Then the average school performance in school i is given by

$$p_i = s_i(\beta_0 - \beta_{II}s_i) + (1-s_i)(\beta_0 - \beta_{IN}s_i) = \beta_0 - \beta_{IN}s_i - (\beta_{II} - \beta_{IN})s^2_i \qquad (3)$$

Therefore, while the relationship between performance and the share of immigrants is linear for each group within the school, it is non-linear for the average student in the school. In particular, if the (negative) impact of a higher share of immigrants is stronger for immigrant than for native students, equation (3) is concave, and reallocations of immigrants from a school with many immigrants to a school with fewer immigrants increases overall school performance.

In summary, when the share of immigrants negatively affects the school performance of immigrants and natives, desegregating schools by re-distributing immigrants typically affects the equality of school outcomes but can also affect efficiency, depending on whether: a) peer effects are non-linear; b) they are linear but asymmetric across natives and immigrants in the same school. Therefore, empirical evidence on the existence and the shape of the relationship between the share of immigrants and school performance is essential to draw policy implications and to evaluate from an economic perspective policies that affect school segregation. We review the existing evidence in the next section.

3 The Effect of the Share of Immigrants on the School Performance of Immigrants and Natives

In the economic and social literature it is well known that peers represent an important educational input. Pupils are affected by their schoolmates, and these effects could be positive or negative. For instance, schoolmates can create either a disruptive or a collaborative and stimulating environment. They can be supportive in studying activities and share valuable information. Peers can also contribute to the formation of values and aspiration and serve as positive or negative role models.

The effects originated from the interactions among schoolmates are commonly referred to as 'peer effects' and have been analysed at length by the economic

and sociological literature. Nonetheless, the literature investigating the specific question of whether class composition by ethnicity or immigrant status affects educational outcomes is relatively small and new.

Individual school performance can be affected by the share of students with an immigrant background in several ways. On the one hand, a high share of immigrant students may create a particularly problematic learning environment and adversely influence both native and immigrant students, because of differences in initial skills and attitudes. A high share of students who do not master the language of instruction may hamper teaching activities. Immigrant children who attend a school with a high share of immigrant pupils face reduced exposure to native students, with potentially negative consequences both on their integration in the host country and on their educational outcomes. On the other hand, the cultural diversity of mixed classes and schools may generate a stimulating atmosphere, with positive effects on learning processes. A high share of immigrant students might also help teachers and school authorities to recognize specific learning difficulties ("salience") and undertake decisions aimed at overcoming them (Schneeweis, 2015).[12]

Understanding the nature and the magnitude of peer effects in education is crucial for school design. If peer effects are at work, individual educational outcomes are affected by how children with an immigrant background and children of native parents are arranged across classes. Average outcomes are likely to be affected as well, as discussed above.

---

[12] "On the one hand, interaction of peers of different cultural background may generate positive externalities, such as quicker acquisition of language skills…In addition, a high concentration of disadvantaged pupils in certain schools may lower their quality, for example, if it results in a decline in the average quality of teachers. There is empirical evidence that the educational outcomes of immigrants may be indeed adversely affected by differences in school quality. Second-generation pupils who themselves have an advantageous background but go to school with many disadvantaged students achieve lower test scores than comparable pupils who attend a school with many advantaged students…" (Bonin, 2016, p.32).

3.1 Empirical Issues

By and large, the empirical research done by economists in this area aims at establishing causal effects. Yet, the identification of the causal impact of school composition on educational outcomes is not straightforward because students and their parents choose their schools and consequently their peers. Immigrants typically locate in poorer areas and, as a consequence, their children attend schools with many lower-achieving native students. In addition, as discussed above, given their residential decision, households might have some degree of freedom in school choice and select schools on the basis of expected peer characteristics and perceived quality.

Furthermore, the allocation of immigrant students among classes is not random, but decided by the school administration. This implies that studies of peer effects based on simple econometric models that regress individual school outcomes on their own individual characteristics (measures of ability, family background and so on) as well as on peer outcomes and characteristics are plagued by serious problems. One such problem is that it is impossible to separate the effects of peer outcomes from those of peer characteristics (the well – known "reflection" problem).

Another problem is self-selection. Since peers are not assigned randomly but chosen, it is very likely that a student's characteristics are correlated with those of his\her peers. If some of these characteristics are omitted from the analysis because they are not observed by the analyst, the resulting estimates of peer effects are biased. The induced bias can be either downwards or upwards. On the one hand, the fact that immigrant students self-select into schools attended by native students with low unobserved ability leads to overestimating the negative effect of the share of immigrants on performance, because of the negative spurious correlation between the educational attainment of native students and the share of immigrant students in the school. On the other hand, the effect of the share of immigrants is likely to be

under-estimated if school authorities assign classes with a high share of immigrant pupils to better teachers.

To overcome these problems the existing empirical literature has adopted different strategies: instrumental variables, aggregation of data at levels (the country, city, metropolitan area or school) at which sorting is reduced or eliminated and school fixed effect models that exploit the variation in the composition of immigrant within schools and between grades.

3.2 US Evidence

While US empirical research have often focused on racial minorities, European research has paid more attention to immigrants. Examples of US research include Guryan, 2004, who shows that the racial desegregation of American school districts in the 1970s-80s benefitted black students by reducing their dropout rate, and Angrist and Lang, 2004, who investigate the effects of the "Metco" school racial desegregation program (a program that sends mostly black students from Boston schools to more affluent suburbs) and find no effect of "Metco" students on the test scores of white students in receiving districts, but a negative impact on the reading and language scores of their black peers.

Hoxby, 2000, uses an identification strategy that relies on the variation in the ethnic composition of cohorts within schools and shows that the share of black students in class has negligible effects on the performance of white students, but a negative impact on the test scores of black students. The estimated negative effect is about four times larger for black than for white students. In a similar fashion, Hanushek and Rivkin, 2009, Hanushek et al., 2009, and Cooley, 2014, find that immigrant peer effects are stronger for immigrant than for native pupils. In contrast, Friesen and Krauth, 2011, study the effects of the language spoken at home on educational attainment and find that the 'within-group' effects are weaker than the 'across-groups' effects.

3.3 European Evidence

The impact of immigrant concentration on the academic achievement of European students has been analysed by several studies. While some papers (Brunello and Rocco, 2013, Ballatore et al., 2013, Hardoy and Schone, 2013; Tonello, 2015) focus exclusively on the effects of the share of pupils with an immigrant background on native students, other papers (Jensen and Rasmussen, 2011; Andersen and Thomson, 2011; Ohinata and Van Ours, 2013; Contini, 2013; Schneeweis, 2015) consider also the impact of this share on immigrant students.

Overall, results are mixed. As summarized in Table 1, the estimated negative effects of the share of immigrants on native children range from sizeable - see Gould et al., 2009, Ballatore et al., 2013, and Hardoy and Schone, 2013 - to small - see Brunello and Rocco, 2013, Frattini and Meschi, 2016 and Tonello, 2015, to virtually zero - see Geay et al., 2013, Ohinata and Van Ours 2013, Contini, 2013 and Schneeweis, 2015. While Jensen and Rasmussen, 2011, find negative effects of ethnic concentration on both native and immigrant students, Ohinata and Van Ours, 2013, Contini, 2013, and Schneeweis, 2015, find no sizeable effect on native students and negative effects on immigrant students.

Quasi-experimental evidence is provided by Gould et al., 2009, and Geay et al., 2013. Gould et al., 2009, analyse the impact of immigrant concentration during elementary school on the long-term academic outcomes of native students by using the wave of mass migration from the former Soviet Union to Israel in the early 1990s. Their identification strategy is based on the assumption that, conditional on the total number of immigrant students admitted to a given school, the variation in the proportion of immigrants across grades of the same school can be considered to be solely due to exogenous demographic factors. They find sizeable negative effects of the share of immigrants on the performance of native students.

Geay et al., 2013, exploit the exogenous variation generated by the influx of white immigrants following the E.U. enlargement to Eastern European countries in 2005. In their study, they analyse the effect of the share of non-native English speakers on the educational attainment of native English speakers in England. Their results show no statistically significant effect.

Contini, 2013, Ohinata and Van Ours, 2013, and Frattini and Meschi, 2016, address the endogenous sorting of children with an immigrant background by exploiting the variability in the share of immigrant students within schools and between classes of a given grade. Their approach is based on the assumption that, once school fixed effects are controlled for, the allocation of children with an immigrant background between classes is as good as random. This is clearly a very strong assumption, and one that is unlikely to hold when school principals can reallocate immigrants between classes (see Ballatore et al, 2014).

Using Italian data, Contini, 2013, reports that the share of immigrant children in the class has weak negative effects on the test scores of native children but larger negative effects on immigrant children. No adverse effects of the share of immigrant children on native pupils are found also by Ohinata and Van Ours, 2013, who look at Dutch data using repeated waves from PIRLS (Progress in International Reading Literacy Study) and TIMSS (Trends in International Mathematics and Science Study). They find instead evidence that this share affects negatively the reading scores of immigrant students.

Frattini and Meschi, 2016, use administrative data on the universe of students belonging to the 2009 and 2010 cohorts who were enrolled in the vocational secondary schools of the largest Italian region (Lombardy) and find that in these schools, where the concentration of immigrants is higher than in more academic oriented institutions, the share of immigrants in the classroom has a negative effect on the math test scores of natives. The size of the estimated effect is largest in absolute value for low ability native students.

Ballatore et al., 2014, criticise the empirical approach adopted by Contini, Ohinata and van Ours and Frattini and Meschi by convincingly arguing that identification strategies based on within-school variation in the share of students with an immigrant background might lead to biased results because of class size adjustments implemented by school administrators who fear disruption effects from immigrant children. Once this source of bias is taken into account, they find adverse consequences of immigrant concentration on native children.

An alternative approach that bypasses the problems associated to the endogenous allocation of students to classes is to aggregate data at the school level and use the within-school variation that occurs across grades. As argued by Hoxby, 2000, this is demographic variation that can be considered as good as random. This estimation strategy is adopted by Hardoy and Schone, 2013, who focus on upper secondary schools in Norway and consider as outcome variable the probability of dropping out from school. They find that an increase in the share of immigrant students increases the dropout rate of native students, and show that the estimated effect is driven by the share of immigrants with parents with lower education and by immigrant students who arrived in the host country after age 7. They conclude that the negative effect of the share of immigrants may be due to a skill deficit.

A similar approach is adopted by Schneeweis, 2015, who looks at grade repetition in primary and secondary Austrian schools and track attendance after primary education. She finds that, while native students are not affected by the share of immigrant students, the latter are negatively affected by immigrant concentration. The estimated negative spill-over effects are particularly strong for students belonging to the same ethnic group.

Somehow less convincingly, Jensen and Rasmussen, 2011, instrument immigrant concentration in the class using the ethnic concentration in the geographical area where the school is located. For their strategy to be valid,

they need to assume that the concentration of immigrants in the area only affect the school performance of natives by influencing the share of immigrants in the class. This is clearly a strong assumption. They investigate the effect of immigrant concentration on the PISA test scores of 9th grade students in Denmark and find that it is negative both for native and for immigrant students.

Similar results are found also by Andersen and Thomsen, 2011, who instrument the immigrant concentration in Danish schools (ninth grade) with the percentage of bilingual children enrolled in upper secondary school in each municipality. In a similar fashion, Tonello, 2015, uses administrative data covering the universe of Italian junior high school students and an instrumental variables strategy that relies on the variation provided by the number of resident immigrants living in the school catchment area ten years before the test. He finds a weak negative impact of the share of immigrant students on the test scores of natives.

Not particularly convincing is also the estimation strategy used by Szulkin and Jonsson, 2007, who investigate whether the share of students with an immigrant background affects teacher-assigned school grades in ninth grade (age 16) in Sweden. They handle selection issues by controlling for several student and school characteristics (selection on observables) and find that a high share of immigrant students reduces the grades of all students but particularly so for immigrant pupils. This strategy requires that the unobserved characteristics do not correlate with observed ones and with the share of immigrants.

Finally, Brunello and Rocco, 2013, address the sorting of immigrants within countries by aggregating at the country level both the test scores of native children and the share of immigrant students. By virtue of aggregation, they remove the sorting of individuals across schools. Since immigrants can also sort among different countries, they control for between-country migration

flows by conditioning on country fixed effects, country specific trends, per capita GDP, education expenditure and the stock of immigrants in a given country at a given time. Conditional on these covariates, changes in the share of immigrant pupils in each country depend mainly on demographic factors and are as good as random. Using PISA data from 19 OECD countries they find that a higher share of immigrant pupils has statistically significant but small negative effects on the test scores of native children.

3.4 Non-linear peer effects

In spite of the important economic implications of non-linear peer effects, only a few of the contributions reviewed above have investigated whether the relationship between test scores and the share of immigrants is non-linear. Schneeweis, 2015, allows for a quadratic relationship between the share of immigrants and the educational outcomes of immigrants and natives, that include the selection of an academic track after primary school and grade repetition in primary school, but find no support for such a relationship. When she restricts, however, the share of immigrants to those belonging to the same country of origin she finds that a quadratic (and convex) specification fits well the data for immigrants but not for natives. Her estimates suggest that the negative effects of ethnic concentration decline as the share of the own immigrant group becomes larger. This could depend on the fact that when the share of students from a specific ethnic group increases their specific needs become easier to identify and teachers and school administrators are able to manage them more effectively. In fact, students from the same ethnic group are more homogenous compared to the entire group of students with an immigrant background.

Gould et al., 2009, also investigate whether the effect of the share of immigrants on the performance of natives is non-linear by adopting a quadratic specification. When their outcome variable is the dropout rate before completing 12th grade, they find that there is no significant (linear or non-

linear) effect of the share of immigrants. This share, however, affects the probability that natives pass the matriculation exam, a requirement to access college. Interestingly, the effect is non-linear and convex,[13] indicating that the impact of the share on matriculation is smaller in schools with more immigrants. They estimate that increasing the immigrant concentration from 0 to 10% reduces the probability that a native student passes the matriculation rate by 4.2 percentage points. Adding additional ten points to the concentration - from 10% to 20% - reduces this probability by "only" 1.9 percentage points.

These results, and those by Schneeweis, 2015, suggest that the adverse effects of immigrants on the educational outcomes of natives are higher at lower levels of immigrant concentration. As discussed above, this could be due to the presence of returns to scale in the ability of schools to absorb immigrants and deal with their needs, or to the fact that the integration of immigrant students is easier in a context where there is a sufficiently high number of similar peers. In any case, convex non-linear peer effects implies that re-distributing immigrants from schools with a high share to schools with a low share of immigrants is likely to reduce total school performance and therefore to reduce efficiency.

Results pointing in the opposite direction are found by Tonello, 2015, Szulkin and Jonsson, 2007, Andersen and Thomson, 2011, Hardoy and Schøne, 2013, Frattini and Meschi, 2016 and Brunello and Rocco, 2013. Tonello, 2015, regresses the test scores of natives on the share of immigrants using a quadratic specification and finds that a higher share has negative and marginally increasing effects on the selected outcome. Similar qualitative results are obtained by Szulkin and Jonsson, 2007, who use Swedish data and regress test scores on a set of dummy variables indicating arbitrarily-sized bins of the share of immigrants. They find evidence that a critical threshold in their

---

[13] With convexity, when the coefficient associated to the share of immigrants is negative, the one associated to the square of the share of immigrants is positive.

data is a 40 percent share of immigrant students: in schools that do not reach this threshold, there is virtually no effect of the share on test scores. In schools with a share above the threshold, the estimated impact of the share becomes negative and sizeable.

In a similar fashion, Crema, 2016, use Italian data to estimate the effects of the share of immigrants on the test scores of natives in the second and fifth grade of primary schools. As in Szulkin and Jonsson, she use dummies for equally spaced intervals in the share of immigrants and finds that the negative effects of the share are largest when it is at or above 0.30.

A slightly higher threshold, at 50 percent, is found by Andersen and Thomson, 2011, using Danish data. They conduct a separate analysis for native Danish and immigrant students and find that the latter are more negatively affected by the share of immigrant students than the former. This is an example of the asymmetric peer effects discussed in sub-section 2.2 of this report. Since the negative impact of the share is larger in absolute values for immigrant students, the relationship between average school performance (of natives and immigrants) and the share of immigrants is concave.

Smaller thresholds are found by Hardoy and Schøne, 2013, and Frattini and Meschi, 2016, who consider countries where the concentration of immigrants does not reach very high levels. The first study finds that the share of immigrants has no negative effects on student outcomes below 5 percent and negative effects above this threshold, and the second study finds that the share has negative effects only when the concentration of immigrants in the school is higher than 18 percent.

Overall, the evidence on non-linear peer effect is mixed. Although there is some evidence - for Austria and Israel - that the relationship between immigrant concentration and educational outcomes is convex, most of the studies considered above point to a concave relationship. Concavity is also confirmed by the multi-country study by Brunello and Rocco, 2013. In

addition, there is evidence of asymmetric peer effects, as the educational performance of immigrant students appears to be more negatively affected by the concentration of immigrants than the performance of natives.

As discussed in Section 2, a concave relationship between the share of immigrants and educational outcomes suggests that the redistribution of immigrants from schools with a high share of immigrants to schools with a lower share not only improves equality of outcomes but also fosters economic efficiency.

3.5 Ethnic Diversity

An important issue is the effect produced by ethnic diversity. The literature discussed above focuses on the share of immigrant children in a class or school, but disregards almost entirely the composition of the class in terms of the portfolio of different ethnic groups. Yet, the effects of immigrant students may vary according to the degree of diversity of the immigrant peer group. The main dimensions of diversity that could matter for educational outcomes are: diversity in the country of origin and language dissimilarity.

The few available studies in this area measure diversity in the country of origin by using the Herfindahl index, which considers both the share of each origin group and the number of the groups. Dronkers and Van der Velden, 2012, use OECD data and find that the learning performance of migrants is negatively affected by higher values of the index, computed at the school level. Veerman, 2015, confirm these negative effects using Swiss PISA results. Similar findings are obtained by Veerman et al., 2013, who report that the diversity of pupils in terms of country of origin has negative effects on reading scores, but no effects on math scores. According to the authors this difference could derive from the different instructional needs of the pupils with respect to math and reading comprehension: "It could be that for reading comprehension native pupils possibly need more instruction that connects to their own needs as natives. (p. 391)"

Unfortunately, these studies only show interesting correlations but fail to establish causal effects running from ethnic heterogeneity to school performance. Frattini and Meschi, 2016, show that the negative effects of the share of immigrant students on performance in Italy are driven by the classes with high diversity in the country of origin and high linguistic distance. Their results suggest that it might be optimal to form classes with a low number of ethnic groups and that there is an important role for linguistic support. Clearly, additional research in this area is required, that covers a broader set of countries.

4 Policies Addressing the School Segregation of Immigrants

The empirical evidence discussed in the previous section suggests that students with an immigrant background are negatively affected by a higher share of immigrant students in the class or school. Results are more mixed for students with a native background, not about the sign of the effect of a higher share of immigrants, that is negative, but about its size.

This evidence lends some support to the view that immigrant peer effects are asymmetric, stronger in absolute value for immigrant pupils than for native pupils. The discussion in Section 2 suggests that, even when peer effects are linear, these asymmetries can generate a concave relationship between the share of immigrants and average school (class) performance. Although not conclusive, the bulk of the evidence on non-linear peer effects supports concavity. The clear economic implication of these findings is that de-segregation policies cannot only improve equality but can also increase aggregate efficiency.

Country practice provides examples of how education systems have managed to reduce segregation. According to a classification recently provided by the OECD, 2009, policies in place include the introduction of lotteries, "bussing" initiatives, measures to improve the quality of concentrated schools and the

improvement in parental information. In addition, desegregation has been addressed by establishing a ceiling to the share of immigrants in classes or schools.

4.1 Lotteries

With school choice, selection of students into the best schools is often based on ability and parental background. Since immigrants often have a disadvantaged background, they tend to concentrate in less attractive institutions. A more diverse student intake can be promoted by using lotteries to pick among applicants to over-subscribed schools. Alternatively, school funding may be weighted according to socio-demographic characteristics of the student population, inducing good schools to enrol migrant students from low socio-economic backgrounds in order to obtain additional resources.

Lotteries to allocate places in over-subscribed schools have been used mainly in the United States. An example is the policy initiated in 2002 by the Charlotte-Mecklenburg school district. Under this system, parents submitted their top three school choices. The district assigned each student to a neighbourhood "home school", usually the school closest to them, and guaranteed admission to this school if students did not receive any of their top three choices. Admission to non-guaranteed schools was determined by lottery. Students choosing non-home schools were first assigned to a priority group (based on previous school attendance, free lunch eligibility, and school choice zone) and then given a random lottery number. Any slots remaining after accommodating home school students were assigned in order of priority group and random number. If a school was not filled by those listing it as a first choice, the process was repeated with those listing the school as a second choice (Stasz and van Stolk, 2007).

In the Chicago Public Schools (CPS) system of the early 2000s, students could apply to any CPS school, with no limitations on number of applications. In most cases, a lottery admission was used when schools were over-subscribed.

Because of desegregation goals and variation in the number of slots in different grade levels, separate lotteries were conducted for each gender-race-grade combination (Stasz and van Stolk, 2007). A similar lottery scheme has been run in the Milwaukee Parental Choice Programme, Wisconsin.

Several papers have evaluated the impact of these programs, with fairly mixed results. A study by Greene et al, 1999, of the Milwaukee Parental Choice Programme finds that students placed in private schools achieved better in maths and reading scores than students who had been denied a place. Hoxby, 2004, examines the charter schools in the Chicago area operating similar lottery schemes to manage over-subscription and finds a particularly positive effect in student achievement (reading and math scores) for admitted Hispanic pupils and pupils from low-income backgrounds compared to Hispanic and low-income pupils who were denied a place.

In contrast, Hastings et al, 2005, looking at the use of randomised lottery schemes in Charlotte-Mecklenburg, show that, among those applying to over-subscribed schools, winning the lottery had no significant impact on reading and math scores. However, winning the lottery had modest impacts on other outcomes, such as reducing absences and disciplinary suspensions. On a similar line, a study by Cullen et al, 2006, finds little evidence that winning a lottery provides any systematic benefit across a wide variety of traditional academic measures.

In Europe, an example of lotteries is the major school admission reform in Brighton and Hove, a UK school district. The new system incorporated a lottery for over-subscribed places and new catchment areas. Allen et al, 2010, examine the post-reform changes in school composition and find no significant change in student sorting: if anything, their estimates suggest a rise in socio-economic segregation. The authors attribute this rather unexpected result to the design of the new catchment areas, which has considerably complicated the patterns of winners and losers. They conclude that "…it

seems unlikely that the reforms are likely to substantially lower social segregation across schools even in the long-run in this city where differences in the quality of housing stock across areas are deeply entrenched and the boundaries of the new catchment areas mean that families living in the most deprived neighbourhoods have little chance of accessing the most popular schools in the centre of the city" (p.17).

4.2 Bussing

In the United States, the landmark Supreme Court decision *Brown v. Board of Education* in 1954 disallowed de jure racial segregation of schools, but the Court's 1971 *Swann v. Charlotte-Mecklenburg Schools* (CMS) decision led to the implementation of race-based bussing (see Billings et al, 2014), or free transportation of students to schools in different areas. The Court ruled schools were de facto segregated, due to highly segregated neighbourhoods and contiguous catchment areas around each school. Following the court order, school zones in CMS were redrawn to capture non-contiguous areas with different racial compositions. CMS was mandated to keep each school's percent black within 15 percentage points of the district average, and CMS periodically redrew boundaries to ensure that this balance was kept. Racial balance was preserved using ''satellite'' zones that bussed students from inner-city neighbourhoods with high shares of minority students to schools located in suburban, highly white neighbourhoods.

Following the example of bussing policies in the United States, other countries are experimenting with ways to distribute immigrants more evenly across schools. In some Danish municipalities, for example, schools with predominantly native Danish students are receiving migrant students from other schools. Some municipalities report positive results. In Aarhus, for example, 34% of pupils bussed to a new school experienced an above normal progression in their linguistic development, 45% developed as expected and 20% below expectations (Danish Ministry of Education, 2008).

In France, the inter-ministerial initiative *Espoir banlieues* was launched in 2008 to promote educational strategies to support young people from socio-economically disadvantaged areas. The objectives of the initiative included the promotion of a more mixed school intake, for example by experimenting with bussing plans (OECD, 2010).[14]

Indirect evidence on the effects of redistributing pupils by bussing them to schools with a higher share of natives comes from the discontinuation of bussing policies in the Charlotte-Mecklenburg US school district. After a North Carolina State Supreme Court ruling, and beginning in 2002, the district switched to a neighbourhood-based student choice plan. The key features of the new assignment policy were that school boundaries were redrawn as contiguous areas around a school, and students were assigned to their neighbourhood school by default (see Billings et al, 2014). Because neighbourhoods in Charlotte were still highly segregated, this change led to a large and sudden increase in school segregation in the fall of 2002.

Billings et al, 2014, show that the re-segregation of CMS schools widened inequality of outcomes between whites and minorities. They find that all students, white and black, score lower on high school exams when they attend schools with more minority students, and estimate that a 10 percentage point increase in the share of minorities in a student's assigned school decreases high school test scores by about 0.014 standard deviations. Since the net effect of re-zoning was that students attended schools with a greater share of peers of their own race, their estimates imply a widening of the racial achievement gap of about 0.025 standard deviations.

More direct evidence on US de-segregation policies following *Brown v. Board of Education* is provided by Guryan, 2004, who finds that de-segregation plans led to two to three percentage points decline in the school dropout rate of blacks, without having any significant effect on the dropout rate of whites.

---

[14] Other initiatives include the "Innovative Action to Improve Student Integration in France".

Guryan also finds no evidence that the length of exposure to integration has had a compounding effect on dropout rates, implying that students who had been in de-segregated schools for a longer period of time do not seem to benefit more than those with a relatively short period of exposure.

4.3 Improving the quality of concentrated schools

One way to encourage native students to choose schools with diverse student populations is to place attractive schools with special curricula in relatively disadvantaged areas. In the US, such "magnet schools", offering special math, science or art curricula exist since the 1970s. Other initiatives have focused instead on raising the quality of schools with high proportions of migrant students. In Switzerland, for example, the QUIMS (Quality in Multi-Ethnic Schools) programme offers extra resources and professional support to schools with 40% or more students from migrant backgrounds. Among other things, the project explicitly aims to attract more Swiss and middle class students to these schools (Gomolla, 2006).

Adding extra financial resources to schools with a high share of immigrants may be more effective than increased exposure to natives. Reber, 2014, shows that, in the case of Louisiana, school de-segregation was accompanied by dramatic changes in the state's system of school finance that, together with large increases in federal funding, substantially increased the average spending for the schools blacks attended. She finds that the rate of continuing to the 11th and 12th grade and graduating from high school increased more in higher black enrolment share districts after de-segregation, suggesting that the additional funding that came with de-segregation was more important than increased exposure to whites in increasing black educational attainment. In particular, she estimates that a 42 percent increase in funding led to a 15 percent increase in high school graduation rates, and a rough cost-benefit calculation suggests that additional spending had positive net present value.

4.4 Parental information

Some policies attempt to influence the preferences of native and / or migrant parents. In the Netherlands, the government established a "knowledge-centre for mixed schools" (see OECD, 2010). The centre started pilots in seven cities to identify effective interventions at the local level that could reduce segregation in education. For example, the municipality of Rotterdam runs bus tours to take parents around the choice of local schools. The purpose of the tour is to allow parents to discuss enrolment options and to encourage them to use their local schools.

Voluntary parent initiatives may also affect segregation, as it happens in the Netherlands. These initiatives consist of actions undertaken by parents who collectively sign up for highly segregated schools in order to create a better balance. Parents interact with the school authorities about the curriculum, individual attention for their children, placement in groups and after-school child care. Most of these initiatives are too recent to determine the effectiveness of such actions. In addition, there are student exchange projects undertaken by schools with very different compositions. These projects, which include collective sports, after-school child care and excursions, attempt to create some form of inter-ethnic contact. However, this may have little effect on student performance.

4.5 Ceilings to the share of immigrants

Many countries provide separate schooling for newcomers in an effort to accelerate assimilation. In special "international classes" in Germany, for example, migrant and refugee children receive intensive language training in an attempt to move them into normal German classrooms as soon as possible. This is clearly a temporary arrangement that should facilitate integration in mixed classes. Special classes for newly arrived immigrant children have been organized also in Denmark. A few Danish schools (both compulsory schools - Rådmandsgades skole - and high schools - Langkær Gymnasium - with very

high immigrant shares have experimented with having classes with migrants only and classes with a maximum of 50 percent immigrants in order to avoid 'native flights' to other neighboring schools.

In 2010 the Italian government introduced a 30 percent ceiling to the share of immigrants in the first grade classes of primary and secondary schools, with the purpose of limiting school segregation. The application of this norm, however, has been rather limited, and recently the region Emilia Romagna has allowed schools in the region to ignore the ceiling and to exclude second generation immigrants from the computation of the share of immigrants in the class or school. To date, there is no empirical research evaluating the impact of a ceiling to the share of immigrants on school stratification and school outcomes. However, the evidence presented by Crema, 2016, suggests that the negative effects of the share of immigrants on the performance of natives are highest at or above the selected ceiling.

Conclusions

In this report we have reviewed the economics literature on the school segregation of immigrants and on the effects of a higher share of immigrants on the performance of both immigrants and natives. We have mainly discussed two questions: 1) whether the share of immigrants in classes and schools have any effect on the performance of natives and immigrants; 2) whether the shape of the relationship between the share of immigrants and average school performance can inform us about the efficiency implications of de-segregation policies.

The evidence on the effects of the share of immigrants suggests that these effects are likely to be negative (and often sizeable) for immigrants and negative but probably small for natives. Even assuming that peer effects are linear, this evidence points to an important asymmetry. When we aggregate the performance of natives and immigrants and consider average school

performance, this asymmetry generates concave peer effects, a key condition for the efficiency of de-segregating policies.

The evidence on non-linear peer effect is not conclusive but broadly points to concavity. There is also evidence that tipping points - or thresholds in the share of immigrants – exist, and that the negative effect of the share of immigrants increases in absolute value above these points. Unfortunately, the estimated values of tipping points vary perhaps too broadly to provide useful policy recommendations, from 5 to 50 percent. **Overall, the message seems clear: desegregation policies are not only equitable – they provide better opportunities to individuals with relatively low parental background – but also efficient.**

Several de-segregation policies have been implemented in the US and in Europe, including admission lotteries, bussing students from schools with a high share of immigrants to schools with low shares, additional resources to schools with a high share of immigrants, parental information and the introduction of ceilings to the share of immigrants in classes and schools. Unfortunately, only some of these policies have been accurately evaluated, especially in the US.

While the bulk of the evidence of admission lotteries suggest limited or no effects, there is some evidence for the US and Denmark that bussing policies may work in improving the school performance of immigrants. Similarly, there is evidence that providing more resources to schools with a high share of immigrants improves performance. But which policy is better? To our knowledge, there is very little research providing a comparative analysis of the costs and benefits of each policy. Clearly, more needs to be done to evaluate the policies in place and provide a comparative assessment of alternative policies.

References

Allen, R, Burgess, S and McKenna, I., 2010, The early impact of Brighton and Hove's school admission reforms, Bristol University Working Paper.

Andersen, S and Thomsen, M., 2011, Policy Implications of Limiting Immigrant Concentration in Danish Public Schools, *Scandinavian Policy Studies*, 27-52.

Angrist, J. and Lang, K., 2004, Does School Integration Generate Peer Effects? Evidence from Boston's Metco Program, *American Economic Review*, 94(5), pp. 1613-1634.

Ballatore R., Fort M., Ichino A., 2014, The Tower of Babel in the Classroom: Immigrants and Natives in Italian Schools, IZA Discussion Paper 8732.

Betts, J and Fairlie, R., 2003, Does Immigration induce "Native Flight" from Public Schools into Private Schools?, *Journal of Public Economics*, 87, 987-1012.

Billings, S., Deming, D. and Rockoff, J., 2014, School Segregation, Educational Attainment and Crime: Evidence from the End of Bussing in Charlotte Mecklenburg, *Quarterly Journal of Economics*, 435-476.

Böhlmark, A, Holmlund, H and Lindahl, M, 2015, School Choice and Segregation: evidence from Sweden, IFAU Working Paper.

Bonin, H, 2016, The Potential of Education in Economic Cost-benefit Analysis of Migrants in the EU, EENEE Analytical Report n.31.

Brunello, G. and L. Rocco, 2013, The Effect of Immigration on the School Performance of natives: Cross Country Evidence Using PISA Test Scores, *Economics of Education Review*, 32, 234-246.

Burgess, S., McConnell, B., Propper, C., and Wilson, D., 2007, The Impact of School Choice on Sorting by Ability and Socio-economic Factors in English Secondary Education, in L. Woessmann and P. Peterson (eds.), *Schools and the Equal Opportunity Problem*, MIT Press, Cambridge, MA.

Carneiro, P and Heckman, J., 2002, The Evidence on Credit Constraints in Post-secondary Schooling, *Economic Journal*, Royal Economic Society, vol. 112(482), pages 705-734

Cascio, E. and Lewis, E., 2012, Cracks in the Melting Pot: Immigration, School Choice, and Segregation, *American Economic Journal: Economic Policy,* 4(3): 91-117.

Contini D., 2013, Immigrant background peer effects in Italian schools, *Social Science Research*, 43(4), 1122–1142.

Cooley, J., 2013, Can Achievement Peer Effect Estimates Inform Policy? A View from Inside the Black Box, *Review of Economics and Statistics*, 96(3), pp. 514-523.

Crema, A., 2016, Immigrant Concentration and Educational Performance in Italian Primary Schools, mimeo, University of Padova.

Cullen, J., Jacob, B., and Levitt, S., 2006, Effects of School Choice on Student Outcomes: Evidence from Randomized Lotteries. *Econometrica*, Volume 74 Issue 5 1191 –1215.

Danish Ministry of Education, 2008, *OECD Review of Migrant Education – Country Background Report for Denmark*, OECD, Paris

Dronkers, J., & Van der Velden, R., in press, Positive but also negative effects of ethnic diversity in schools on educational performance? An empirical test using cross-national PISA data. In M. Windzio (Ed.), *Integration and inequality in educational institutions*. Dordrecht, The Netherlands: Springer.

Duncan, O and Duncan, B, 1955, A Methodological Analysis of Segregation Indexes*, American Sociological Review*, 20,2,210-17

Epple D amd Romano, R. 2011, Peer Effects in Education: a Survey of the Theory and Evidence, in Benhabib J, Bisin A and Jackson M., *Handbook of Social Economics*, vol.1.

European Union, 2009, Council conclusions of 26 November 2009 on the education of children with a migrant background, *Official Journal of the European Union*, 11.12.2009

Eurostat, 2011, Migrants in Europe: A statistical portrait of the first and second generation.

Farre, L, Ortega, F and Tanaka, R, 2016, Immigration and School Choices in the Midst of the Great Recession, mimeo

Frattini T. and E. Meschi, 2016, Immigrants' peer effects in vocational schools, mimeo.

Friesen J. and B. Krauth, 2011, Ethnic enclaves in the classroom, *Labour Economics*, 18(5), pp. 656–663.

Geay C., S. McNally, S. Telhaj, 2013, Non-native Speakers of English in the Classroom: What Are the Effects on Pupil Performance?, *Economic Journal*, 123(570), F281–F307.

Gerdes, C, 2013, Does Immigration Induce "Native Flight" from Public Schools? Evidence from a Large-scale Voucher Program, Annals of Regional Science, 50, 645-666.

Gomolla, M., 2006, Tackling the underachievement of learners from ethnic minorities: A comparison of recent policies of school improvement in

Germany, England and Switzerland, *Current Issues in Comparative Education*, Vol. 9/1.

Gould E., V. Lavy and D. Paserman, 2009, Does immigration affect the long-term educational outcomes of natives? Quasi-experimental evidence, Economic Journal, 119(540), pp. 1243–1269.

Greene, J., Peterson, P. and Du, J., 1999, Effectiveness of School Choice. The Milwaukee Experiment, *Education and Urban Society*, 31,2, 190-213.

Guryan, J, 2004, Desegregation and Black Dropout Rates, *American Economic Review*, Vol. 94, No. 4., pp. 919-943

Hanushek, E and Woessmann, L, 2010, Education and Economic Growth, in Peterson P, Baker E, McGaw B, (Editors), *International Encyclopedia of Education*. volume 2, pp. 245-252. Oxford: Elsevier.

Hanushek E. and S. Rivkin, 2009, Harming the best: How schools affect the black-white achievement gap, Journal of Policy Analysis and Management, 28(3), pp. 366–393.

Hanushek E., J. Kain, and S. Rivkin, 2009, New evidence about brown v. board of education: The complex effects of school racial composition on achievement, Journal of Labor Economics, 27(3), pp. 349–383.

Hardoy H. and Schøne P., 2013, Does the Clustering of Immigrant Peers Affectthe School Performance of Natives? Journal of Human Capital, 7(1), pp. 1-25.

Hastings, J., Kane, T., and Staiger, D., 2005, Parental Preferences and School Competition: Evidence from a Public School Choice Programme, *NBER Working Paper* no. 11805, November 2005.

Hoxby, C., 2004, A Straightforward Comparison of Charter Schools and Regular Public Schools in the United States, HIER Working Paper, 2004.

Hoxby, C., 2000, Peer Effects in the Classroom: Learning from Gender and Race Variation, National Bureau of Economic Research: Working Paper No. 7867.

Jenkins, S., Micklewright, J. and Schnepf, S., 2006, Social segregation in secondary schools: how does England compare with other countries? IZA Discussion Paper 1959.

Jensen P. and A. Rasmussen, 2011, The effect of immigrant concentration in schools on native and immigrant children's reading and math skills, *Economics of Education Review*, 30(6), pp. 1503–1515.

Karsten, S. (2006), Policies for disadvantaged children under scrutiny: The Dutch policy compared with policies in France, England, Flanders and the USA, *Comparative Education*, Vol. 42/2.

Noack, R., 2016, A Danish school now separates children by ethnicity, *The Washington Post*, September 8.

OECD, 2009, *The Labour Market Integration of the Children of Immigrants*, OECD Publishing, Paris

OECD, 2010, *Closing the Gap for Immigrant Students. Policies, Practices and Performance*, OECD Publishing, Paris.

OECD, 2014, *PISA 2012 Technical Report*, OECD Publishing, Paris

OECD,2015, *International Migration Outlook 2015*, OECD Publishing, Paris

Ohinata, A. and J. C. van Ours, 2013, How immigrant children affect the academic achievement of native Dutch children. *Economic Journal* 123, F308-F331.

Rangvid, B. 2010, School Choice, Universal Vouchers and Native Flight from Local Schools, *European Sociological Review,* 26, 3, 319–335.

Reber, S, 2014, School Desegregation and Educational Attainment for Blacks, *Journal of Human Resources*, 45,4, 894-914

Schneeweis N., 2015, Immigrant concentration in schools: Consequences for native and migrant students, *Labour Economics*, 35, pp.53-76

Schapiro, M, 1990, *Selective Admission and the Public Interest*, The College Board Press, New York.

Schneider, K, Schuchart, C, Weishaupt, H and Riedel, A, 2011, The Effect of Free Primary School Choice on Ethnic Groups – Evidence from a Policy Reform, Schumpeter Working Papers, Wupperthal.

Soderstrom, M and Uusitalo, R, 2010, School Choice and Segregation: Evidence from an Admission Reform, *Scandinavian Journal of Economics*, 112(1), 55–76

Statz, C and van Stolz, C, 2007, The Use of Lottery Systems in School Admissions, RAND Working Paper.

Szulkin R. and J. Jonsson, 2007, Ethnic segregation and Educational Outcomes in Sweden Comprehensive School. A Multilevel Analysis, mimeo

Tonello M., 2015, Peer effects of non-native students on natives' educational outcomes: mechanisms and evidence, *Empirical Economics*, forthcoming

Van Ours, J.C. and J. Veenman, 2003, The educational attainment of second-generation immigrants in The Netherlands, *Journal of Population Economics*, 16(4), 739–53.

Veerman G., H. van de Werfhorsta and J. Dronkers, 2013, Ethnic composition of the class and educational performance in primary education in The Netherlands, *Educational Research and Evaluation*, pp. 2-32.

Veerman, G. , 2015, The relationship between ethnic diversity and classroom disruption in the context of migration policies, *Educational Studies*, 41(1‑2), pp. 209‑225.

Winston, G. and Zimmermann, D., 2004, Peer Effects in Higher Education, in Hoxby, C. (ed.), *College Choices: The Economics of Where to Go, When to Go and How to Pay for it,* University of Chicago Press.

Tables and Figures

Table 1. Average share of immigrants in schools – measured as the percentage of total enrolment. 15 years old students. PISA 2003 and 2012.

Country	Average share of immigrants in schools - 2012	Average share of immigrants in schools - 2003	Percentage change in the share between 2003 and 2012
Austria	16.5	13.3	3.2
Belgium	15.3	11.8	3.5
Switzerland	24.3	20.0	4.3
Czech Republic	3.3	1.3	2.0
Germany	13.4	15.4	-2.0
.Denmark	9.2	6.5	2.7
Spain	9.9	3.4	6.5
Finland	3.4	1.9	1.5
France	15.0	14.3	0.7
Great Britain	13.0	8.0	5.0
Greece	10.6	7.4	3.2
Hungary	1.7	2.3	-0.6
Ireland	10.2	3.5	6.7
Italy	7.5	2.1	5.4
Latvia	4.7	9.4	-4.7
Netherlands	10.9	11.0	-0.1
Norway	9.5	5.6	3.9
Portugal	6.9	5.0	1.9
Sweden	14.9	11.5	3.4
USA	21.6	14.4	7.2
Australia	22.7	22.7	0.0

Note: our computations using PISA microdata.

Table 2. Average share of immigrants in schools – measured as the percentage of total enrolment. 14 years old students. TIMSS 1999 and 2011. Eight graders.

Country	Average share of immigrants in schools - 2011	Average share of immigrants in schools - 1999	Percentage change in the share between 1999 and 2011
England	14.9	12.7	2.2
Finland	4.2	2.7*	1.5
Hungary	2.5	6.2	-3.7
Italy	8.8	0.7	8.1
Slovenia	9.2	10.0	-0.8
Australia	26.4	21.7	4.7
USA	18.8	12.3	6.5

Notes: our computations based on TIMSS micro-data. * seven graders.

Table 3. The Effects of the Share of Immigrants in the Class or School on the Performance of Natives and Immigrants. European Studies

Authors	Estimated effect	Country	Data	Estimation Method	Estimated Effects
Szulkin and Jonsson (2007)	Immigrant concentration on school grades in Sweden	Sweden	Official school registry data of nine-graders	Controls for school and individual characteristics	Natives: negative effects Non-natives: negative effects
Gould et al. (2009)	Immigrant concentration on natives' dropout rates and chances of passing the high school matriculation exam (necessary to attend college).	Israel	Administrative panel data on school enrolment and test scores from 1993 to 2001.	Instrumental Variables	Natives: substantial adverse effects
Jensen and Rasmussen (2011)	Immigrant concentration on PISA test scores.	Multi-country study	PISA test scores of 9th grade students in Denmark	Instrumental Variables	Natives: negative effects
Andersen, S and Thomsen, M. (2011)	Immigrant concentration on school grades	Denmark	Danish register data	Instrumental Variables	Natives: negative effects Immigrants: negative effects
Brunello and Rocco (2013)	Immigrant concentration on natives' PISA test scores.	Multi-country study	PISA panel data for 2000–2009.	Aggregation at country level.	Natives: small negative effects.
Geay et al. (2013)	Immigrant concentration on the test scores of native English speakers in England.	England	National Pupil Database between 2003 and 2009.	Instrumental Variables	Natives: no sizable negative effects
Ohinata and Van Ours (2013)	Immigrant concentration on PIRLS and TIMSS test scores	Multi-country study	PIRLS and TIMSS test scores	School fixed effects	Natives: no sizable negative effects Non-natives: negative effects
Contini (2013)	Immigrant concentration on INVALSI test scores	Italy	INVALSI test scores	School fixed effects	Natives: no sizable negative effects

					Non-natives: negative effects
Hardoy and Schøne (2013)	Immigrant concentration in Norway upper secondary schools on Dropout rates of native	Norway	Register data collected by Statistics Norway of all students who started their first year of upper secondary school during the period 1996–2003.	Variation in the fraction of migrant students among cohorts within schools.	Natives: negative effects
Ballatore et al. (2014)	Immigrant concentration on INVALSI test scores	Italy	INVALSI test scores		Natives: substantial adverse effects
Schneeweis (2015)	Immigrant concentration in Austrian primary schools on repetition in primary and secondary schools and track attendance after primary education.	Austria	Register data covering 22 school cohorts of compulsory school students in Linz.	Variation in the fraction of migrant students among cohorts within schools	Natives: no sizable negative effects Non-natives: negative effects
Frattini and Meschi (2016)	Immigrant concentration in Italian Vocational schools on test scores	Italy	Administrative data on students enrolled in vocational secondary schools	School fixed effects	Natives: negative effect on math test scores
Tonello (2015)	INVALSI test scores	Italy	Administrative data covering the census of Italian junior high schools	Variation in the fraction of migrant students among cohorts within schools	Natives: weak negative impact

Figure 1. Country – specific share of immigrants. PISA 2003 and 2012
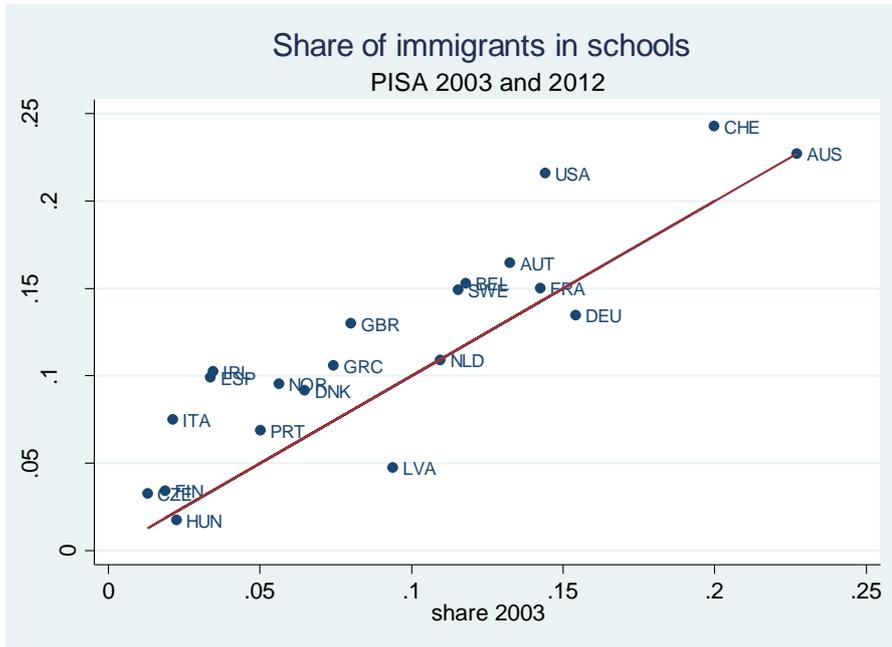
Figure 2. Country – specific segregation and share of immigrants. PISA 2012
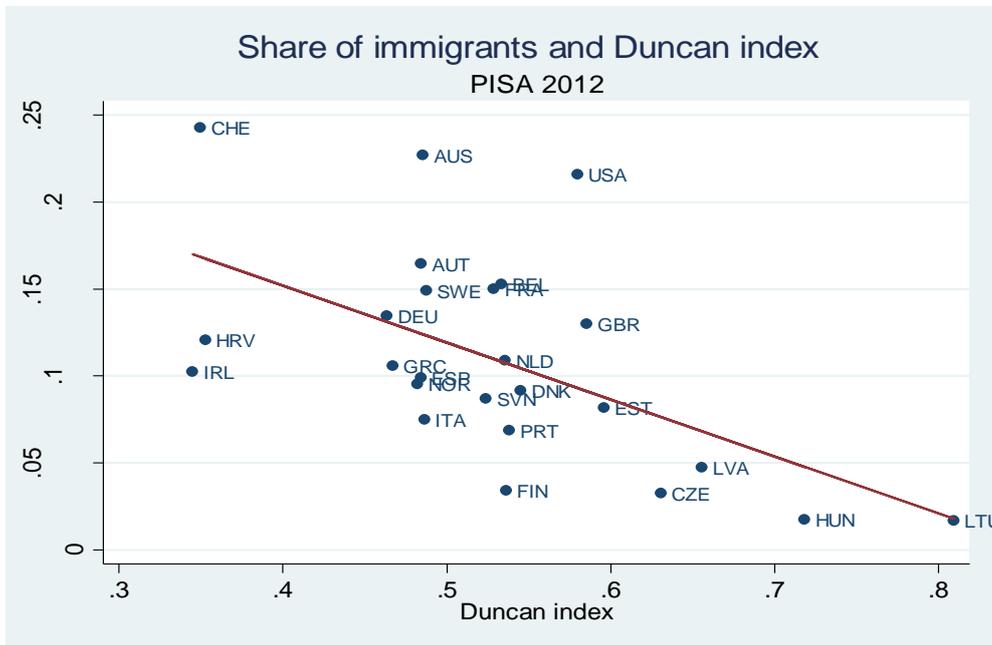
Figure 3. Country – specific segregation in 2003 and 2012. PISA.
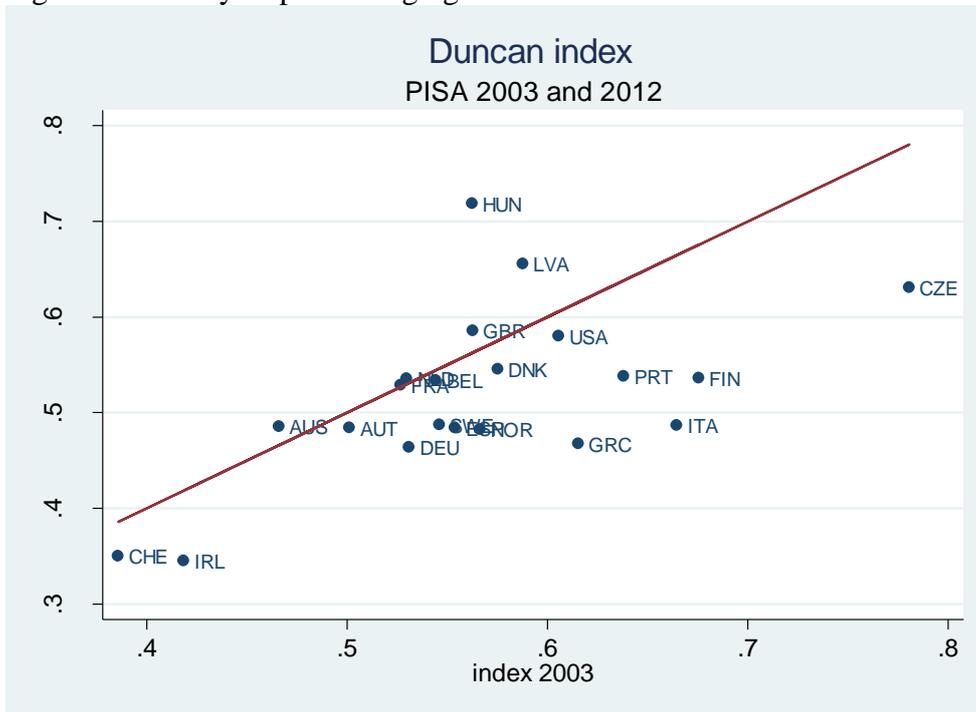
Figure 4. Country – specific segregation and math test scores in 2012. PISA.
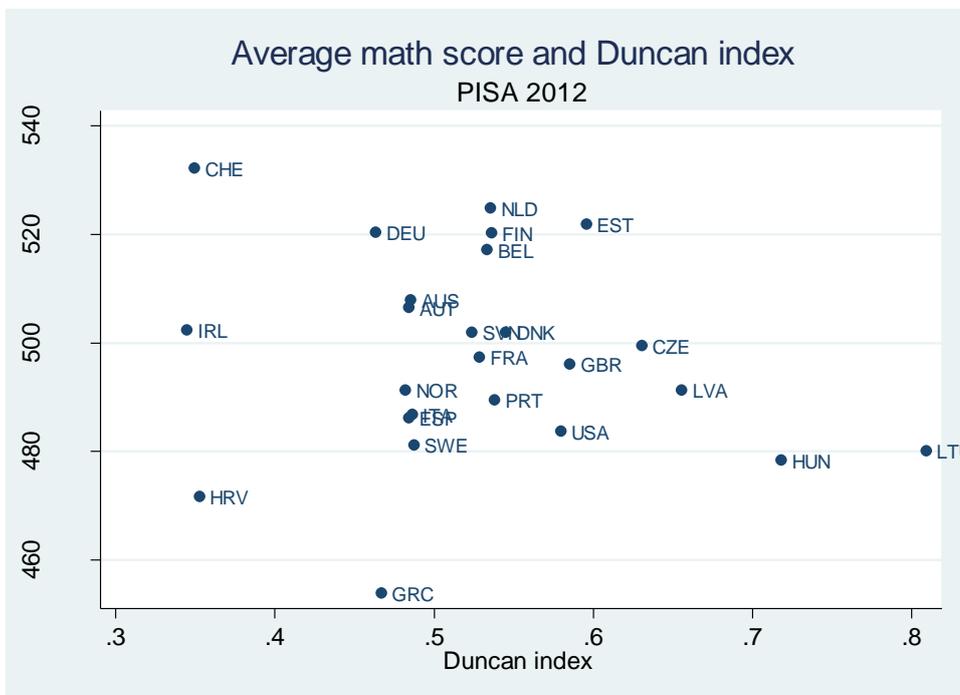
Figure 5. Linear peer effects. Average performance W/T in the vertical axis, immigrant share in the horizontal axis.

$\beta_0 - \beta_1 s_2$

$\beta_0 - \beta_1[ts_1 + (1-t)s_2]$

$\beta_0 - \beta_1 s_1$

s_2 $ts_1 + (1-t)s_2$ s_1
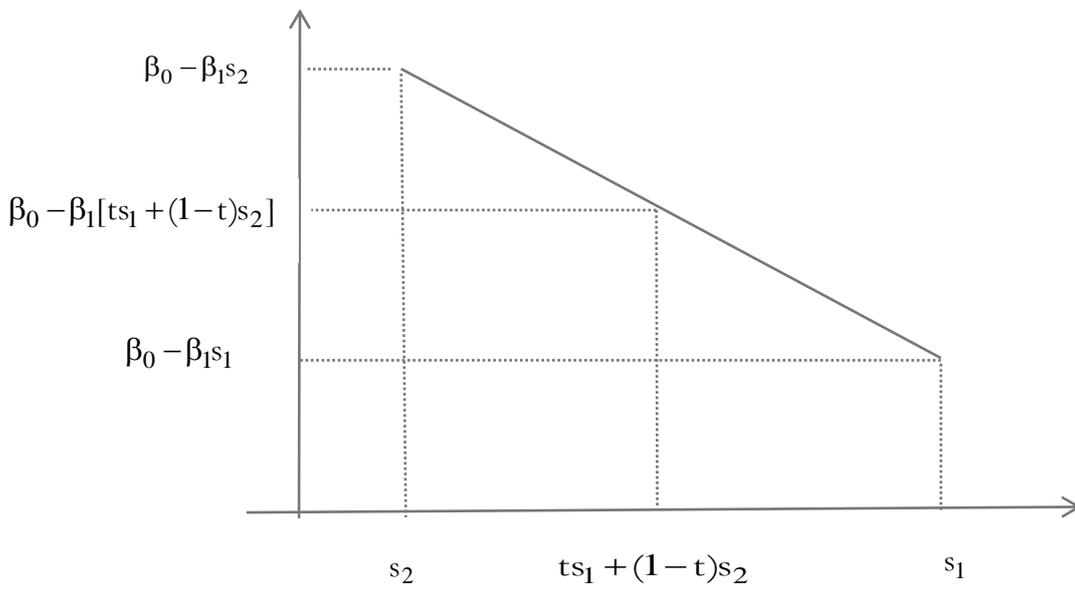
Figure 6. Non-linear peer effects. Concavity. Average performance W/T in the vertical axis, immigrant share in the horizontal axis.

$f(s_2)$

$f[ts_1+(1-t)s_2]$

$tf(s_1)+(1-t)f(s_2)$

$f(s_1)$

s_2

$ts_1+(1-t)s_2$

s_1
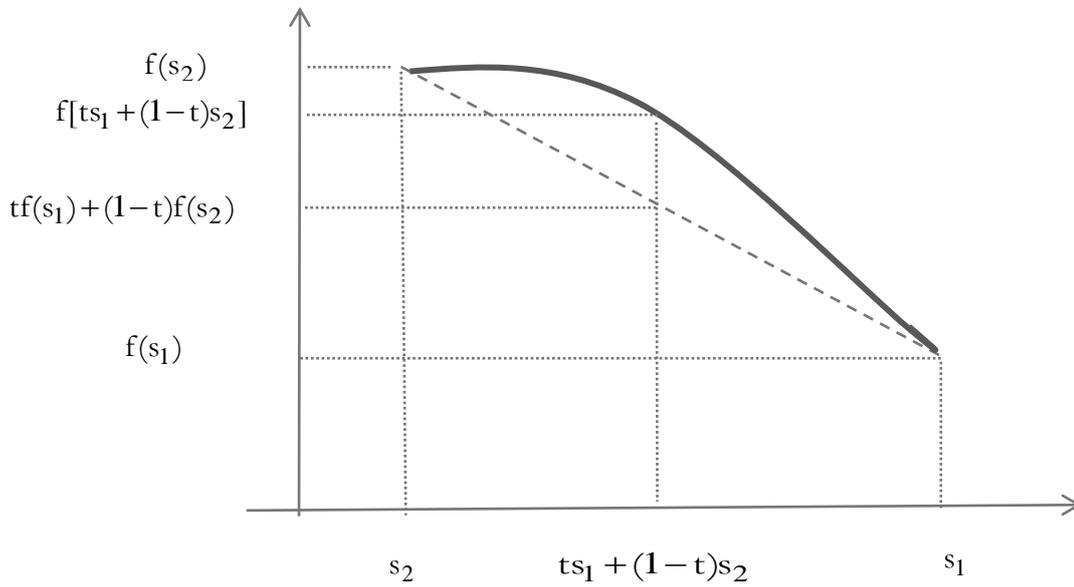
Figure 7. Non-linear peer effects. Convexity. Average performance W/T in the vertical axis, immigrant share in the horizontal axis.
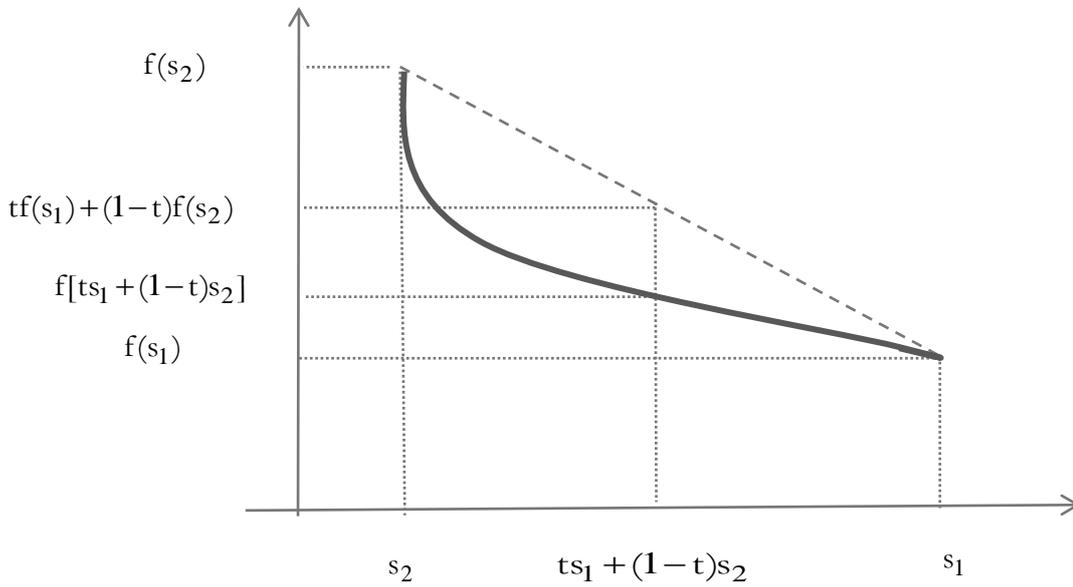
Figure 8. Tipping point s_t in the response of school performance to the share of immigrants.

EENEE Analytical Reports

Publications Office