Master's Thesis Econometrics

Peer effects on educational attainment: evidence from the Netherlands

A.M.R. Pronk

Faculty of Economics and Business
University of Groningen

July 23, 2020

Master's Thesis Econometrics, Operations Research and Actuarial Studies
Supervisor: S. Sovago
Second assessor: Prof. dr. T.J. Wansbeek

Author: Rosanne Pronk
Student ID: 2791110
Email: a.m.r.pronk@student.rug.nl

Peer effects on educational attainment: evidence from the Netherlands

Master's Thesis

Student
Rosanne Pronk

Student number
S2791110

July 23, 2020

Abstract

Segregation by migration background and socioeconomic status is growing in Dutch primary schools. This paper investigates the consequences of those types of segregation on educational attainment in primary and secondary school, using administrative data on five cohorts of final grade pupils in the Netherlands. We use linear probability models with school and cohort fixed effects to study how primary school peer compositions affect pupils' educational achievement. We find that a higher proportion of disadvantaged peers negatively influences a pupil's educational attainment in primary school, although the effects are small. These effects persist at least until three years in secondary school. Moreover, we show that peer effects are heterogeneous. Pupils with a non-Western migration background tend to perform better compared to pupils without this migration background when they are exposed to more non-Western peers. Also, pupils with a lower socioeconomic status tend to perform worse when they are exposed to more peers with lower socioeconomic status. This paper shows that the peer composition in primary school has effects that last long after primary school.

Contents

1 Introduction

Over the past years, the economic-, social- and ethnic segregation in the Dutch educational system has risen. Policymakers consider this enhanced segregation as undesirable as it can lead to a decrease in the quality of education when segregation leads to differences in educational opportunities (Inspectie van het Onderwijs (Inspectorate of Education), 2018). To reduce the consequences that stem from school segregation, it is crucial to understand how these effects originate. Peer effects are one concept through which segregation can affect school achievement (Ryan, 2000). Whereas the direct effects of peers in the context of educational attainment are investigated (e.g. Fekjær and Birkelund (2007); Southworth (2010); Sykes and Kuyper (2013)), little is known about whether these effects are lasting.

This research examines the influence of peer compositions in primary school on pupils' educational attainment in primary and secondary school. This allows us to observe whether peer effects in primary school are lasting in secondary school. We study the peer composition of primary schools based on ethnic, social, and economic background. Specifically, we use the proportion of pupils with a non-Western migration background, with parents with low educational attainment, and with parents with low wealth. We use register data from more than 38,000 pupils that were in the final grade of primary school in one of the ten largest cities in the Netherlands between 2011 and 2016. This rich dataset allows us to show how segregation in primary school, through peer effects, contributes to segregation in secondary school.

One way in which peers affect each other is through achievement (Ryan, 2000). Achievement gaps between pupils with varying backgrounds can exhibit through the relation of a pupil's ability and its background (see Blake, 1981; Jeynes, 2005; Bouchard & McGue, 1981; Inspectie van het Onderwijs, 2018; Hill & Duncan, 1987, for studies on the impact of different background characteristics on ability). In the Netherlands, the transition from primary to secondary school is based on a pupil's ability. Around the age of twelve, pupils enter secondary school in different tracks. Each pupil gets advice about which track to follow. This advice can be given by the teacher (*first teacher's advice*) or can be based on the results of an exit test (*test advice*). The first teacher advice and test advice are used to measure educational attainment in primary school. Educational attainment in secondary school is measured by the level of education in the third class of secondary school.

The key identifying assumption of this research is that the variation in the peer proportions of interest is not related to unobserved factors affecting the first teacher advice, test advice, and level of education in the third class of secondary school, conditional on school and cohort fixed effects. This assumption secures that, conditional on the included controls, pupils are randomly sorted into primary schools, which enables us to identify the causal influence of peer compositions on school attainment. We support this assumption with a set of balancing tests.

This paper shows that primary school peer composition negatively affects the educational attainment in primary school and that these effects are still present at least three years after entering secondary school. Even though the effects are small, this shows that segregation in primary school, through peer effects, contribute to school segregation in secondary school. We also show that peer effects are heterogeneous. We find that pupils with a non-Western migration background perform better, compared to pupils without this background, when they are exposed to a higher proportion of non-Western peers. Negative peer effects are smaller and positive peer effects are larger for those pupils. Additionally, pupils with parents with low wealth or with low educational attainment perform worse compared to pupils

without these characteristics when they are exposed to a higher proportion of respectively low-wealth or low-education peers in their class. Negative peer effects are larger for those pupils.

This research contributes to the literature on school segregation and peer effects in two ways. Where current literature on school segregation focuses mainly on the effects of ethnic school segregation on achievement, our research also investigates the influences of social and economic segregation. Additionally, the literature studies the effect of school characteristics on achievement within the same level of schooling. For example, the effect of ethnic segregation in secondary school on achievement in secondary school is investigated (see e.g. Sykes & Kuyper, 2013). Our research lets go of this routine and focuses on school effects across levels, i.e. the effect of primary school peer characteristics on secondary school performance. This allows us to identify lasting effects of primary school segregation.

The outcomes of this research provide several insights for politicians and municipalities. First, this research provides insight into the degree of segregation by three common characteristics in primary school in the ten largest cities in the Netherlands. This can be used by politics or municipalities as a baseline measurement of segregation. Moreover, the indices describing the development of the three kinds of segregation over the different years can be applied to evaluate the effectiveness of policies employed by municipalities to counteract segregation. Second, it shows which differences between primary schools are damaging for equality in educational opportunities and hence, in the long run, for the quality of education. Third, it demonstrates how segregation in primary school contributes to segregation in secondary school. Understanding of these concepts can be used as input to make or adjust policies that change the composition of pupils in schools. In that way, the results can be informative in how policymakers can stimulate equal educational opportunities.

The remainder of this paper is structured as follows. First, a review of the relevant literature is given. Then, background information is provided about the Dutch school system. After that, the data is described, followed by an explanation of the empirical strategy. Next, the findings are discussed. The last section concludes the results, discusses the limitations of the research, and gives suggestions for future research.

2 Related literature

This chapter discusses the relevant literature about the causes and effects of school segregation. We also analyze the literature about peer effects in the context of school segregation and discuss the papers that investigated school segregation in the Netherlands.

2.1 Causes of school segregation

School segregation is a broad concept and its effects have been studied extensively. According to Ball (2003) and Burgess, Greaves, Vignoles, and Wilson (2011), school segregation is the spatial manifestation of unequal distributions of pupils with different ethnic, social and economic characteristics across schools. The literature mentions different causes of school segregation.

One of the causes is residential segregation. Frankenberg (2013) for the US, Taylor and Gorard (2001) for the UK and Kristen (2003) for Germany, argue that residential segregation is major in explaining school segregation. The degree to which school segregation is explained by residential segregation depends on the organisation of the school system.

In some school systems, for example in the UK, the distribution of pupils in schools is based on the residential location of children through catchment areas, whereas in other systems parents have free choice, and school compositions depend on heterogeneity in parents' preferences for schools. In the former case, patterns of residential segregation are more important. Hence, to decrease school segregation, measures were introduced that counteracted residential segregation. One of these measures is expanding the free school choice (Orfield & Eaton, 1996). The idea is that allowing pupils to enter schools outside their neighbourhood reduces the impact of the residence on school compositions and thereby decreases school segregation.

There are, however, also papers that show contradicting results. Those papers argue that high degrees of free school choice enhance school segregation, also when there is accounted for residential segregation (see e.g. Böhlmark, Holmlund, and Lindahl (2016)). As a result, free school choice can be seen as the second explanation of school segregation.

The third cause of school segregation is the extent of between-school variation in a certain region. The design of the educational system can differ across countries and regions and depends on the proportion of public and private schools, denominated schools and schools with a particular educational philosophy (e.g. Montessori, Jenaplan, Dalton). Boterman (2018) argues that the chance at school segregation increases with the amount of options parents have. Moreover, Burgess, Greaves, Vignoles, and Wilson (2015) show that the restrictions parents have in their choice for a school, rather than heterogeneous preferences for schools across parents, drive differences in access to schools across family types. When the between-school variation in a certain region is higher, parents have a larger choice set of schools, which increases the chance of segregation in schools between parents with different ethnic, social and economic backgrounds.

Closely related to the former is the fourth explanation of school segregation. School segregation can also be increased by the level of autonomy schools have in selecting students (Boterman, 2019). Parents admit their children to their desired school(s). However, this does not necessarily mean that children will be enrolled in this particular school. This depends on the level of autonomy schools have to select students. When schools have more freedom in choosing their desired students, there is a higher chance that specific schools choose students with a particular profile, which increases the possibility of school segregation. The degree to which this cause is present is related to the extent of between-school variance. When the supply of schools is more differentiated within a region, there is a higher chance that schools demand students with specific profiles.

Once summarizing the above, one could say that school segregation is instigated by residential segregation, as well as by school selection and admission. An introduction to the effects of school segregation will be given in the next section.

2.2 Effects of school segregation

Segregation can be seen as the extent of separation across two or more groups. These groups can differ by e.g. ethnicity, socioeconomic status, occupation, gender or any other criteria (Kristen, 2003). The literature on school segregation most often focuses on differences in ethnic (Frankenberg, 2013; Böhlmark et al., 2016; Kristen, 2003) and socioeconomic (Taylor & Gorard, 2001; Böhlmark et al., 2016) background. Moreover, school segregation and its effects are measured within different environments and by various standards. Examples of environments in which the effects become visible are during primary school, secondary school, higher education and after graduation. School segregation and its effects are gen-

erally measured in the same environment instead of in different environments. This means that studies focus for example on segregation in primary school and measure the associated effects also in primary school, instead of measuring the effects in later education or even after graduation. A large part of the literature concentrates on segregation in primary school (see e.g. Frankenberg, 2013; Kristen, 2003; Boterman, 2018). Frankenberg (2013) mentions several reasons for studying primary schools. One of these reasons, and probably the most important one, is that primary schools are indicative of how groups with different backgrounds are divided in the community.

The effects of school segregation are often scrutinized in terms of educational achievement and attainment. Sykes and Kuyper (2013) studied, for example, the effect of the ethnic and socioeconomic composition of secondary schools on academic achievement in the third year of secondary school. They found that students that attended secondary schools with higher levels of socioeconomic status performed better when accounted for background characteristics and prior achievement. Moreover, Billings, Deming, and Rockoff (2014) examined whether racial segregation in secondary school influences educational achievement and attainment levels. They argue that the educational achievement of both white and minority students is lower when they are assigned to schools with more minority students.

For the case of ethnic segregation, there are two explanations as to how segregation leads to differences in school achievement and educational attainment. The first explanation relates to the learning opportunities in the school. Learning opportunities may be influenced by high proportions of minority students in the school (Kristen, 2002). The underlying thought is that teachers adjust their teaching style and lower their expectations when they have a class with a high percentage of minority students and that teachers spend more time on these students as they often need extra help. The second explanation relates to peer effects. Peer effects are the effects on students' achievement associated with the background of students with which she attends school (Van Ewijk & Sleegers, 2010; Palardy, 2013). Palardy studied the relationship between high school socioeoconomic segregation and student attainment and found that socioeconomic segregation is strongly associated with high school graduation and college enrollment. Students that attended high schools with high socioeconomic compositions were more likely to graduate and to enroll in college, compared to students that attended schools with low socioeconomic compositions. Palardy postulates peer effects as one of the mediating mechanisms for these effects. In the next paragraph we will expand on the theory of peer effects.

2.3 Peer effects of school segregation

Ryan (2000) shows that peers affect each other with respect to motivation, engagement, and achievement. The idea is that a high proportion of students with low motivation, engagement or achievement negatively influences students' achievement. In the context of ethnic segregation, it is questionable to what extent negative peer effects exist. No unambiguous answer is provided to the question whether ethnic minorities do have lower motivation, engagement, and achievement in school. Several studies show the opposite. Fekjær and Birkelund (2007) for example, argue that ethnic minority students who complete upper secondary education are more motivated than their native counterparts.

Several researchers studied the phenomenon of peer effects in the context of education. Booij, Leuven, and Oosterbeek (2017) studied peer effects that originate from the ability composition of tutorial groups. They show that students with low and medium ability benefit from being assigned to groups with more able peers and that students do better in more

homogeneous groups. Students with high ability are unaffected. The authors show evidence that these results do not arise from an adjustment in teaching. Similar results are shown by Feld and Zölitz (2017), who study peer effects in a comparable setting. They show that students that are assigned to sections with, on average, higher-achieving peers significantly increase their grades in that course. This result, however, does not apply to low-achieving students. These students are harmed by high-achieving peers. Previous research has been executed within the context of peer effects of classroom composition. Other research has been performed in more broad settings, where researchers investigate peer effects that arise from for example school compositions.

Southworth (2010) analyses the relation between achievement and the racial and poverty composition of the school. She founds that, when taking into account student, family, and other school characteristics, both a higher proportion of minority students and a higher poverty level in the school negatively affect student achievement. Moreover, increasing teacher quality leads to a reduction of these effects, but does not eliminate them. This result suggests that school composition is more important in explaining students' achievement than teacher quality. Similar results are suggested by Willms (2010) and Gibbons and Telhaj (2016). Willms (2010) investigates the impact of school composition on students' literacy performance in science. He argues that literacy performance is negatively affected by school segregation, where school segregation can either originate from the distribution of students from different socioeconomic backgrounds across schools or from the selection processes of schools. Moreover, Gibbons and Telhaj (2016) examine the effect of school composition in primary school on secondary school performance. Specifically, they study whether pupils' academic progress is faster during secondary school when their schoolmates in secondary school performed well in primary school. Although small, they found that these peer effects exist: students' academic achievement in secondary school is increased for students that attend secondary school with students that performed better in primary school. The effects originate from peers' family background and achievement at the age of seven.

2.4 School segregation in the Netherlands

Our study focuses on the peer effects based on migration background, parental education level and parents' wealth in primary school on primary and secondary school achievement. The study is performed using data from the Netherlands. Therefore, we will analyse the existing Dutch literature on school segregation.

School segregation and its associated effects are currently a hot topic in the Netherlands. The discussion is fed by a report of the Inspectorate of Education, that reported that school segregation is increasing and that it can lead to differences in educational opportunities (Inspectie van het Onderwijs, 2018). Several studies have explored school segregation in the Netherlands (Ladd, Fiske, & Ruijs, 2009; Gramberg, 1998; Sykes & Musterd, 2011; Karsten, Ledoux, Roeleveld, Felix, & Elshof, 2003; Karsten et al., 2006; Clark, Dieleman, & De Klerk, 1992; Dijkstra, Jungbluth, & Ruiter, 2001; Boterman, 2018, 2019).

The greater part of the Dutch literature focuses on ethnic segregation in primary education. Ladd et al. (2009) describe the history of school segregation in the Netherlands. According to them, school segregation by socioeconomic status was overwhelmed by segregation based on religion, initiated by the pillarization of the Dutch society in the late 19th century. This ended only after the secularization in the 1950s and the flow of immigrants in the 1960s and 1970s. The influence of religion declined and segregation by ethnicity and socioeconomic status became modal. Moreover, the authors mention two of the main causes

of ethnic, social and economic school segregation in the Netherlands: residential segregation and the free school choice. They studied the effect of free school choice on segregation and show that free school choice enhances school segregation. The impact of residential segregation on school segregation is studied by Boterman (2019). He demonstrates that in the Netherlands, where parents, as well as schools, have a high degree of autonomy in choosing schools and admitting pupils, residential segregation explains most of the existing school segregation. A similar result was earlier found by Karsten et al. (2006).

The contexts in which school segregation in the Netherlands is studied varies: Gramberg (1998) and Clark et al. (1992) study school segregation in Amsterdam, Boterman (2018, 2019), Ladd et al. (2009) and Karsten et al. (2006) in Dutch cities, and Sykes and Musterd (2011), Dijkstra et al. (2001) and Karsten et al. (2003) in the Netherlands as a whole. Karsten et al. (2003) investigated the mechanisms of school choice and the relation with ethnic segregation. They found that the ethnic composition of the school affects parents' school choice for primary schools. The most important factor in choosing a school is the "match" between home and school for native Dutch parents. For ethnic minority parents, the degree of differentiation and academic standard of the school are more important. Sykes and Musterd (2011) investigate school segregation in a broader sense. They focus not only on segregation by ethnicity but also by socioeconomic status, for which they use parents' educational attainment as a proxy. They study the relation between school and neighbourhood contexts on the one hand and educational achievement on the other hand, using a multilevel analysis. They found that when neighbourhood and school contexts are considered separately, both show a significant relation with pupils' educational achievement. However, when considering the contexts simultaneously, the effect of the neighbourhood vanishes and only the school remains a significant indicator. There is a strong and negative effect of low school socioeconomic status on educational achievement, both for native Dutch students and ethnic minorities. Only for native Dutch students, there is a negative effect of school ethnic minority concentration on achievement.

3 Context

For a better understanding of this paper, this chapter provides background information about the educational system in the Netherlands.

3.1 The Dutch educational system

Figure 1 presents a schematic overview of the Dutch education system. The figure shows that children enter primary school from the age of four. In the Netherlands, pupils are compulsory to follow education from the age of five until eighteen. There is an exception to this rule. Pupils that have a "start qualification" (and are sixteen or older) can leave school earlier. A start qualification is obtained when a pupil graduates from pre-university education (VWO), senior general secondary education (HAVO), or secondary vocational education (MBO).

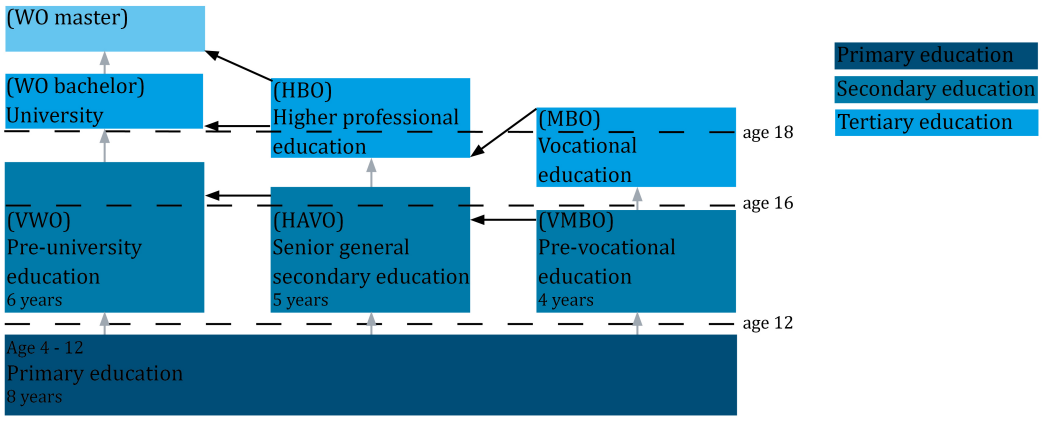


Figure 1: Schematic overview of the Dutch educational system.

After entering primary school at the age of four or five, primary education lasts eight years. At the age of twelve, children enter secondary school in different tracks, depending on their capabilities. Children can enter secondary school at three tracks: pre-vocational education (VMBO), lasting four years, HAVO, lasting five years, and VWO, lasting six years. After pupils graduate from secondary school, they can enter higher education. Pupils that finish VMBO can enter intermediate vocational education (MBO), pupils that finish HAVO can enter higher professional education (HBO), and pupils that finish VWO can enter university (WO). The grey arrows in Figure 1 show the regular path in which pupils follow the different levels (primary, secondary, tertiary) of education. The black arrows indicate the non-regular paths of education that pupils can follow. In secondary education, students can, for example, enter the HAVO track after they finished VMBO. This is an example of what is called "stapelen", i.e. accumulating multiple diplomas in the same level (e.g. secondary education). Similarly, pupils can enter HBO after finishing MBO or WO after finishing HBO.

The Dutch educational system distinguishes itself from other systems by possessing a few key features. The first feature is the free school choice. Parents can freely choose the desired primary, and under certain conditions, also secondary school for their children. Moreover, schools possess a large degree of autonomy in selecting pupils. Schools can by deciding on, among other things, the tracks they offer, select specific pupils into their school. Compared to other countries, such as England and the United States, choices of parents and schools do not rely on catchment areas. The autonomy of schools is the second feature of the Dutch educational system. The third feature is that the Dutch educational system is publicly funded for the greatest part. As a result quality differences between schools are only minor. Moreover, it strengthens the free parental choice, as parent's economic status does not form a barrier. A fourth feature is the tracking system. Pupils are tracked at the early age of twelve when they enter secondary school. There is a high degree of differentiation in schooling offered in secondary school, with tracks that differ concerning their curricula, prestige, length and final qualifications. These four characteristics together form a unique school environment.

3.2 School advice and tracking

As discussed, children in the Netherlands enter secondary school in different tracks. In the last year of primary school, pupils get advice about the secondary school track that best fits their capabilities. There exist two types of advice: the first teacher's advice and the test advice. The first teacher advice is given by the teacher based on observations and test results during different years of primary school. The test advice is based on the results of an exit test that every pupil makes in the last year of primary school. Since the school year 2014/2015, the first teacher's advice is told to pupils before they make the exit test. After the exit test, the test advice is obtained. This advice is also communicated with pupils and their parents. If the test advice is higher than the first teacher's advice, the school should reconsider the first teachers' advice, and possibly adjust it upwards. This new advice is referred to as the *final teacher's advice*. The first teacher's advice cannot be adjusted downwards. Starting in the school year 2014/2015, the teacher's advice is binding in determining the secondary school track pupils enter. Figure 2 gives a schematic overview of the origin of the school advice with which pupils enter secondary school.

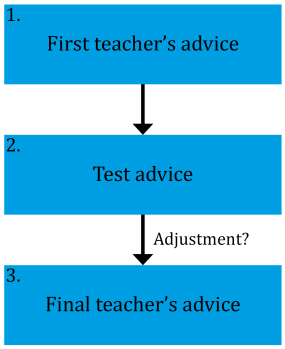


Figure 2: Schematic overview of the decision process for school advice.

In the past years, there have been some changes in the supply of tracks in secondary schools. One of these changes is that the number of secondary schools that offer multiple tracks has decreased. Schools reject for example the VMBO track and only offer the other, higher tracks, or split the school into multiple departments (Dronkers, 2014). As a result, the possibilities for changing to a higher or lower track decrease. Moreover, a narrowing of mixed classes in the first year of secondary schools arises (Elffers, Van de Werfhorst, & Fischer, 2015). Consequently, more and more pupils are tracked at one level at the start of secondary school. The above stresses why a correct teacher's advice has become even more important over the years.

Karsten et al. (2006) mention segregation as a cause that forces schools to reduce the number of offered tracks. The authors write about two forms of segregation in secondary school: segregation between different tracks as a result of different results in primary school and segregation as a result of heterogeneity in choice preferences. Concerning the latter, it appears that schools that offer all tracks are becoming less popular because of their internal segregation, they say. Since pupils choose schools consisting of pupils of the same track, these mixed schools are at risk of being closed.

Not only in the Netherlands but also in other countries between school-tracking exist, although the age of tracking differs (Van de Werfhorst, 2018). A large amount of literature is

available about the effects of tracking. Many of these studies focus on the relation between tracking and inequalities in learning opportunities. Van de Werfhorst (2018), for example, studies the educational inequalities by socioeconomic background in nine countries, by comparing countries with and without reforms in their educational system, across time. In systems that transformed from tracked to comprehensive education, he finds socioeconomic inequalities to be more strongly reduced than in systems without this reform. The research suggests that tracking enhances inequalities. This effect could arise through the mediating role of segregation. The Inspectie van het Onderwijs (2018) and Karsten et al. (2006) mention tracking as a cause of segregation. They show that pupils with a migration background are over-represented in vocational tracks, whereas academic tracks mainly consist of pupils with high-educated parents. As a result, pupils with different socioeconomic backgrounds finish secondary school at different levels, which leads to differences in possibilities for further education. Consequently, this contributes to inequality in educational opportunities between various groups of pupils.

4 Data

The data that is used to conduct this research is provided by Statistics Netherlands (CBS). The data comes from different sources. Background information of pupils and their parents is available via the municipal database (Basisregistatie Personen, BRP). Information about parental education is obtained via DUO (Dienst Uitvoering Onderwijs) and the EBB (Enquete beroepsbevolking) of Statistics Netherlands. The tax authority (Belastingdienst) provides information about income and wealth. Information about primary and secondary schools, school advice, test advice, and track in secondary school are gathered from DUO. In each dataset, a pupil's Citizen Service Number (Burger Service Nummer, BSN) is encrypted and replaced by a unique identifier. This identifier makes it possible to merge information from different sources. Moreover, it allows us to link parents with their children such that we can connect parents' background characteristics to the information about pupils.

4.1 Sample

Our population consists of pupils that are in the final grade of primary school in the school years 2011/2012 until 2015/2016 in one of the ten largest cities in the Netherlands (see Appendix A.1 for the list with cities). The chosen time period consists of the five most recent waves of pupils for which data is available about their school level in the third class of secondary school. Including multiple cohorts allows us to more accurately estimate school fixed effects. We only select pupils for which the first teacher advice, test advice, and school level in the third class of secondary school is known. Moreover, as the test advice from different exit tests is not comparable, we select schools that use the most common exit test in the Netherlands (CITO). This corresponds to approximately 87 percent of the schools in our sample. As we are interested in estimating peer effects, we also decided to select primary schools that have per year at least 18 and at most 35 pupils in the eighth grade. Since the data does not allow us to distinguish multiple classes in the same grade, this selection makes it plausible that our sample consists of groups of pupils from the same classroom. Furthermore, schools that appear in the dataset in only one or two years, are removed. This is because a precise estimation of school fixed effects is not possible for those schools, which can influence the accuracy of our estimates. Our final sample consists of 38,667 pupils in 390 primary schools.

4.2 Variable description

4.2.1 Dependent variables

The goal of this research is to investigate primary school peer effects on a pupil's educational attainment in primary and secondary school. A pupil's educational attainment in primary school is measured by their first teacher advice and test advice. A pupil's school level in the third class in secondary school is used to measure educational attainment in secondary school. This is the track after three years in secondary school when the pupil did not repeat a class from the moment it started secondary education. In secondary school, we distinguish six tracks: VMBO-basis, VMBO-Kader, VMBO-Gemengd, VMBO-Theoretisch, HAVO, and VWO. In practice, schools offer either VMBO-Gemengd or VMBO-Theoretisch, and the tracks are considered to be interchangeable. Hence, in the analysis, we distinguish the school levels as given in Table A.2 in the Appendix. The levels are ranked in order of difficulty, where a higher rank is associated with a higher level of difficulty. It becomes clear that secondary school achievement can take on five values. Besides those five tracks presented in Table A.2, the teacher's advice and test advice can also consist of a combination of two consecutive tracks, for example, HAVO/VWO. This is what we call a combination advice. In total there are four possibilities: VMBO-B/VMBO-K, VMBO-K/VMBO-GT, VMBO-GT/HAVO, and HAVO/VWO. This results in a total of nine possible tracks for the first teacher's advice and school advice.

4.2.2 Characteristics of pupils

In the analysis, we control for several background characteristics of pupils. We will describe these variables in detail below.

Gender
There exist differences in educational achievement between men and women. According to the Inspectie van het Onderwijs (2018) these differences are mainly present in secondary education. There, boys more often repeat a class and change to a lower track, and less often change to a higher track than their initial advice, compared to girls.

Age
Pupils are in primary school from the age of 4 or 5 until 12. We use the age of a pupil at the start of their final year, i.e. the first of September, in primary school. The majority of pupils naturally has the age of ten, eleven, or twelve. A pupil's age can indicate whether a pupil is a fast, moderate, or slow learner. A higher age might imply that the pupil learns slower, resulting in a lower level of achievement.

Migration background
One of the focus points of this research is to estimate the effect of the proportion of ethnic minority peers in a class on pupils' educational attainment. Hence, it is of major importance to clarify the classification of migration background. For each pupil in the dataset, we know their country of origin and that of their legal parents. To decide a pupil's migration background we take into account the generation that a pupil belongs to. We will first elaborate on these generations.

We distinguish three generations: first generation, second generation, and third generation. Pupils that are not born in the Netherlands and from which at least one of the

parents is also not born in the Netherlands are called first-generation immigrants. Pupils that are born in the Netherlands, but of which at least one parent is non-Dutch are called second-generation immigrants. Pupils that are born in the Netherlands and from which at least one of the four grandparents is non-Dutch belong to the third generation.

For a pupil that belongs to the first generation, the country where the pupil is born determines the country of origin. A pupil that belongs to the second generation has the country where the mother is born as their country of origin, unless that is the Netherlands. Then, the country where the father is born determines the pupil's country of origin. For a pupil that belongs to the third generation the country of origin is determined by the country of origin of the mother, unless that is also the Netherlands. In that case, the country of origin of the father defines the pupil's country of origin. The countries of origin are divided into three categories: Dutch, Western, and non-Western. A pupil is assigned to the Western group when the pupil or the (grand)parents are from one of the countries in Europe (except Turkey), North America and Oceania, or Indonesia or Japan. Pupils are assigned to the non-Western group when the pupil or their (grand) parents have one of the countries in Africa, Latin America, and Asia (except Indonesia and Japan) as their country of origin. Pupils that have themselves or their (grand) parents the former Dutch Antilles or Aruba as their country of origin are also part of the non-Western group. Based on their socioeconomic and sociocultural status, Indonesia and Japan are categorized as Western countries. This group consists mainly of persons born in the former Dutch East Indies or employees, and their families, of Japanese companies.

Youth support

The last characteristic of pupils for which we control is whether a pupil receives any form of youth support. Youth support is additional support for children to help them deal with any form of limitations they encounter in their functioning. The support can enclose support with learning disabilities or an internal stay in an institution, and everything in between. A pupil that receives youth support might have social-emotional of psychological problems, which might influence its learning performance in primary and secondary school. Moreover, teachers can use the fact that a pupil receives youth support as an incentive to lower their school advice for that pupil. This is another way in which school attainment might be affected.

For each pupil that receives or has received any form of youth support, we know the start and end date of the period that the pupil received youth support. With this information, we can assess whether a pupil received youth support when they were in the eighth grade of primary school. We distinguish three categories for youth support: not receiving youth support, receiving youth support without internal stay, and receiving youth support with internal stay.

4.2.3 Characteristics of households and parents

Next to pupils' direct characteristics, we also control for characteristics of pupils' parents and the household pupils are in. The BRP registers not only information of individual persons in the Netherlands, it also contains links between children and their (legal) parents. As for each individual a household number is available that identifies the household a person is in, it is possible to determine whether a child is in the same household as their (legal) parents. This allows us to link characteristics of the parents of the pupil and the household in which the pupil is located to the pupil. The following features of the household and

parents of the pupil are utilized.

Number of children in the household
The number of children in the household can affect the educational attainment of a child. In her research about the effect of family size on the quality of children, Blake (1981) shows that the more children parents have the lower the quality is of each child, in terms of educational attainment and college plans. As a possible reason for this effect, she mentions the dilution of parental attention when the number of children increases; attention positively impacts the motivation of children, which can, in turn, affect for example educational attainment.

Parental structure
Another household characteristic that can impact a pupil's achievement is the parental structure. By using an extensive categorization for family structure, and controlling for gender, race, and socioeconomic status, Jeynes (2005) found family structure to be an important predictor of children's academic achievement. For each pupil, we know the parental structure the pupil is exposed to. We distinguish seven categories: living with legal mother and legal father, living with legal mother, living with legal father, living with legal mother or father and partner, living in an institutional household, living in another structure, or unknown parental structure. Another household structure consists of children living in a household without their legal parents, such as a foster home.

Parent's educational attainment
The educational attainment of parents is an important predictor of a pupil's educational attainment. This effect arises in multiple ways. The most evident way is the heredity of intelligence: more intelligent parents in general also have more intelligent children, compared to less intelligent parents. This relation was revealed long ago and is investigated thoroughly (see Bouchard and McGue (1981) for a meta-study on this topic). However, the effect can also originate in an indirect fashion. In the Dutch school environment, where tracking and free school choice are key features, parents with different levels of educational attainment bring their children to different primary schools. Moreover, pupils from parents with lower educational attainment get lower school advice, their advice is less often adjusted and they enter secondary education at a lower level than comparable performing pupils with parents with high educational attainment (Inspectie van het Onderwijs, 2018). For most parents in the dataset, there is information about their level of educational attainment. The level corresponds to the highest level of education that a person has obtained. For each pupil, the level of education of their parents that is used in the analysis is as follows. When the level of education is available for both parents, the highest level is used. When the level of education is available for only one of the parents of a pupil, that education level is used. The parental education level can take 14 different values in the data. For the analysis, we consider five groups. Table 1 shows how these groups are formed.

Table 1: Classification of parental educational attainment.

Classification in analysis	Original classification
Primary education	Primary education
Lower secondary education	VMBO, HAVO class 1/2/3, VWO class 1/2/3, MBO level 1
Higher secondary education	HAVO class 4/5, VWO class 4/5/6, MBO level 2/3/4
Bachelor degree	HBO-associate degree, HBO-bachelor, University-bachelor
Master degree	HBO-master, University-master, Doctor

Wealth
Wealth consists of disposable income and equity. Various papers investigate the effect of household income on the educational attainment of children and find that higher income is associated with higher levels of educational attainment (see e.g. Hill & Duncan, 1987). More than household income, wealth gives an integral picture of the money that a household has available to spend, as it takes into account debts and equity of the household. The variable is an assembly of two variables and is constructed in the following way. The disposable income of the household is standardized, which means that the income is corrected for the size and structure of the household. This is done by dividing the disposable household income by the so-called equivalence factor: a factor that expresses the extent of the economies of scale from running a joint household. The standardized disposable income, as well as household equity, is divided into percentiles. This division is based on the standardized disposable income of all Dutch households, except institutional households and households for which the income is unknown. The wealth variable is the average percentile of the standardized disposable household income and equity.

4.2.4 Primary school peer compositions

The main goal of this research is to gain insight into the influence of primary school peer composition on secondary school performance. This paragraph explains how these peer compositions are calculated. We look at peer composition from three different perspectives: migration background, parents' wealth, and parental education level. The peer compositions are calculated using the leave-out principle. In essence, this principle uses the characteristics of all peers to which a pupil is exposed, to calculate the peer composition for this pupil. This means that the characteristics of the pupil itself are not taken into consideration. That is, the leave-out mean for pupil i in school s in a given year is calculated as:

$$\bar{z}_{(i)s} = \frac{N_s \bar{z}_s - z_{is}}{N_s - 1}, \tag{1}$$

where N_s is the number of pupils in the eighth grade of school s, $\bar{z}_s$ is the group mean of the peer characteristic of interest of school s and z_{is} is the value of the peer characteristic of interest for pupil i in school s.

For the calculation of the peer composition of primary schools we only use the characteristics of pupils that are in the last grade of primary school. This is because we are interested in the educational achievement of pupils in this grade. It is most likely that they are influenced by pupils in the same grade, compared to pupils from other grades, as these pupils share the same classroom and school-related activities. We now describe how these peer compositions are exactly constructed.

Ethnic minority
A pupil belongs to the group of pupils with an ethnic minority background when the pupil has a non-Western migration background. Hence, we calculate the peer proportion of pupils with a non-Western migration background at the school-cohort level.

Low wealth
As described above, wealth is composed by combining household disposable income and household equity. Pupils of which their parents' wealth falls into the fortieth lowest percentiles belong to the group of pupils with parents with low wealth. We calculate the proportion of peers in the low-wealth group at the school-cohort level.

Low-educated parents
We are interested in the proportion of peers with low-educated parents. We categorize a pupil as having low-educated parents when the education level of their parents falls into the categories primary education or lower secondary education. Also, when both parents have unknown educational attainment, we categorize their educational attainment as low. This is to avoid that we cannot use a significant part of our sample due to missing values in this variable. The classification is not without reasoning. From the mid-eighties, Statistics Netherlands has integral data from all schools that offer education at the bachelor or master level. As the parents in our dataset are most likely to have finished their latest education after 1985, the probability is almost zero that they have a missing value when they have finished one of the higher levels of education. Just as the other two peer proportions, the peer proportion of pupils with low-educated parents is calculated at the school-cohort level.

4.3 Current state of segregation

With this research, we want to investigate the influence of primary school peer effects on primary and secondary school attainment. Therefore, insight into the present state of segregation in primary schools is of interest. A common measures of segregation is the Dissimilarity Index (DI). The dissimilarity index is a popular measure, because of its intuitive interpretation. According to Graham (2018), DI equals the proportion of disadvantaged pupils who would need to move to another school to obtain perfect integration, relative to the proportion that would need to move under a status quo of perfect segregation. The main drawback of this index is that it does not satisfy the decomposability property. Therefore it is not possible to distinguish segregation occurring within and between groups. As our goal is to sketch a general picture of the state of segregation in Dutch primary schools instead of providing a detailed explanation about the origin of segregation, this disadvantage is no concern for this research.

The expression for DI is as follows:

$$DI = \frac{1}{2}\sum_{s=1}^{n}\left|\frac{P_{L_s}}{P_L} - \frac{P_{H_s}}{P_H}\right|, \tag{2}$$

where P_{L_s} is the number of disadvantaged pupils in school s, P_{H_s} is the number of non-disadvantaged pupils in school s, P_L is the total number of disadvantaged pupils, P_H is the total number of non-disadvantaged pupils and n is the number of schools. DI can range from 0 to 1, where 0 indicates no segregation and 1 indicates complete segregation.

Table 2 shows the results of the calculation of the dissimilarity indices. The columns contain the dissimilarity index by ethnicity, household wealth, and level of education. The

results are based on pupils in the eighth grade of a school in the ten largest cities of the Netherlands.

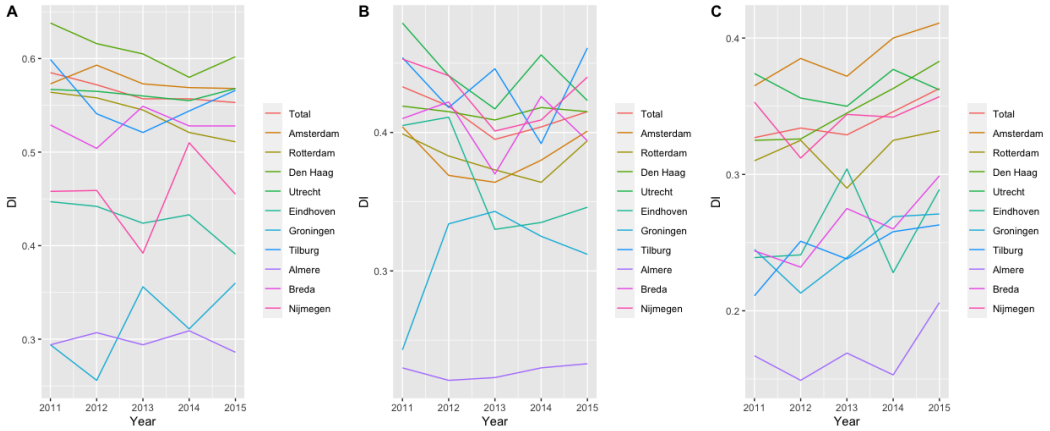
From Table 2 it is clear that segregation by ethnicity is highest in all cities, except Groningen. Moreover, segregation by household wealth is, except in Amsterdam, higher than segregation by parental education. The table also shows that, in general, segregation is highest in Den Haag and Utrecht and lowest in Almere.

Table 2: Segregation in the Netherlands.

City	Ethnicity	Wealth	Education
Amsterdam	0.576	0.384	0.398
Rotterdam	0.541	0.382	0.338
Den Haag	0.609	0.416	0.368
Utrecht	0.564	0.444	0.387
Eindhoven	0.432	0.369	0.284
Groningen	0.309	0.313	0.284
Tilburg	0.555	0.435	0.280
Almere	0.299	0.227	0.212
Breda	0.529	0.405	0.293
Nijmegen	0.455	0.429	0.345
Total	0.565	0.413	0.358

Notes. The table presents segregation by ethnicity, household wealth and parental education level for the different cities in the dataset. The reported numbers are dissimilarity indices.

The results in Table 2 can be separated by year. Figure 3 shows the trends in the DIs for different cities. The figure demonstrates that in most cities, segregation by ethnicity has decreased and segregation by parental education has increased in the observed time period. This result is also found by the Inspectie van het Onderwijs (2018).



Notes: The figure shows the dissimilarity index (DI) by ethnicity (Panel A), household wealth (Panel B) and parental education (Panel C) for different cities over time.

Figure 3: Trends in the Dissimilarity Index.

4.4 Descriptive statistics

This paragraph shows descriptive statistics of our sample. Tables A.3, A.4, and A.5 in the Appendix report the mean and standard deviation of the control variables, for different subpopulations of the data. As a reference, the descriptive statistics for the complete population are also added to the tables. In our data, 51% of all pupils has a non-Western migration background, 43% of all pupils has parents with low wealth and 47% of all pupils has low-educated parents.

In Tables 3, 4, and 5 we show the distribution of the different groups of pupils across the various education levels. Table 3 shows the proportion of pupils with a non-Western migration background, with low-wealth parents and with low-educated parents for the different levels of education of the first teacher advice. In Tables 4 and 5 the same proportions are shown for the values of respectively the education level of the test advice and the level in the third class of secondary school. The shares of pupils in the different levels of education and the different minority groups are also added.

From Table 3 we observe that, in general, the proportion of pupils in the non-Western group decreases when the level of education increases. We observe the same result for the proportion of pupils with parents with low wealth and pupils with low-educated parents. The results in Tables 4 and 5 show similar patterns. The trends in Tables 3, 4 and 5 coincide with the statements of the Inspectie van het Onderwijs (2018) and Karsten et al. (2006). They state that academic tracks are over-represented by pupils with high-educated parents and that vocational tracks mainly consist of pupils with a migration background.

Table 3: Proportion of pupils in three groups for the different levels of the first teacher advice.

First teacher advice	Share non-Western	Share low wealth	Share low education	Total
VSO/Praktijk/VMBO-B	0.68	0.54	0.57	0.11
VMBO-BK	0.65	0.51	0.55	0.04
VMBO-K	0.62	0.51	0.53	0.13
VMBO-KGT	0.53	0.46	0.50	0.02
VMBO-GT	0.54	0.46	0.49	0.21
VMBO-GT/HAVO	0.55	0.45	0.50	0.07
HAVO	0.45	0.39	0.43	0.17
HAVO/VWO	0.44	0.37	0.43	0.08
VWO	0.34	0.31	0.35	0.18
Total	0.51	0.43	0.47	

Notes. This table shows the share of pupils with non-Western migration background, the share of pupils with parents with low wealth and the share of pupils with low-educated parents, for the different levels of the first teacher advice. The results are based on the complete sample (38,667 pupils).

Table 4: Proportion of pupils in three groups for the different levels of the test advice.

Test advice	Share non-Western	Share low wealth	Share low education	Total
VSO/Praktijk/VMBO-B	0.66	0.53	0.55	0.12
VMBO-BK	0.61	0.51	0.55	0.11
VMBO-K	0.59	0.48	0.51	0.09
VMBO-GT	0.56	0.46	0.49	0.15
VMBO-GT/HAVO	0.52	0.44	0.49	0.10
HAVO	0.47	0.40	0.43	0.13
HAVO/VWO	0.42	0.37	0.43	0.13
VWO	0.35	0.31	0.36	0.16
Total	0.51	0.43	0.47	

Notes. This table shows the share of pupils with non-Western migration background, the share of pupils with parents with low wealth and the share of pupils with low-educated parents, for the different levels of the test advice. The results are based on the complete sample (38,667 pupils).

Table 5: Proportion of pupils in three groups for the different levels of education in secondary school.

Education	Share non-Western	Share low wealth	Share low education	Total
VSO/Praktijk/VMBO-B	0.68	0.54	0.58	0.14
VMBO-K	0.61	0.50	0.53	0.17
VMBO-GT	0.55	0.46	0.50	0.28
HAVO	0.46	0.39	0.44	0.20
VWO	0.34	0.30	0.35	0.22
Total	0.51	0.43	0.47	

Notes. This table shows the share of pupils with non-Western migration background, the share of pupils with parents with low wealth and the share of pupils with low-educated parents, for the different levels of education in the third class of secondary school. The results are based on the complete sample (38,667 pupils).

5 Methodology

The following chapter explains the method that is used to find the influence of peer effects on primary and secondary school attainment.

5.1 Structure of the data

Figure 4 gives a schematic overview of the structure of our data. It shows that we consider pupils (level 1) within cohorts (level 2) within schools (level 3). The number of pupils can differ per cohort and school. The observations of pupils in the same school or cohort are not independent of each other. We should take this dependence into account when estimating the model.

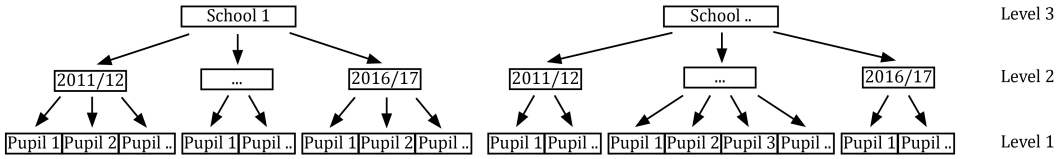


Figure 4: Structure of the multilevel model.

5.2 Empirical model

Our goal is to give a causal interpretation of the parameters of interest. We follow the approach of the peer effects studies of Lavy and Schlosser (2011), Brenoe and Zölitz (in press), and Gibbons and Telhaj (2016). To be able to make causal interpretations of the parameters of interest, no unobservable and time-varying factors must exist that affect sorting of pupils into primary schools that are correlated with attainment. By including school fixed effects and cohort fixed effects, we control for unobservable and time-varying factors that are correlated with school selection. Hence, conditional on these fixed effects, pupils are randomly sorted into primary schools. This results in the following model to investigate the primary school peer effects on a pupil's attainment:

$$y_{ics} = \alpha + \beta_1 PNW_{ics} + \beta_2 PLW_{ics} + \beta_3 PLE_{ics} + C_{ics}\boldsymbol{\gamma}' + T_s\boldsymbol{\delta}' + S_c\boldsymbol{\zeta}' + \varepsilon_{ics}, \quad (3)$$

where y_{ics} is the level of education of the first teacher advice, the test advice, or in the third class of secondary school for pupil i in cohort c and primary school s. These outcome variables can take on five values in the analysis (see Table A.2). We use multiple linear probability models to estimate the effect of peer characteristics on educational attainment. As the dependent variable is binary in a linear probability model, we estimate for each outcome variable four linear probability models as given in equation (3). The binary dependent variables in those models are as follows: the pupil is in VWO track, the pupil is at least in HAVO track (so either HAVO or VWO), the pupil is at least in VMBO-GT track (so either VMBO-GT, HAVO or VWO), the pupil is at least in VMBO-K track (so either VMBO-K, VMBO-GT, HAVO or VWO).

The vector C_{ics} includes pupil's characteristics and characteristics of their parents and household. The vectors T_s and S_c are respectively cohort fixed effects and school fixed effects. These vectors with control variables are gradually added when estimating the model. This allows us to observe how sensitive our results are to including those vectors. Lastly, ε_{ics} accounts for unobserved effects. As we discussed, pupils within schools and cohorts are not independent of each other. To allow the outcomes of pupils to be correlated with those of their peers, the error term is clustered at the cohort-school level.

The variables of interest are PNW_{ics}, PLW_{ics}, and PLE_{ics}. Those variables represent respectively the proportion of peers with a non-Western migration background, with parents with low wealth, and with low-educated parents pupil i in cohort c in primary school s is exposed to. The parameters β_1, β_2, and β_3 capture the effect on pupils' attainment in secondary school of a one percentage point increase in these proportions.

5.3 Measuring heterogeneous peer effects

Model (3) does not allow us to identify peer effects for different groups of pupils. That is, we cannot distinguish the effect of more minority peers for pupils that are in the minority groups we consider and pupils that are not in these groups. However, as these two groups conceptually differ in one characteristic that is related to educational attainment, it could be argued that those groups are differently affected by peer effects. For example, pupils with a non-Western background are negatively affected by an increase in the proportion of non-Western peers in the class, whereas pupils with another migration background are positively affected by the same increase. When those effects are such that they cancel out each other, we cannot observe those effects when estimating equation (3). Such insights can be used to distribute pupils in classes in such a way that negative peer effects within classes are minimized. With that, it helps to more effectively counteract differences in educational opportunities that result from peer effects. Hence, we will also estimate a model that can measure possible heterogeneous peer effects. This model is given by the following equation:

$$\begin{aligned} y_{ics} = \alpha &+ \beta_1 PNW_{ics} + \beta_2 NW_{ics} * PNW_{ics} + \beta_3 PLW_{ics} + \beta_4 LW_{ics} * PLW_{ics} \\ &+ \beta_5 PLE_{ics} + \beta_6 LE_{ics} * PLE_{ics} + C_{ics}\boldsymbol{\gamma}' + T_s\boldsymbol{\delta}' + S_c\boldsymbol{\zeta}' + \varepsilon_{ics}, \end{aligned} \quad (4)$$

where y_{ics} is either a pupil's level of education in the third class of secondary school, its first teacher advice or its test advice. Moreover, PNW_{ics}, PLW_{ics}, PLE_{ics}, C_{ics}, T_s, S_c, ε_{ics} are the same as in equation (3). The variables NW, LW and LE are dummy variables

indicating respectively whether a pupil has a non-Western migration background, whether the parents of a pupil have wealth in the lowest two quintiles, and whether the parents of a pupil obtained at most primary or lower secondary education.

5.4 Validity assessment

The key identifying assumption of our research is that the factors that change the proportions of peers of interest are uncorrelated with unobserved factors affecting pupils' educational attainment. To assess the validity of this assumption, we perform a set of balancing tests, inspired by Lavy and Schlosser (2011) and Brenoe and Zölitz (in press).

The first balancing test checks whether our three proportions of peers are related to changes in the background characteristics of pupils. The checks are performed by regressing either one of the proportions of peers on background characteristics, cohort fixed effects, and school fixed effects. Since we run a large number of regressions, some estimates may be significant due to chance. This means that, even when the peer characteristics are not correlated with pupil's background characteristics, we expect 1 percent of the coefficients to be statistically significant at the 1 percent level, 5 percent of the coefficients at the 5 percent level and 10 percent of the coefficients at the 10 percent level (Brenoe & Zölitz, in press).

The results are presented in the first column of Tables A.6, A.7, and A.8 in the Appendix. We observe that the proportion of peers with a non-Western background is related to some of the background characteristics. A similar result is found for the other two proportions. Although these correlations are small, the number of correlations is more than we would expect based on a random selection of pupils in schools. Also, the correlations appear for the variables directly related to the peer proportions. That is, we find a correlation between the proportion of non-Western peers and the different migration backgrounds.

To overcome this problem, we propose a solution. The solution is adding the mean of the proportions of peers over all years within a school. This method was initiated by Guryan, Kroft, and Notowidigdo (2009), who state that the balancing test as proposed above might give misleading results. He states that this arises from the fact that the individual himself cannot be assigned to his own peer group. What happens, in the case of ability grouping, is that the peer group of a pupil with high ability is based on pupils with an average ability that is slightly lower. The reverse holds for pupils with low ability. The problem is larger when peer groups are small. In our context, a similar problem could arise. The solution they propose is to control for this difference in mean, by adding the mean of the variable of interest of the overarching peer group. The results of the validity checks executed with this solution can be found in the second column of Tables A.6, A.7, and A.8. When comparing the first and second column in the tables we observe a slight decrease in the number of significant correlations. More importantly, the correlations appear not in the variables directly related to the peer proportions. Based on these results we consider the selection of pupils into primary schools as good as random, and not driven by individual and household characteristics, conditional on school fixed effects, cohort fixed effects, and peer proportions at the school level.

Our second balancing test checks whether the proportions of peers are autocorrelated over time. That is, we regress the proportion of peers of interest in time t on the same proportion of peers in time $t-1$, conditional on cohort fixed effects and school fixed effects. This regression is performed separately for each school. Table A.9 in the Appendix summarizes the results of these regressions. The table reports the share of schools for which

the proportion of peers with a non-Western background, with parents with low wealth and with low-educated parents are autocorrelated. Table A.9 shows that the shares for all three proportions are lower than what we would expect when there is no autocorrelation. Hence, we find no evidence that the three proportion of peers we study are autocorrelated over time.

As a last randomization check, we show the year-to-year variation in the proportions of peers within schools. We compare this with the normal distribution. The results are presented in Figure 5, 6, and 7 in the Appendix. The variations are calculated by computing the residuals from the regression of the proportion of peers at the school-cohort level on school fixed effects and cohort fixed effects. The figures show support for our assumption that the sorting of pupils into schools is random, conditional on the included controls.

Summarizing the above, the three balancing tests provide evidence in favor of our identifying assumption. Tables A.6 until A.9, and Figures 5, 6 and 7 give reassuring results that prove that there is random sorting of pupils into primary schools conditional school fixed effects, cohort fixed effects, and peer proportions at the school level.

6 Results

Our results show that small and, in general, negative peer effects are present on educational attainment in primary school and that these effects persist in secondary school. Moreover, peer effects are different across distinct groups of pupils. This chapter elaborates on these findings. We start by discussing the overall effect of peers on school attainment.

6.1 Peer effects on primary school attainment

Table A.10 in the Appendix reports the results of how the proportions of peers based on migration background, parents' wealth, and parental education level affect the first teacher advice. In each column, a different set of control variables is used. Column (1) includes no control variables, column (2) includes school and cohort fixed effects, column (3) controls for school and cohort fixed effects as well as for individual, parents' and household characteristics and column (4) controls for school and cohort fixed effects, individual, parents' and household characteristics, and peer proportions at the school level. The table shows the estimated coefficients for different dependent variables.

The estimates in column (1) are added as a benchmark for comparison. From column (2) we observe that both the magnitude and sign of the coefficients change drastically when adding school and cohort fixed effect, for all dependent variables. This result shows that there are indeed unobserved factors that affect the peer proportions in primary school. Hence, it provides evidence for the design of this study and stresses the importance of controlling for school and cohort fixed effects. In column (3) we also control for individual, parents' and household characteristics. The results of the balancing tests show that some of these characteristics are possibly driving the selection of pupils into primary schools. Comparing the estimates in column (2) and (3) we observe that the magnitude of the coefficients somewhat changes, but that the signs of most estimates do not change when adding pupil's background characteristics. The estimates that change their sign were almost zero and not significant in column (2). Although the selection of pupils into primary schools seems not to be related to pupil's characteristics, we proposed a solution that could eliminate this problem. We add peer proportions at the school level to our model. The estimation

results are presented in column (4). Comparing column (3) and (4), we observe a minor change in the estimates. The results in columns (2), (3), and (4) indicate that pupil's characteristics are not affecting random sorting of pupils into primary schools. Hence, we can interpret our estimates in a causal way.

When interpreting the results, we focus on column (4), as this column includes the most complete set of control variables. Table A.10 shows that there is a negative relation between each one of the proportions of peers and the probability of obtaining a first teacher advice that is higher than the lowest possible advice. This means that when a pupil is exposed to a higher proportion of peers in the non-Western, low-wealth, or low-education group in its school, the probability of obtaining a higher teacher advice is lower for this pupil. Not all our estimates are significant, however. Taking a more profound look, we observe a small influence of the different peer proportions on obtaining different levels of advice. We find that a 10 percentage point increase in the proportion of low-wealth peers decreases the probability of getting HAVO or VWO advice by 0.53 percentage points, ceteris paribus. This means that in a class with 20 pupils, when the amount of pupils with parents with low wealth increases by two, the probability of obtaining at least HAVO advice decreases by this amount. The same proportion does not influence the probabilities of obtaining a lower advice. Moreover, the effect disappears for the group of pupils obtaining VWO as advice. As by the design of our model the dependent variables are related, this result indicates that the proportion of peers in the low-wealth group mainly has a negative influence on the probability of obtaining the HAVO track. We find no other peer effects that influence the probability of obtaining one of the higher tracks, i.e. HAVO or VWO. When the proportion of non-Western peers increases by 10 percentage points, we find a decrease of 0.52 percentage points in the probability of getting a VMBO-GT or higher advice, holding all other factors constant. Moreover, a 10 percentage point increase in the proportion of peers with low-educated parents decreases the probability of getting VMBO-K or higher advice by 0.73 percentage points, ceteris paribus. These two results vanish for a higher advice. This could imply that the proportion of non-Western peers only affects pupils' chance of obtaining VMBO-GT advice, compared to a lower advice, and that the proportion of peers with low-educated parents only affects pupils' chance of obtaining VMBO-K advice, compared to the lowest advice, i.e. VMBO-B.

We next interpret the estimation results in Table A.11. A similar pattern regarding the changes in coefficients of column (1) until (4) is observed as in Table A.10. We again interpret the estimates of column (4). The estimates of -0.080 and -0.089 show that an increase in the proportion of low-wealth peers decreases the probability of obtaining VWO or at least HAVO as test advice, holding all other factors equal. We observe a lower standard error for the coefficient estimating the effect on obtaining the VWO track. This indicates that pupils with VWO test advice, which is the highest advice possible, are more affected by low-wealth peers. We also observe that an increase in the same proportion decreases the probability of obtaining VMBO-K or higher test advice. This result shows that an increase in the proportion of peers in the low-wealth group negatively influences the chance of obtaining, VWO, HAVO, or VMBO-K as test advice, but that pupils with VMBO-GT advice are not affected. This result is surprising as we expect the higher levels of education to be more affected than the lower levels. Again, the estimated effects are small. To place the results in perspective, we know that 16% of our sample has a VWO test advice. Hence, the absolute decrease of 0.080 percentage points in the chance of obtaining the VWO test advice corresponds to a relative decrease in the group of pupils with a VWO test advice of 5%, which is minor. We also find that the proportion of peers with low-educated parents

decreases the probability of obtaining VMBO-GT advice. We observe that a 10 percentage point increase in this peer proportion decreases the probability of obtaining at least VMBO-GT as test advice by 0.72 percentage points, ceteris paribus. This result is not significant for the other levels of the test advice. An interesting result is observed for the proportion of non-Western peers. This proportion does not decrease the probability of obtaining a specific advice. Instead, it increases the probability of obtaining the highest test advice, when all other factors are held constant. Thus, pupils with more non-Western peers in the class have an increased chance of obtaining VWO test advice.

Important to note is that peer effects on the higher levels of the test advice will be earlier apparent than peer effects on the lower levels of the test advice. This stems from the way the score on the exit test is converted into advice. Each score corresponds to an advice, but the range of scores that lead to a lower test advice is larger. This means that when the score of the test advice decreases, on average, by one point due to peer effects, more pupils with a VWO advice change to a HAVO advice compared to for example the number of pupils that change from a VMBO-GT to VMBO-K advice.

All in all, the results in Tables A.10 and A.11 show that, although small, peer effects are existing in primary school. These effects are, in general, negative, as we expected. However, the results do not show an unambiguous effect throughout the different levels of the outcome variables. Since the dependent variables are related, this means that only part of the pupils in the sample is affected by an increase in the different peer proportions. For example, mostly the pupils with a high advice are negatively influenced by the proportion of low-wealth peers, whereas pupils with a relatively low advice are harmed by the proportion of non-Western peers and peers with low-educated parents.

6.2 Peer effects on secondary school attainment

Now that we have observed peer effects on primary school achievement, we are wondering whether these peer effects persist in secondary school. Therefore, we next discuss the results of the effects of peer proportions on obtaining distinct levels of education in the third class of secondary school, as given in Table A.12. The table sketches a similar picture as Tables A.10 and A.11; the sign and magnitude of the coefficients change when adding school and cohort fixed effects. When adding individual controls, there are small changes in the coefficients and there are switches in signs only for small and insignificant estimates. The estimation results in columns (3) and (4) are almost identical. This again provides support for our key identifying assumption that pupils randomly select into primary schools, conditional on school fixed effects, cohort fixed effects, and peer proportions at the school level.

The fourth column of Table A.12 shows that, in general, there is a negative relation between the proportions of peers and the probability of obtaining a higher school level in secondary school. We observe that the low-wealth proportion negatively influences the probability of obtaining the higher levels of education, i.e. HAVO or VWO. In contrast, the proportions of non-Western and low-education peers negatively influence the probability of obtaining the lower levels of education, i.e. VMBO-GT or VMBO-K. We find that a 10 percentage point increase in the proportion of low-wealth peers decreases the probability of being in the VWO track, compared to being in a lower track with 0.63 percentage points, ceteris paribus. This corresponds to a relative decrease in the group of pupils in the VWO track in the third class of secondary school of 2.9%. Moreover, an equal increase lowers the probability of being in the HAVO or VWO track, compared to being in a lower track, with 0.69 percentage points, holding all other factors constant. Similar to the result for the test

advice, we observe an increase in the standard error for the coefficient when pupils that are in the HAVO track are also included in the dependent variable. This might imply that pupils in the VWO track are more affected by an increase in the proportion of low-wealth peers than pupils in the HAVO track. We also find that a 10 percentage point increase in the proportion of non-Western peers decreases the probability of being in VMBO-GT or a higher track with 0.52 percentage points and being in VMBO-K or a higher track with 0.35 percentage points, ceteris paribus. The effect is stronger for pupils that are at least in the VMBO-GT track. The influence of peers with low educated parents on the levels of education varies. On the one hand, the results show that an increase in the peer proportion by 10 percentage points leads to an increase in the probability of obtaining the VWO track, of 0.23 percentage points, when all other factors are held constant. On the other hand, a 10 percentage point in the same proportion leads to a 0.57 percentage point decrease in the chance of obtaining at least VMBO-K, ceteris paribus. Thus, when pupils are exposed to more non-Western peers in primary school, they have a slightly higher chance of being in the VWO track after three years in secondary school and a slightly lower chance of being in the VMBO-K track.

In sum, small peer effects exist in secondary school. Just as for the peer effects on primary school attainment, the effects are in general negative and not present across all dependent variables. This indicates that not all pupils are affected by higher proportions of disadvantaged peers in the class. The results on primary and secondary school attainment sketch a similar picture. They point out that the probability of obtaining higher levels of education, either in secondary school or by means of an advice in primary school, is negatively influenced by the proportion of peers with parents with low wealth. In addition, non-Western peers and peers with low-educated parents negatively influence the chance of obtaining the lower school levels. The similarities in the results indicate that peer effects exist in primary school and that they persist in secondary school.

6.3 Heterogeneity

Even though Tables A.10, A.11, and A.12 provide relevant insights into the effect of peer proportions on educational attainment, we are not able to observe whether these effects vary across groups of pupils. It could be that pupils in different groups have opposite effects that cancel each other out. In that case, we lose information, which is undesirable. Moreover, an analysis of heterogeneous peer effects enables a deeper understanding of which pupils are affected by changes in peer compositions. Such information can be used as input for a directed approach in reducing negative peer effects.

Tables A.13, A.14, and A.15 in the Appendix show us the heterogeneity of peer effects on respectively the first teacher advice, the test advice, and the education level in the third class of secondary school. The models control for school and cohort fixed effects, individual controls, and school peer proportions. Columns (1) until (4) present the regression results of the different indicator variables. All tables show convincing results that pupils with a non-Western migration background, pupils wit parents with low wealth, and pupils with low-educated parents have lower chances of obtaining one of the tracks higher than VMBO-B, compared to pupils not in these groups.

Table A.13 shows that an increase in the peer proportion of non-Western pupils only affects the first teacher advice of non-Western pupils. We find that non-Western pupils, compared to other pupils, have a lower chance of obtaining at least HAVO advice, ceteris paribus. As the effect is not visible for other advice and the dependent variables are re-

lated, the result indicates that an increase in the proportion of non-Western peers only affects non-Western peers with HAVO advice. Moreover, pupils in the low-wealth group, compared to pupils not in this group, have a lower probability of obtaining VMBO-K or higher advice, when all other factors are held constant. Similarly, pupils with parents having low-educated parents have lower probabilities of obtaining VMBO-K or higher advice and obtaining VMBO-GT or higher advice. Although we also find that a higher proportion of peers in the low-wealth group decreases the chance of obtaining VWO or at least HAVO advice, we do not find a difference in this result for different groups of pupils. In sum, the results show that the negative influences of peer effects on the first teacher advice are larger for disadvantaged pupils.

Table A.14 shows the heterogeneity of peer effects on the test advice. We find that when the proportion of non-Western peers increases, the probability of obtaining a VWO test advice increases. This result does not depend on a pupil's migration background. However, the probability of obtaining at least HAVO test advice is lower for non-Western pupils compared to pupils not in this group. Additionally, the probability of obtaining VMBO-GT or higher advice or VMBO-K or higher advice is higher for non-Western pupils, when all other factors are held constant. This result indicates that when the proportion of non-Western peers in primary school increases, non-Western pupils, compared to pupils with other migration backgrounds, have as much chance to obtain VWO advice, less chance to obtain HAVO advice and more chance to obtain VMBO-GT or VMBO-K advice. Just as in Table A.13 we observe a negative effect of the proportion of low-wealth peers on obtaining VWO advice or at least HAVO test advice that does not vary across groups of pupils. Nevertheless, we find that the probability of obtaining the two lower levels of advice is lower for pupils in the low-wealth group, compared to pupils not in this group. This same result is observed for pupils that have low-educated parents, compared to pupils not in this group. Overall, we observe that negative peer influences on the test advice are lower for non-Western pupils than for other pupils and higher for pupils in the low-wealth and low-education group, compared to pupils not in these groups.

Lastly, we observe the behavior of peer effects in different groups on the track in secondary school. From Table A.15 we observe that an increase in the proportion of non-Western peers results in a decrease in the probability of obtaining at least the HAVO, VMBO-GT, or VMBO-K track in the third class of secondary school, when all other factors are held constant. For two of these outcome variables, this effect is different for non-Western pupils and pupils with another background. For non-Western pupils, a 10 percentage point increase in the proportion of non-Western peers in the school leads to a 0.52 percentage point decrease in the probability of obtaining HAVO or a higher track, whereas for pupils without this migration background there is a decrease of 0.66 percentage points, ceteris paribus. Similarly, the decrease in the probability of obtaining VMBO-GT or a higher track is smaller for non-Western pupils than for all other pupils. No heterogeneity is found for the effect of non-Western peers on obtaining VMBO-K or a higher track. Looking at the effect of low-wealth peers on educational attainment in secondary school, we find no heterogeneous peer effects. Both pupils in the low-wealth group and pupils not in this group have a lower chance of obtaining VWO or at least HAVO in the third class of secondary school when the proportion of low-wealth peers in the class increases. This result appears to be stronger for pupils in the VWO track than pupils in the HAVO track. For pupils with and without low-educated parents, we observe a difference in obtaining at least the VMBO-GT and VMBO-K track, compared to a lower track. We observe that pupils with low-educated parents, compared to pupils not in this group, are less likely to be at least in one of those

tracks in the third class when the proportion of peers with low-educated parents increases. For example, a 10 percentage point increase in the proportion of low-educated peers leads to a 0.88 percentage point higher decrease in the probability of obtaining VMBO-K or a higher track for pupils that are in the low-education group compared to pupils not in this group, holding all other factors constant. Finally, both pupils with and without low-educated parents have a higher chance of being in the VWO track when the proportion of peers with low-educated parents in the class increases.

In summary, the level of education in the third class of secondary school for non-Western pupils, compared to pupils with other migration backgrounds, is less affected by having more non-Western peers in primary school. In addition, regarding pupils with low-educated parents, the negative effects of having more peers with low-educated parents in the school are larger for this group, compared to pupils not having low-educated parents. No difference in the influence of having more peers with parents with low wealth is found for pupils with and without parents with low wealth.

The insights of Tables A.13, A.14, and A.15, point out that small heterogeneous peer effects exist across all outcomes variables. The results indicate that non-Western pupils are most often better off than pupils with other migration backgrounds when the proportion of non-Western peers in the class increases. Those pupils have more chance to obtain higher than minimum levels of education in secondary school and on the test advice. In contrast, regarding pupils and peers in the low-wealth or low-education group, we find that those pupils are more harmed by the negative peer effects compared to pupils not in these groups. We also observe that the heterogeneous peer effects are similar across the outcome variables. This again indicates that the peer effects that are present in primary school are still present in the third class of secondary school.

7 Discussion and conclusion

This paper investigates whether peer effects regarding migration background, wealth, and parental education influence a pupil's educational attainment in primary and secondary school. Using administrative data on Dutch pupils in the ten largest cities in the Netherlands, we have identified peer effects on the first teacher advice, test advice, and the level of education in the third class of secondary school. In addition, we give insight into the heterogeneity of those peer effects across groups of pupils.

This paper provides evidence for the existence of small primary school peer effects on the first teacher advice, test advice, and level of education in the third class of secondary school. We find that an increase in the proportion of pupils with parents with low wealth or low education, in general, negatively affects a pupil's educational attainment in primary and secondary school. These results are consistent with those of Sykes and Musterd (2011), Sykes and Kuyper (2013), and Palardy (2013) who show that high socioeconomic compositions of students in schools positively affect student's educational attainment and that low socioeconomic compositions negatively affect educational attainment. We find both positive and negative influences of the proportion of non-Western pupils on a pupil's educational attainment. Just as in the literature, this result is ambiguous. Billings et al. (2014) and Palardy (2013) show that a higher proportion of minority peers in the school has a negative effect on a pupil's educational achievement. In contrast, Fekjær and Birkelund (2007) point out that ethnic minority students are more motivated. As a result, a high proportion of those peers could positively influence a pupil's educational attainment.

The research also shows that peer effects are heterogeneous. We find that, in general, non-Western pupils are less harmed by negative peer effects due to an increase in the proportion of non-Western peers in the class, compared to pupils with another migration background. Their test advice is positively influenced by an increase in the non-Western peer proportion and the negative effects on their obtained track in secondary school are smaller. However, both pupils with parents with low wealth and pupils with low-educated parents, compared to pupils not in these groups, are more harmed by peer influences due to an increase in the proportion of those peers in the school. The negative effects on educational attainment are larger for those pupils. We also find that the peer effects that we observe in secondary school are for the greater part similar to the peer effects found in primary school. This indicates that the peer effects on primary school attainment are lasting at least until three years after leaving primary school. Hence, to reduce the negative effects of segregation on educational attainment, the focus should be on reducing peer effects on the first teacher and test advice in primary school.

Our research shows that not all pupils are affected by an increase in one of the peer proportions of interest. For example, we demonstrate that the proportion of low-wealth peers negatively influences the pupils that obtain one of the higher levels of education, whereas the proportion of peers with low-educated parents negatively influences the pupils that obtain one of the lower levels of education. Still, in light of the government's goal to provide equal educational opportunities for all pupils, any kind of negative peer effects is undesirable. This is because the results might stem from teachers that underestimate the possibilities of their pupils, a phenomenon explained by Kristen (2002). Another reason could be that teachers are not able to differentiate between different kinds of pupils and cannot challenge their higher-achieving pupils. By the design of the Dutch educational system, the negative effects of obtaining a lower teacher or test advice can continue through secondary school and the possibilities of following tertiary education afterward, long in life.

Even though we provide interesting insights into the existence of peer effects in primary and secondary school attainment, we are aware of the fact that there could be multicollinearity in our model. This could arise from the inclusion of three main predictors in our specification that could be correlated with each other. Multicollinearity has some undesirable effects. It could result in imprecise estimates for the variables that are correlated. This is because changes in one independent variable are associated with changes in another independent variable, which makes the determination of the effect of a one unit change in one of the independent variables difficult. Furthermore, the standard errors of the affected coefficients are unreliable and generally too large. This makes it harder to reject the null hypothesis of no effect of the variable of interest. For our research, this means that in case of multicollinearity our estimates of the peer proportions could be unreliable and the effects of peers could be underestimated.

By the design of the study, our research also faces some limitations. First, our sample limits the conclusions that we can draw to relatively small schools as we only included schools that had a maximum of 35 final grade pupils. If we are able to distinguish between multiple classes in the same grade, we could have included more schools in our research and our results could be generalized. This will also allow us to obtain a completely balanced sample of schools, which makes it possible to more accurately estimate school fixed effects. Another limitation is that we only include schools that used the most common exit test (CITO), because the results of different exit tests are not comparable. From school year 2019/2020, all exit tests must be constructed in such a way that the results across different tests can be compared. When repeating this research with a sample of pupils that were in

the eighth grade in school year 2019/2020 or later, one would not be limited to selecting one exit test. As the market share of alternative exit tests is continuously increasing, this is especially useful.

With this study, we provide additional insights to the literature on peer effects in the school context by showing that peer effects in primary school have lasting effects in secondary school. We show that segregation in primary school, through peer effects, contributes to the between-track segregation in secondary school. Although our estimation results are small, this research signals an undesirable trend and stresses the importance of reducing peer influences in primary school. This can help in counteracting differences in educational opportunities between different groups of pupils, and with that prevent a decrease in the quality of education. As the negative peer effects are largest for pupils with parents with low wealth and with low-educated parents, municipalities should focus on distributing these pupils as evenly as possible over classes and schools, when they want to stimulate equal opportunities in education.

Our results are also a good starting point for further research. First of all, it would be interesting to extend our findings by investigating samples that also include pupils from large schools. Moreover, one could generate the results by estimating an ordered logit model. Instead of multiple estimates of the peer effects on different (ordered) levels of education, this model gives one overall result of the effect of peers, which might be useful. Our results show that primary school segregation, through peer effects, contributes to school segregation in secondary school. Therefore, it might be interesting to deepen our knowledge about how primary school segregation exist. A suggestion is to study the sorting of pupils into schools and the extent to which pupils with specific characteristics switch schools during primary school. Lastly, based on our findings, we are wondering how primary school peer effects develop in the long run. One idea could be to study whether the primary school peer composition also affects a pupil's highest level of obtained education.

References

Ball, S. J. (2003). *Class strategies and the education market: The middle classes and social advantage*. London: RouteledgeFalmer.

Billings, S. B., Deming, D. J., & Rockoff, J. (2014). School segregation, educational attainment, and crime: Evidence from the end of busing in Charlotte-Mecklenburg. *The Quarterly Journal of Economics*, *129*(1), 435–476.

Blake, J. (1981). Family size and the quality of children. *Demography*, *18*(4), 421–442.

Böhlmark, A., Holmlund, H., & Lindahl, M. (2016). Parental choice, neighbourhood segregation or cream skimming? An analysis of school segregation after a generalized choice reform. *Journal of Population Economics*, *29*(4), 1155–1190.

Booij, A. S., Leuven, E., & Oosterbeek, H. (2017). Ability peer effects in university: Evidence from a randomized experiment. *The review of economic studies*, *84*(2), 547–578.

Boterman, W. R. (2018). School segregation in the free school choice context of Dutch cities. *Understanding School Segregation: Patterns, Causes and Consequences of Spatial Inequalities in Education. London: Bloomsbury*, 155–178.

Boterman, W. R. (2019). The role of geography in school segregation in the free parental choice context of Dutch cities. *Urban Studies*, *56*(15), 3074–3094.

Bouchard, T. J., & McGue, M. (1981). Familial studies of intelligence: A review. *Science*, *212*(4498), 1055–1059.

Brenoe, A. A., & Zölitz, U. (in press). Exposure to more female peers widens the gender gap in STEM participation. *Journal of Labor Economics*.

Burgess, S., Greaves, E., Vignoles, A., & Wilson, D. (2011). Parental choice of primary school in England: what types of school do different types of family really have available to them? *Policy Studies*, *32*(5), 531–547.

Burgess, S., Greaves, E., Vignoles, A., & Wilson, D. (2015). What parents want: School preferences and school choice. *The Economic Journal*, *125*(587), 1262–1289.

CBS. (2020). *Bevolking; geslacht, leeftijd, nationaliteit en regio, 1 januari.* Retrieved from `https://opendata.cbs.nl/#/CBS/nl/dataset/84727NED/table?dl=35E8A`.

Clark, W., Dieleman, F., & De Klerk, L. (1992). School segregation: managed integration or free choice? *Environment and Planning C: Government and Policy*, *10*(1), 91–103.

Dijkstra, A. B., Jungbluth, P., & Ruiter, S. (2001). Verzuiling, sociale klasse en etniciteit. segregatie in het nederlandse basisonderwijs. *Sociale Wetenschappen*, *44*(4), 24–48.

Dronkers, J. (2014). *Sociale herkomst en kwaliteit van vo scholen.* Retrieved from `https://www.vosabb.nl/wp-content/uploads/2014/12/Schoolprestaties-2014-scholen.pdf`

Elffers, L., Van de Werfhorst, H., & Fischer, M. (2015). De invloed van het verkorten van de heterogene brugperiode op leerprestaties, burgerschap en motivatie: een quasi-experimentele case study. *Pedagogische Studiën*, *92*(6), 413–433.

Fekjær, S. N., & Birkelund, G. E. (2007). Does the ethnic composition of upper secondary schools influence educational achievement and attainment? A multilevel analysis of the Norwegian case. *European Sociological Review*, *23*(3), 309–323.

Feld, J., & Zölitz, U. (2017). Understanding peer effects: On the nature, estimation, and channels of peer effects. *Journal of Labor Economics*, *35*(2), 387–428.

Frankenberg, E. (2013). The role of residential segregation in contemporary school segregation. *Education and Urban Society*, *45*(5), 548–570.

Gibbons, S., & Telhaj, S. (2016). Peer effects: Evidence from secondary school transition in England. *Oxford Bulletin of Economics and Statistics*, *78*(4), 548–575.

Graham, B. S. (2018). Identifying and estimating neighborhood effects. *Journal of Economic Literature*, *56*(2), 450–500.

Gramberg, P. (1998). School segregation: The case of Amsterdam. *Urban Studies*, *35*(3), 547–564.

Guryan, J., Kroft, K., & Notowidigdo, M. J. (2009). Peer effects in the workplace: Evidence from random groupings in professional golf tournaments. *American Economic Journal: Applied Economics*, *1*(4), 34–68.

Hill, M. S., & Duncan, G. J. (1987). Parental family income and the socioeconomic attainment of children. *Social Science Research*, *16*, 39–73.

Inspectie van het Onderwijs. (2018). *De staat van het onderwijs 2016/2017.* Retrieved from `https://www.onderwijsinspectie.nl/documenten/rapporten/2018/04/11/rapport-de-staat-van-het-onderwijs`.

Jeynes, W. H. (2005). Effects of parental involvement and family structure on the academic achievement of adolescents. *Marriage & Family Review*, *37*(3), 99–116.

Karsten, S., Felix, C., Ledoux, G., Meijnen, W., Roeleveld, J., & Van Schooten, E. (2006). Choosing segregation or integration? The extent and effects of ethnic segregation in dutch cities. *Education and Urban Society*, *38*(2), 228–247.

Karsten, S., Ledoux, G., Roeleveld, J., Felix, C., & Elshof, D. (2003). School choice and ethnic segregation. *Educational policy*, *17*(4), 452–477.

Kristen, C. (2002). Hauptschule, realschule oder gymnasium? *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, *54*(3), 534–552.

Kristen, C. (2003). *School choice and ethnic school segregation: Primary school selection in Germany.* Waxmann Verlag.

Ladd, H. F., Fiske, E. B., & Ruijs, N. (2009). Parental choice in the netherlands: Growing concerns about segregation. In *National conference on school choice, vanderbilt university.*

Lavy, V., & Schlosser, A. (2011). Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics*, *3*(2), 1–33.

Orfield, G., & Eaton, S. E. (1996). *Dismantling desegregation. The quiet reversal of brown v. board of education.* ERIC.

Palardy, G. J. (2013). High school socioeconomic segregation and student attainment. *American Educational Research Journal*, *50*(4), 714–754.

Ryan, A. M. (2000). Peer groups as a context for the socialization of adolescents' motivation, engagement, and achievement in school. *Educational Psychologist*, *35*(2), 101–111.

Southworth, S. (2010). Examining the effects of school composition on North Carolina student achievement over time. *Education Policy Analysis Archives*, *18*(29), 1–45.

Sykes, B., & Kuyper, H. (2013). School segregation and the secondary-school achievements of youth in the Netherlands. *Journal of Ethnic and Migration Studies*, *39*(10), 1699–1716.

Sykes, B., & Musterd, S. (2011). Examining neighbourhood and school effects simultaneously: what does the Dutch evidence show? *Urban Studies*, *48*(7), 1307–1331.

Taylor, C., & Gorard, S. (2001). The role of residence in school segregation: Placing the impact of parental choice in perspective. *Environment and Planning A*, *33*(10), 1829–1852.

Van de Werfhorst, H. G. (2018). Early tracking and socioeconomic inequality in academic achievement: Studying reforms in nine countries. *Research in Social Stratification and*

Mobility, *58*, 22–32.

Van Ewijk, R., & Sleegers, P. (2010). The effect of peer socioeconomic status on student achievement: A meta-analysis. *Educational Research Review*, *5*(2), 134–150.

Willms, J. D. (2010). School composition and contextual effects on student outcomes. *Teachers College Record*, *112*(4), 1008–1037.

A Appendices

A.1 Background information

Table A.1: Dutch cities with population size on January 1, 2019.

City	Population size
Amsterdam	862 965
Rotterdam	644 618
Den Haag	537 833
Utrecht	352 866
Eindhoven	231 642
Groningen	231 299
Tilburg	217 259
Almere	207 904
Breda	183 873
Nijmegen	176 731

Source: CBS (2020)

Table A.2: Classification of school levels.

Classification in analysis	Original classification
VWO	VWO
HAVO	HAVO
VMBO-GT	VMBO-Gemengd and VMBO-Theoretisch
VMBO-K	VMBO-Kader
VMBO-B	VMBO-Basis

A.2 Descriptive statistics

Table A.3: Descriptive statistics I

	Total			Not non-Western			non-Western		
Variable	N	mean	sd	N	mean	sd	N	mean	sd
Male	38667	0.488	0.500	18816	0.491	0.500	19829	0.486	0.500
Age	38667	11.133	0.527	18816	11.076	0.512	19829	11.187	0.535
Migration background									
Dutch	38667	0.402	0.490	18816	0.826	0.379	19829	0.000	0.000
Western	38667	0.085	0.278	18816	0.174	0.379	19829	0.000	0.000
non-Western	38667	0.513	0.500	18816	0.000	0.000	19829	1.000	0.000
Unknown	38667	0.001	0.024	18816	0.000	0.000	19829	0.000	0.000
Generation									
None	38667	0.303	0.459	18816	0.622	0.485	19829	0.000	0.000
1st	38667	0.048	0.215	18816	0.038	0.191	19829	0.058	0.234
2nd	38667	0.549	0.498	18816	0.136	0.343	19829	0.942	0.234
3rd	38667	0.099	0.299	18816	0.204	0.403	19829	0.000	0.000
Unknown	38667	0.001	0.024	18816	0.000	0.000	19829	0.000	0.000
Parental structure (living with:)									
Legal parents	38667	0.666	0.472	18816	0.683	0.465	19829	0.650	0.477
Legal mother	38667	0.248	0.432	18816	0.213	0.409	19829	0.281	0.450
Legal father	38667	0.021	0.144	18816	0.026	0.160	19829	0.016	0.126
Legal mother and partner	38667	0.048	0.213	18816	0.061	0.240	19829	0.035	0.184
Legal father and partner	38667	0.007	0.083	18816	0.008	0.087	19829	0.006	0.078
Other household	38667	0.009	0.094	18816	0.008	0.089	19829	0.010	0.099
Institutional household	38667	0.000	0.005	18816	0.000	0.007	19829	0.000	0.000
Unknown	38667	0.001	0.038	18816	0.001	0.023	19829	0.001	0.035
Children									
0	38667	0.009	0.093	18816	0.008	0.091	19829	0.009	0.095
1	38667	0.150	0.357	18816	0.194	0.395	19829	0.108	0.310
2	38667	0.417	0.493	18816	0.512	0.500	19829	0.326	0.469
3	38667	0.267	0.442	18816	0.222	0.415	19829	0.310	0.462
4 and more	38667	0.157	0.364	18816	0.063	0.243	19829	0.246	0.431
Unknown	38667	0.001	0.038	18816	0.001	0.023	19829	0.001	0.035
Parental education									
Primary education	38667	0.139	0.346	18816	0.036	0.187	19829	0.236	0.425
Lower secondary education	38667	0.114	0.318	18816	0.076	0.265	19829	0.151	0.358
Higher secondary education	38667	0.257	0.437	18816	0.236	0.425	19829	0.277	0.448
Bachelor degree	38667	0.124	0.330	18816	0.171	0.376	19829	0.080	0.271
Master degree	38667	0.151	0.358	18816	0.255	0.436	19829	0.053	0.224
Unknown	38667	0.215	0.411	18816	0.225	0.418	19829	0.204	0.403
Wealth									
1st quintile	38667	0.039	0.193	18816	0.030	0.170	19829	0.047	0.213
2nd quintile	38667	0.391	0.488	18816	0.242	0.428	19829	0.533	0.499
3rd quintile	38667	0.275	0.446	18816	0.263	0.440	19829	0.286	0.452
4rd quintile	38667	0.166	0.372	18816	0.244	0.430	19829	0.092	0.288
5th quintile	38667	0.112	0.315	18816	0.204	0.403	19829	0.024	0.152
Unknown	38667	0.018	0.132	18816	0.016	0.126	19829	0.018	0.132
Youth support									
None	38667	0.964	0.186	18816	0.958	0.200	19829	0.970	0.171
Without internal stay	38667	0.031	0.174	18816	0.038	0.190	19829	0.026	0.158
With internal stay	38667	0.004	0.067	18816	0.004	0.066	19829	0.005	0.068

Notes. The table reports the means and standard deviations of pupils' characteristics for the complete population, the group of non-Western pupils and the group of pupils with another migration background.

Table A.4: Descriptive statistics II

	Total			No low wealth			Low wealth		
Variable	N	mean	sd	N	mean	sd	N	mean	sd
Male	38667	0.488	0.500	21355	0.499	0.500	16630	0.475	0.499
Age	38667	11.133	0.527	21355	11.070	0.501	16630	11.207	0.544
Migration background									
Dutch	38667	0.402	0.490	21355	0.537	0.499	16630	0.232	0.422
Western	38667	0.085	0.278	21355	0.090	0.286	16630	0.076	0.265
non-Western	38667	0.513	0.500	21355	0.373	0.484	16630	0.692	0.462
Unknown	38667	0.001	0.024	21355	0.000	0.000	16630	0.000	0.000
Generation									
None	38667	0.303	0.459	21355	0.422	0.494	16630	0.154	0.361
1st	38667	0.048	0.215	21355	0.030	0.170	16630	0.066	0.249
2nd	38667	0.549	0.498	21355	0.433	0.495	16630	0.702	0.458
3rd	38667	0.099	0.299	21355	0.115	0.319	16630	0.078	0.269
Unknown	38667	0.001	0.024	21355	0.000	0.000	16630	0.000	0.000
Parental structure (living with:)									
Legal parents	38667	0.666	0.472	21355	0.813	0.390	16630	0.496	0.500
Legal mother	38667	0.248	0.432	21355	0.117	0.322	16630	0.419	0.493
Legal father	38667	0.021	0.144	21355	0.019	0.138	16630	0.024	0.152
Legal mother and partner	38667	0.048	0.213	21355	0.043	0.203	16630	0.055	0.227
Legal father and partner	38667	0.007	0.083	21355	0.007	0.085	16630	0.006	0.080
Other household	38667	0.009	0.094	21355	0.000	0.000	16630	0.000	0.000
Institutional household	38667	0.000	0.005	21355	0.000	0.000	16630	0.000	0.000
Unknown	38667	0.001	0.038	21355	0.000	0.000	16630	0.000	0.000
Children									
0	38667	0.009	0.093	21355	0.003	0.053	16630	0.002	0.045
1	38667	0.150	0.357	21355	0.128	0.334	16630	0.177	0.382
2	38667	0.417	0.493	21355	0.461	0.499	16630	0.369	0.482
3	38667	0.267	0.442	21355	0.270	0.444	16630	0.269	0.443
4 and more	38667	0.157	0.364	21355	0.138	0.345	16630	0.184	0.387
Unknown	38667	0.001	0.038	21355	0.000	0.000	16630	0.000	0.000
Parental education									
Primary education	38667	0.139	0.346	21355	0.077	0.266	16630	0.217	0.413
Lower secondary education	38667	0.114	0.318	21355	0.068	0.252	16630	0.173	0.378
Higher secondary education	38667	0.257	0.437	21355	0.217	0.413	16630	0.310	0.462
Bachelor degree	38667	0.124	0.330	21355	0.165	0.372	16630	0.074	0.262
Master degree	38667	0.151	0.358	21355	0.239	0.426	16630	0.043	0.203
Unknown	38667	0.215	0.411	21355	0.234	0.423	16630	0.183	0.386
Wealth									
1st quintile	38667	0.039	0.193	21355	0.000	0.000	16630	0.090	0.287
2nd quintile	38667	0.391	0.488	21355	0.000	0.000	16630	0.910	0.287
3rd quintile	38667	0.275	0.446	21355	0.498	0.500	16630	0.000	0.000
4rd quintile	38667	0.166	0.372	21355	0.300	0.458	16630	0.000	0.000
5th quintile	38667	0.112	0.315	21355	0.202	0.402	16630	0.000	0.000
Unknown	38667	0.018	0.132	21355	0.000	0.000	16630	0.000	0.000
Youth suppport									
None	38667	0.964	0.186	21355	0.968	0.176	16630	0.967	0.180
Without internal stay	38667	0.031	0.174	21355	0.032	0.175	16630	0.031	0.174
With internal stay	38667	0.004	0.067	21355	0.000	0.017	16630	0.002	0.046

Notes. The table gives the means and standard deviations of pupils' characteristics for the complete population, the group of pupils that has parents with low wealth and the group of pupils that does not have parents with low wealth. A parent has low wealth when the average of his income percentile and wealth percentile is equal or lower than 40, i.e. in the first two quintiles.

Table A.5: Descriptive statistics III

	Total			No low education			Low education		
Variable	N	mean	sd	N	mean	sd	N	mean	sd
Male	38667	0.488	0.500	20585	0.493	0.500	18082	0.482	0.500
Age	38667	11.133	0.527	20585	11.058	0.503	18082	11.219	0.541
Migration background									
Dutch	38667	0.402	0.490	20585	0.512	0.500	18082	0.277	0.448
Western	38667	0.085	0.278	20585	0.094	0.291	18082	0.074	0.263
non-Western	38667	0.513	0.500	20585	0.395	0.489	18082	0.647	0.478
Unknown	38667	0.001	0.024	20585	0.000	0.000	18082	0.001	0.035
Generation									
None	38667	0.303	0.459	20585	0.381	0.486	18082	0.214	0.410
1st	38667	0.048	0.215	20585	0.032	0.175	18082	0.067	0.251
2nd	38667	0.549	0.498	20585	0.457	0.498	18082	0.655	0.476
3rd	38667	0.099	0.299	20585	0.131	0.337	18082	0.063	0.243
Unknown	38667	0.001	0.024	20585	0.000	0.000	18082	0.001	0.035
Parental structure (living with:)									
Legal parents	38667	0.666	0.472	20585	0.670	0.470	18082	0.661	0.473
Legal mother	38667	0.248	0.432	20585	0.245	0.430	18082	0.252	0.434
Legal father	38667	0.021	0.144	20585	0.024	0.153	18082	0.018	0.132
Legal mother and partner	38667	0.048	0.213	20585	0.051	0.219	18082	0.045	0.206
Legal father and partner	38667	0.007	0.083	20585	0.006	0.080	18082	0.007	0.086
Other household	38667	0.009	0.094	20585	0.004	0.060	18082	0.015	0.122
Institutional household	38667	0.000	0.005	20585	0.000	0.007	18082	0.000	0.000
Unknown	38667	0.001	0.038	20585	0.000	0.016	18082	0.003	0.053
Children									
0	38667	0.009	0.093	20585	0.005	0.068	18082	0.013	0.115
1	38667	0.150	0.357	20585	0.159	0.366	18082	0.139	0.346
2	38667	0.417	0.493	20585	0.465	0.499	18082	0.361	0.480
3	38667	0.267	0.442	20585	0.266	0.442	18082	0.267	0.443
4 and more	38667	0.157	0.364	20585	0.105	0.306	18082	0.216	0.412
Unknown	38667	0.001	0.038	20585	0.000	0.016	18082	0.003	0.053
Parental education									
Primary education	38667	0.139	0.346	20585	0.000	0.000	18082	0.297	0.457
Lower secondary education	38667	0.114	0.318	20585	0.000	0.000	18082	0.244	0.430
Higher secondary education	38667	0.257	0.437	20585	0.483	0.500	18082	0.000	0.000
Bachelor degree	38667	0.124	0.330	20585	0.233	0.423	18082	0.000	0.000
Master degree	38667	0.151	0.358	20585	0.284	0.451	18082	0.000	0.000
Unknown	38667	0.215	0.411	20585	0.000	0.000	18082	0.459	0.498
Wealth									
1st quintile	38667	0.039	0.193	20585	0.039	0.193	18082	0.039	0.194
2nd quintile	38667	0.391	0.488	20585	0.306	0.461	18082	0.488	0.500
3rd quintile	38667	0.275	0.446	20585	0.284	0.451	18082	0.265	0.441
4rd quintile	38667	0.166	0.372	20585	0.201	0.401	18082	0.125	0.331
5th quintile	38667	0.112	0.315	20585	0.159	0.366	18082	0.057	0.232
Unknown	38667	0.018	0.132	20585	0.010	0.102	18082	0.026	0.158
Youth support									
None	38667	0.964	0.186	20585	0.961	0.195	18082	0.968	0.175
Without internal stay	38667	0.031	0.174	20585	0.036	0.187	18082	0.026	0.158
With internal stay	38667	0.004	0.067	20585	0.003	0.054	18082	0.006	0.079

Notes. The table reports the means and standard deviations of pupils' characteristics for the complete population, the group of pupils that have low-educated parents, and the group of pupils that do not have low-educated parents. A parent has low level of education when the highest level of obtained education is primary education or lower secondary education.

A.3 Balancing tests

Table A.6: Balancing test I: Correlation of the proportion of peers with a non-Western migration background with background characteristics.

	(1)		(2)	
Variable	Coefficient	SE	Coefficient	SE
Male	-0.00018	0.00063	-0.00017	0.00063
Age	-0.00053	0.00076	-0.00043	0.00074
Migration background				
Dutch	0.00264	0.00180	0	0.00194
Western	0.00269	0.00185	0.00111	0.00233
non-Western	-0.00403***	0.00159	-0.00737	0.00678
Generation				
None	0.00098	0.00116	-0.00127	0.00087
1st	0.00054	0.00156	0.00042	0.00156
2nd	-0.00248*	0.00144	-0.00021	0.00159
3rd	0.00306	0.00191	0.00179	0.00173
Parental structure (living with:)				
Legal parents	-0.00065	0.00059	-0.00059	0.00060
Legal mother	0.00177***	0.00070	0.00185***	0.00069
Legal father	-0.00275**	0.00122	-0.00301***	0.00117
Legal mother and partner	-0.00331	0.00210	-0.00373*	0.00208
Legal father and partner	-0.00123	0.00581	-0.00140	0.00573
Other household	0.00460	0.00311	0.00439	0.00317
Institutional household	0.04836***	0.00527	0.04576***	0.00705
Unknown	-0.00512	0.01175	-0.00502	0.01171
Children				
0	0.00489	0.00346	0.00470	0.00346
1	-0.00026	0.00106	-0.00065	0.00107
2	-0.00055	0.00052	-0.00082	0.00053
3	0.00001	0.00084	0.00025	0.00093
4 and more	0.00102	0.00113	0.00155	0.00097
Unknown	-0.00512	0.01175	-0.00502	0.01171
Parental education				
Primary education	-0.00019	0.00106	0.00038	0.00099
Lower secondary education	-0.00051	0.00125	-0.00038	0.00129
Higher secondary education	-0.00039	0.00066	-0.00035	0.00067
Bachelor degree	0.00010	0.00126	-0.00027	0.00121
Master degree	-0.00136	0.00109	-0.00177	0.00113
Unknown	0.00179*	0.00105	0.00165	0.00113
Wealth				
1st quintile	-0.00022	0.00215	-0.00009	0.00212
2nd quintile	0.00101	0.00115	0.00137	0.00117
3rd quintile	-0.00023	0.00090	-0.00019	0.00092
4rd quintile	-0.00057	0.00130	-0.00091	0.00139
5th quintile	-0.00139	0.00191	-0.00189	0.00195
Unknown	0.00169	0.00231	0.00154	0.00234
Youth support				
None	-0.00402**	0.00206	-0.00383*	0.00204
Without internal stay	0.00325*	0.00198	0.00307	0.00195
With internal stay	0.00865**	0.00402	0.00843**	0.00411

Notes. The results are based on 80 separate regressions, in which the proportion of non-Western peers at the school-cohort level is regressed on one of the background variables. Variables that are not identified are not presented. Each regression controls for school and cohort fixed effects. Moreover, column (2) includes peer proportions of non-Western pupils at the school level. For each regression the coefficient and standard error (clustered at the school-cohort level) are presented. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Balancing test I: Correlation of the proportion of peers in the low-wealth group with background characteristics.

	(1)		(2)	
Variable	Coefficient	SE	Coefficient	SE
Male	-0.00015	0.00097	-0.00037	0.00099
Age	-0.00179**	0.00077	-0.00113	0.00074
Migration background				
Dutch	-0.00173	0.00161	-0.00306**	0.00158
Western	0.00045	0.00079	0.00050	0.00078
non-Western	0.00155	0.00177	0.00288*	0.00175
Generation				
None	-0.00071	0.00141	-0.00216	0.00140
1st	0.00219	0.00241	0.00318	0.00239
2nd	0.00101	0.00118	0.00193*	0.00117
3rd	-0.00188**	0.00093	-0.00172**	0.00089
Parental structure (living with:)				
Legal parents	0.00407***	0.00115	0.00131	0.00122
Legal mother	-0.00345***	0.00099	-0.00031	0.00105
Legal father	-0.00688***	0.00221	-0.00613***	0.00220
Legal mother and partner	-0.00192	0.00204	-0.00140	0.00203
Legal father and partner	-0.00055	0.00431	-0.00087	0.00422
Children				
0	-0.00005	0.01103	-0.00141	0.01103
1	-0.00388***	0.00114	-0.00282***	0.00111
2	0.00040	0.00060	-0.00017	0.00060
3	0.00134*	0.00079	0.00116	0.00079
4 and more	0.00164	0.00107	0.00136	0.00106
Parental education				
Primary education	0.00122	0.00129	0.00257**	0.00129
Lower secondary education	-0.00050	0.00131	0.00087	0.00132
Higher secondary education	-0.00218***	0.00074	-0.00154**	0.00072
Bachelor degree	-0.00047	0.00194	-0.00143	0.00189
Master degree	0.00127	0.00194	-0.00038	0.00192
Unknown	0.00156	0.00114	0.00074	0.00113
Wealth				
1st quintile	-0.00586***	0.00174	-0.00119	0.00166
2nd quintile	-0.00798***	0.00089	0.00164	0.00172
3rd quintile	0.00696***	0.00103	0.00188	0.00117
4rd quintile	0.00228***	0.00077	-0.00197**	0.00085
5th quintile	0.00202	0.00145	-0.00063	0.00143
Youth suppot				
None	-0.00331	0.00287	-0.00367	0.00289
Without internal stay	0.00352	0.00307	0.00376	0.00310
With internal stay	-0.00255	0.00888	0.00103	0.00919

Notes. The results are based on 80 separate regressions, in which the proportion of peers with parents with low wealth (at the school-cohort level) is regressed on one of the background variables. Variables that are not identified are not shown. Each regression controls for school and cohort fixed effects. Moreover, column (2) includes the peer proportion of pupils with low-wealth parents at the school level. For each regression the coefficient and standard error (clustered at the school-cohort level) are presented. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.8: Balancing test I: Correlation of the proportion of peers with low-educated parents with background characteristics.

	(1)		(2)	
Variable	Coefficient	SE	Coefficient	SE
Male	-0.00169***	0.00059	-0.00177***	0.00062
Age	-0.00099	0.00098	-0.00024	0.00096
Migration background				
Dutch	-0.00201	0.00125	-0.00276**	0.00133
Western	0.00071	0.00194	0.00065	0.00197
non-Western	0.00174*	0.00092	0.00251***	0.00094
Unknown	-0.01224	0.01614	-0.00847	0.01671
Generation				
None	-0.00184**	0.00086	-0.00223***	0.00088
1st	0.00076	0.00105	0.00168	0.00106
2nd	0.00163	0.00108	0.00204*	0.00114
3rd	-0.00040	0.00224	-0.00106	0.00225
Unknown	-0.01224	0.01614	-0.00847	0.01671
Parental structure (living with:)				
Legal parents	-0.00080	0.00090	-0.00074	0.00095
Legal mother	0.00180*	0.00095	0.00166*	0.00100
Legal father	-0.00718***	0.00251	-0.00751***	0.00263
Legal mother and partner	0.00052	0.00183	0.00030	0.00184
Legal father and partner	0.00898	0.00568	0.00945*	0.00573
Other household	-0.01012	0.00668	-0.00788	0.00701
Institutional household	0.03559***	0.00508	0.03231***	0.00538
Unknown	0.00177	0.01047	0.00478	0.01072
Children				
0	-0.00662	0.00722	-0.00468	0.00753
1	-0.00142	0.00094	-0.00147	0.00094
2	0.00006	0.00102	-0.00032	0.00109
3	0.00040	0.00120	0.00022	0.00122
4 and more	0.00118	0.00122	0.00208*	0.00110
Unknown	0.00177	0.01047	0.00478	0.01072
Parental education				
Primary education	-0.00475***	0.00136	-0.00040	0.00143
Lower secondary education	-0.00398*	0.00208	0.00062	0.00162
Higher secondary education	0.00569***	0.00073	-0.00004	0.00106
Bachelor degree	0.00320***	0.00130	-0.00059	0.00135
Master degree	0.00312**	0.00149	-0.00042	0.00142
Unknown	-0.00495***	0.00106	0.00073	0.00139
Wealth				
1st quintile	0.00075	0.00148	0.00032	0.00150
2nd quintile	0.00171***	0.00061	0.00237***	0.00060
3rd quintile	-0.00127**	0.00064	-0.00151**	0.00062
4rd quintile	0.00033	0.00100	-0.00010	0.00097
5th quintile	-0.00109	0.00163	-0.00163	0.00166
Unknown	-0.00488	0.00462	-0.00329	0.00485
Youth support				
None	0.00182	0.00182	0.00164	0.00173
Without internal stay	-0.00155	0.00241	-0.00156	0.00238
With internal stay	-0.00347	0.00574	-0.00200	0.00602

Notes. The results are based on 80 separate regressions, in which the proportion of pupils with low-educated parents (at the school-cohort level) is regressed on one of the background variables. Each regression controls for school and cohort fixed effects. Moreover, column (2) includes the peer proportion of pupils with low-educated parents at the school level. For each regression the coefficient and standard error (clustered at the school-cohort level) are presented. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.9: Balancing test II: Autocorrelation of peer proportions

	1% level	5% level	10% level
Proportion of non-Western peers	0.000	0.033	0.050
Proportion of peers with parents with low wealth	0.004	0.029	0.075
Proportion of peers with low-educated parents	0.004	0.017	0.054

Notes. This table shows for three peer variables the proportion of bivariate school-level regressions that are significant at the 1, 5 and 10 percent level.

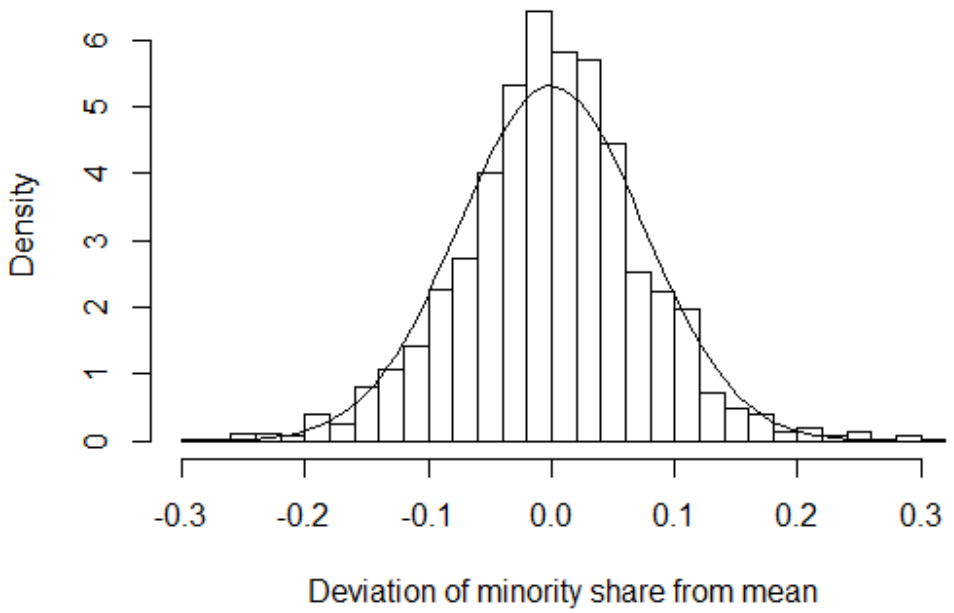


Figure 5: Year-to-year variation in the proportion of non-Western pupils within primary schools.

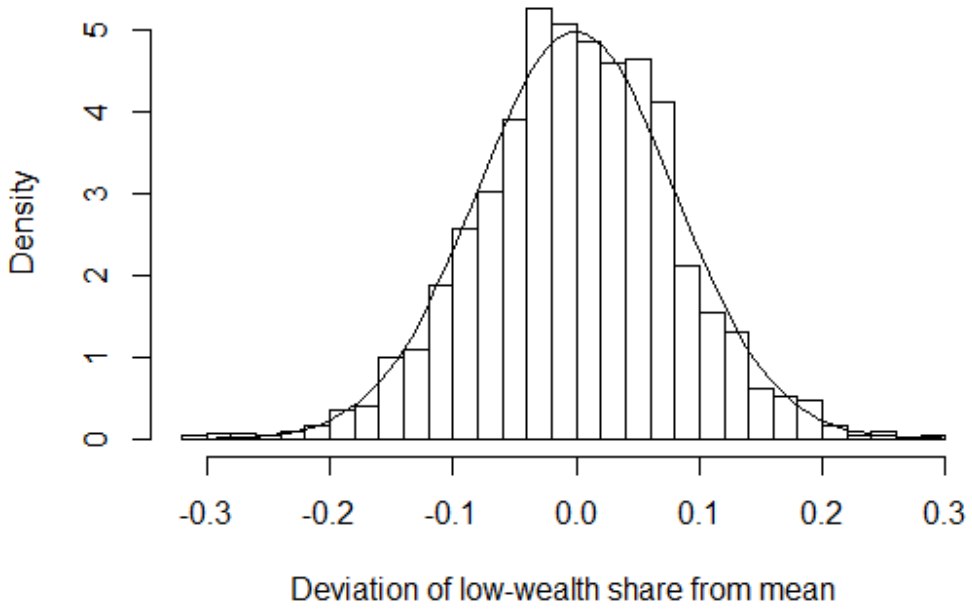


Figure 6: Year-to-year variation in the proportions of pupils with parents with low wealth within primary schools.

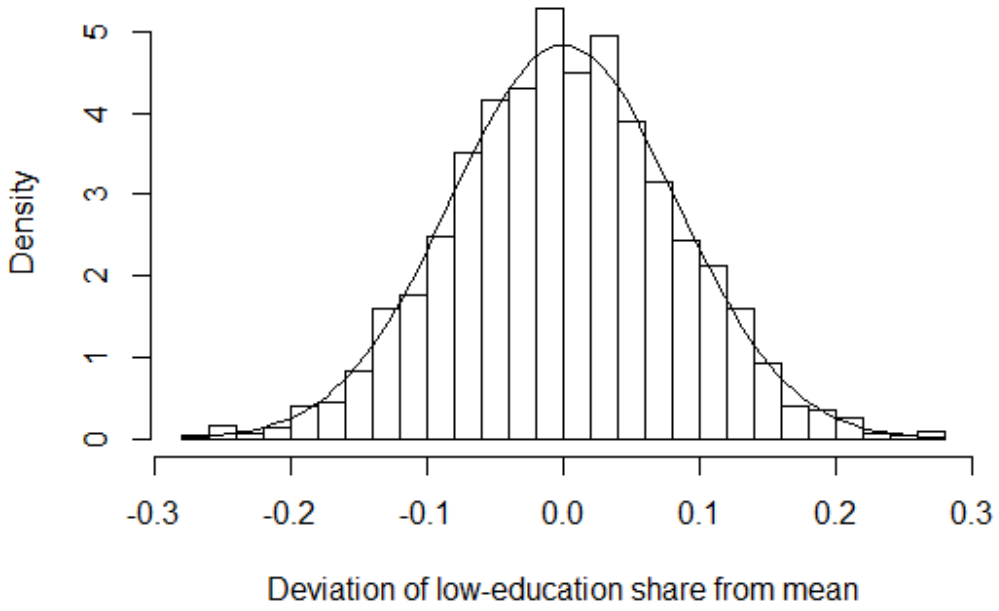


Figure 7: Year-to-year variation in the proportion of pupils with low-educated parents within primary schools.

A.4 Peer influences in education: regression results

Table A.10: The impact of peer effects on the first teacher advice

Dependent variable: at least VWO	(1)	(2)	(3)	(4)
Proportion non-Western	-0.033**	-0.012	-0.001	-0.002
	(0.015)	(0.029)	(0.024)	(0.024)
Proportion low wealth	-0.267***	0.003	-0.018	-0.018
	(0.035)	(0.020)	(0.019)	(0.019)
Proportion low education	-0.230***	0.009	-0.004	-0.004
	(0.023)	(0.023)	(0.028)	(0.028)
Dependent variable: at least HAVO				
Proportion non-Western	-0.089***	-0.032	-0.019	-0.018
	(0.019)	(0.038)	(0.030)	(0.030)
Proportion low wealth	-0.403***	-0.020	-0.053**	-0.053**
	(0.037)	(0.031)	(0.022)	(0.022)
Proportion low education	-0.280***	-0.013	-0.035	-0.037
	(0.033)	(0.035)	(0.026)	(0.026)
Dependent variable: at least VMBO-GT				
Proportion non-Western	-0.129***	-0.061**	-0.052*	-0.052*
	(0.020)	(0.024)	(0.028)	(0.028)
Proportion low wealth	-0.255***	0.022	-0.005	-0.004
	(0.029)	(0.029)	(0.024)	(0.025)
Proportion low education	-0.185***	-0.024	-0.043	-0.043
	(0.023)	(0.039)	(0.034)	(0.034)
Dependent variable: at least VMBO-K				
Proportion non-Western	-0.100***	-0.040	-0.035	-0.035
	(0.021)	(0.027)	(0.023)	(0.024)
Proportion low wealth	-0.119***	0.008	-0.008	-0.008
	(0.027)	(0.026)	(0.024)	(0.024)
Proportion low education	-0.133***	-0.062**	-0.073***	-0.073***
	(0.017)	(0.031)	(0.028)	(0.028)
School fixed effects		✓	✓	✓
Cohort fixed effects		✓	✓	✓
Individual controls			✓	✓
School controls				✓
Observations	37,985	37,985	37,985	37,985

Notes. The table shows the regression results of 16 separate regressions. The dependent variables are indicator variables that equal one when a pupil has obtained at least a specific track as first teacher advice, and zero otherwise. Column (1) until (4) use different sets of control variables. Individual controls include a pupil's gender, age, migration background, generation and background in youth support, the parental structure and the number of other children in the household the pupil is exposed to, and the highest level of obtained education of the parents and their wealth. School controls are the three peer proportions of interest at the school level. Standard errors are clustered at the school-cohort level and are given in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.11: The impact of peer effects on the test advice

Dependent variable: at least VWO	(1)	(2)	(3)	(4)
Proportion non-Western	-0.041***	0.028	0.038*	0.037*
	(0.015)	(0.024)	(0.021)	(0.021)
Proportion low wealth	-0.268***	-0.062***	-0.080***	-0.080***
	(0.031)	(0.012)	(0.014)	(0.014)
Proportion low education	-0.142***	0.032*	0.020	0.020
	(0.019)	(0.018)	(0.020)	(0.020)
Dependent variable: at least HAVO				
Proportion non-Western	-0.105***	0.006	0.017	0.017
	(0.027)	(0.047)	(0.043)	(0.044)
Proportion low wealth	-0.396***	-0.059*	-0.089**	-0.089**
	(0.034)	(0.033)	(0.035)	(0.036)
Proportion low education	-0.212***	-0.001	-0.021	-0.021
	(0.028)	(0.026)	(0.025)	(0.025)
Dependent variable: at least VMBO-GT				
Proportion non-Western	-0.096***	-0.025	-0.014	-0.015
	(0.024)	(0.037)	(0.034)	(0.034)
Proportion low wealth	-0.292***	-0.010	-0.036	-0.035
	(0.026)	(0.038)	(0.035)	(0.035)
Proportion low education	-0.199***	-0.052	-0.072**	-0.072**
	(0.040)	(0.038)	(0.037)	(0.037)
Dependent variable: at least VMBO-K				
Proportion non-Western	-0.072***	-0.004	0.005	0.005
	(0.024)	(0.036)	(0.036)	(0.036)
Proportion low wealth	-0.233***	-0.025	-0.050*	-0.050*
	(0.022)	(0.029)	(0.028)	(0.028)
Proportion low education	-0.184***	-0.032	-0.048	-0.048
	(0.033)	(0.035)	(0.031)	(0.031)
School fixed effects		✓	✓	✓
Cohort fixed effects		✓	✓	✓
Individual controls			✓	✓
School controls				✓
Observations	37,985	37,985	37,985	37,985

Notes. The table presents the regression results of 16 separate regressions. The dependent variables are indicator variables that equal one when a pupil has obtained at least a specific track as test advice, and zero otherwise. Column (1) until (4) use different sets of control variables. Individual controls include a pupil's gender, age, migration background, generation and background in youth support, the parental structure and the number of other children in the household the pupil is exposed to, and the highest level of obtained education of the parents and their wealth. School controls are the three peer proportions of interest at the school level. Standard errors are clustered at the school-cohort level and are given in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.12: The impact of peer effects on education in the third class of secondary school

Dependent variable: at least VWO	(1)	(2)	(3)	(4)
Proportion non-Western	-0.026*	0.002	0.012	0.011
	(0.015)	(0.022)	(0.018)	(0.018)
Proportion low wealth	-0.260***	-0.045***	-0.064***	-0.063***
	(0.028)	(0.011)	(0.009)	(0.009)
Proportion low education	-0.155***	0.034***	0.023*	0.023*
	(0.014)	(0.011)	(0.012)	(0.012)
Dependent variable: at least HAVO				
Proportion non-Western	-0.068***	-0.054	-0.036	-0.035
	(0.022)	(0.047)	(0.036)	(0.036)
Proportion low wealth	-0.446***	-0.031	-0.070***	-0.069***
	(0.037)	(0.035)	(0.023)	(0.023)
Proportion low education	-0.318***	0.004	-0.021	-0.022
	(0.039)	(0.031)	(0.020)	(0.020)
Dependent variable: at least VMBO-GT				
Proportion non-Western	-0.114***	-0.067**	-0.053**	-0.052**
	(0.020)	(0.033)	(0.026)	(0.026)
Proportion low wealth	-0.274***	0.004	-0.032	-0.032
	(0.025)	(0.026)	(0.023)	(0.023)
Proportion low education	-0.231***	-0.001	-0.022	-0.023
	(0.024)	(0.029)	(0.026)	(0.026)
Dependent variable: at least VMBO-K				
Proportion non-Western	-0.092***	-0.041**	-0.034*	-0.035*
	(0.017)	(0.018)	(0.020)	(0.020)
Proportion low wealth	-0.097***	-0.007	-0.025	-0.025
	(0.022)	(0.023)	(0.022)	(0.022)
Proportion low education	-0.158***	-0.045**	-0.057***	-0.057***
	(0.015)	(0.020)	(0.017)	(0.017)
School fixed effects		✓	✓	✓
Cohort fixed effects		✓	✓	✓
Individual controls			✓	✓
School controls				✓
Observations	37,985	37,985	37,985	37,985

Notes. The table reports the regression results of 16 separate regressions. The dependent variables are indicator variables that equal one when a pupil has obtained at least a specific track in secondary school, and zero otherwise. Column (1) until (4) use different sets of control variables. Individual controls include a pupil's gender, age, migration background, generation and background in youth support, the parental structure and the number of other children in the household the pupil is exposed to, and the highest level of obtained education of the parents and their wealth. School controls are the three peer proportions of interest at the school level. Standard errors are clustered at the school-cohort level and are given in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.13: Heterogeneous peer effects on the first teacher advice

Dependent variable: at least	VWO	HAVO	VMBO-GT	VMBO-K
	(1)	(2)	(3)	(4)
Proportion non-Western	-0.022	-0.042	-0.051	-0.033
	(0.029)	(0.030)	(0.036)	(0.023)
Proportion low wealth	-0.043***	-0.073**	-0.015	0.005
	(0.016)	(0.030)	(0.031)	(0.028)
Proportion low education	0.011	-0.009	-0.021	-0.053*
	(0.036)	(0.036)	(0.041)	(0.028)
non-Western	-0.038*	-0.077***	-0.013	-0.006
	(0.022)	(0.023)	(0.010)	(0.016)
Low wealth	-0.147***	-0.196***	-0.131***	-0.039***
	(0.017)	(0.026)	(0.035)	(0.014)
Low education	-0.075***	-0.094***	-0.097***	-0.053***
	(0.008)	(0.022)	(0.031)	(0.015)
Proportion non-Western * non-Western	0.036	0.044***	-0.003	-0.005
	(0.022)	(0.016)	(0.020)	(0.007)
Proportion low wealth * Low wealth	0.055	0.047	0.027	-0.024**
	(0.012)	(0.036)	(0.024)	(0.011)
Proportion low education * Low education	-0.031	-0.056	-0.045**	-0.040***
	(0.021)	(0.046)	(0.023)	(0.011)
Observations	37,985	37,985	37,985	37,985

Notes. The table presents the regression results of 4 regressions. Column (1) until (4) each use a different dependent variable. The dependent variables are dummy variables indicating whether a pupil has obtained at least VWO, at least HAVO, at least VMBO-GT or at least VMBO-K as their first teacher advice. Each regression controls for school fixed effects, cohort fixed effects, pupils, parents and household controls and the peer proportions at the school level. Standard errors are clustered at the school-cohort level and are given in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.14: Heterogeneous peer effects on the test advice

Dependent variable: at least	VWO	HAVO	VMBO-GT	VMBO-K
	(1)	(2)	(3)	(4)
Proportion non-Western	0.039*	-0.005	-0.039	-0.002
	(0.023)	(0.041)	(0.029)	(0.033)
Proportion low wealth	-0.101***	-0.089**	-0.005	-0.018
	(0.014)	(0.037)	(0.042)	(0.032)
Proportion low education	0.039	0.024	-0.036	-0.019
	(0.031)	(0.032)	(0.036)	(0.031)
non-Western	-0.035**	-0.054***	-0.006	-0.004
	(0.016)	(0.019)	(0.017)	(0.022)
Low wealth	-0.148***	-0.161***	-0.108***	-0.081***
	(0.025)	(0.036)	(0.023)	(0.016)
Low education	-0.085***	-0.088***	-0.084***	-0.060***
	(0.019)	(0.025)	(0.022)	(0.022)
Proportion non-Western * non-Western	-0.004	0.040***	0.045***	0.014*
	(0.016)	(0.015)	(0.015)	(0.008)
Proportion low wealth * Low wealth	0.047	0.008	-0.058**	-0.063***
	(0.016)	(0.044)	(0.024)	(0.016)
Proportion low education * Low education	-0.039	-0.093**	-0.072**	-0.058**
	(0.026)	(0.042)	(0.029)	(0.026)
Observations	37,985	37,985	37,985	37,985

Notes. he table shows the regression results of 4 regressions. Column (1) until (4) each use a different dependent variable. The dependent variables are dummy variables indicating whether a pupil has obtained at least VWO, at least HAVO, at least VMBO-GT or at least VMBO-K as their test advice. Each regression controls for school fixed effects, cohort fixed effects, pupils, parents and household controls and the peer proportions at the school level. Standard errors are clustered at the school-cohort level and are given in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.15: Heterogeneous peer effects on education in the third class of secondary school

Dependent variable: at least	VWO	HAVO	VMBO-GT	VMBO-K
	(1)	(2)	(3)	(4)
Proportion non-Western	0.007	-0.066**	-0.077***	-0.035**
	(0.021)	(0.032)	(0.021)	(0.018)
Proportion low wealth	-0.089***	-0.082**	-0.020	-0.011
	(0.009)	(0.035)	(0.030)	(0.023)
Proportion low education	0.035*	0.002	0.009	-0.028**
	(0.020)	(0.025)	(0.029)	(0.014)
non-Western	-0.033*	-0.043*	-0.027	-0.018
	(0.019)	(0.023)	(0.023)	(0.014)
Low wealth	-0.155***	-0.216***	-0.111***	-0.052***
	(0.023)	(0.037)	(0.019)	(0.015)
Low education	-0.083***	-0.114***	-0.078***	-0.031**
	(0.018)	(0.020)	(0.029)	(0.014)
Proportion non-Western * non-Western	0.006	0.057***	0.047***	0.001
	(0.020)	(0.019)	(0.017)	(0.008)
Proportion low wealth * Low wealth	0.056	0.030	-0.021	-0.026
	(0.010)	(0.033)	(0.027)	(0.024)
Proportion low education * Low education	-0.025	-0.050	-0.065**	-0.057***
	(0.020)	(0.031)	(0.027)	(0.015)
Observations	37,985	37,985	37,985	37,985

Notes. The table shows the regression results of 4 regressions. Column (1) until (4) each use a different dependent variable. The dependent variables are dummy variables indicating whether a pupil has at least VWO, at least HAVO, at least VMBO-GT or at least VMBO-K as their school level in the third class of secondary school. Each regression controls for school fixed effects, cohort fixed effects, pupils, parents and household controls and the peer proportions at the school level. Standard errors are clustered at the school-cohort level and are given in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.