

Drop-out teachers

*Student composition and teacher mobility and attrition in
lower secondary schools*

Maja Feng Mikalsen



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Faculty of Social Sciences

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Summary

Teachers are crucial to students' learning outcomes in school. Therefore, it is of particular importance to recruit and retain skilled teachers for schools with a socially or economically disadvantaged student body. However, previous international research has stated that the highest rates of teacher turnover can be found in disadvantaged schools with large concentrations of low-income families, low-achieving students and/or students with minority backgrounds. Therefore, it is key to gain an understanding of whether teachers systematically leave disadvantaged lower secondary schools in Norway or the teaching profession entirely, as well as investigating the mechanisms behind these patterns. I investigate Norway at large, and focus separately on Oslo, due to the large differences in student composition between schools in this city.

I present the first sociological contribution to the understanding of the association between the share of minority students and teacher mobility and/or teacher attrition in Norway and Oslo, respectively. In the study, I pose three research questions: 1) Is there a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Norway and/or Oslo? 2) Is there a positive association between the proportion of students with a minority background and teachers' propensity to leave their profession in Norway and/or Oslo? 3) Whether and how does the association between the proportion of minority students and teacher mobility and/or teacher attrition vary with teacher characteristics in Norway and/or Oslo? I specifically focus on teacher characteristics like teachers' sex, immigrant group and age group. I apply theoretical assumptions from mechanism-based explanations, push- and pull-factors (Gambetta, 1987), the DBO model (“Desires, Beliefs and Opportunities”) (Elster, 2015; Hedström, 2005), as well as previous research. Using linear probability models, with and without school-fixed effects, I investigate the association between the proportion of minority students at school-level and teacher mobility from lower secondary schools and teacher attrition from the teaching profession. I report the average marginal effects of the proportion of minority students on teacher mobility and/or teacher attrition.

By partaking in the project *Ethnic Segregation in Schools and Neighbourhoods: Consequences and Dynamics*, I have access to administrative register data managed by Statistics Norway, as well as data from the Directorate of Education. I completed the merging and appending of variables in Stata 16.1 software in order to have a comprehensive longitudinal data set. The panel data set for the time period between 2003—2013 comprises

individual-level data of teachers, students and students' parents, as well as organisational school-level data from the primary- and lower secondary school information system.

In line with my research questions, I conduct two separate analyses in Norway. A subset of both analyses specifically address the situation in Oslo, which is an especially important venue for studying this topic. Overall, I find that once I include school-fixed effects and school-level and individual-level control variables, the proportion of minority students does not affect the probability that teachers will exit lower secondary schools and/or the teaching profession in Norway and Oslo, respectively. Despite this lack of evidence, the findings indicate dissimilarities in the association between the minority student share and teacher mobility and attrition according to teacher characteristics, like immigrant group and age group. First, teachers who are themselves non-western immigrants are more likely to stay in schools with high or increasing shares of minority students in Norway, compared to native majority teachers. Second, teachers with a non-western descendant background are more likely to leave the teaching profession if working in schools with high or increasing shares of minority students in Norway, relative to native majority teachers. This gives support for the anticipation that minority teachers possibly have different desires, beliefs and/or opportunities in the labour market, relative to native majority teachers. Third, in Oslo, the teachers who are themselves in the oldest age group 65—70, are more likely to leave the profession if working in schools with high or increasing shares of minority students, compared to teachers in age group 18—24. This is in accordance with previous research and theoretical expectations about other desires, beliefs and/or opportunities among teachers coming close to retirement age. Teachers' sex is of no importance for any of the associations in the study.

In general, the thesis has contributed with more information about whether and how the student composition, measured by the share of minority students at school-level is associated with teacher mobility and/or teacher attrition, both in Norway and Oslo. Higher minority concentrations in schools do not make teachers more likely to quit their jobs.

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1 Introduction

It is well established that teachers are important for student achievement in school (Hanushek, Kain, & Rivkin, 2004; Kalogrides, Loeb, & Béteille, 2013, p. 103; Kunnskapsdepartementet, 2009, p. 9). Thus, recruiting and retaining skilled teachers is particularly important for schools with a socially or economically disadvantaged student body. However, according to previous international research, the highest rates of teacher turnover can be found in disadvantaged schools with large concentrations of low-income families, students with minority backgrounds and/or low-achieving students (Barbieri, Rossetti, & Sestito, 2011; Boyd et al., 2011; Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi, Sjoquist, & Stinebrickner, 2007).

In this study, I seek to map the connection between student composition and teacher mobility and/or teacher attrition. There has previously been little research on teacher turnover in Norway, especially in lower secondary schools. Therefore, it is of both societal- and research importance to gain an understanding of whether teachers leave disadvantaged schools in Norway or the teaching profession entirely, as well as investigating the mechanisms behind these patterns. If teachers systematically leave disadvantaged schools, this may be problematic from the point of view of students, parents and policy makers, and it may have important implications for equality of opportunity in the educational system. To explore teacher turnover in Norway, I use data from administrative registers covering all teachers and school-level data, managed by Statistics Norway and the Directorate of Education. I investigate Norway at large, and focus particularly on Oslo, due to the large differences in student composition between schools in this city.

The Norwegian government's goal regarding education is that everyone should have equal opportunities to utilise their abilities and achieve their goals, regardless of social background (Kunnskapsdepartementet, 2008, p. 5). According to OECD's annual indicator report from 2017, for the education sector, Norway is amongst the countries that have the highest expenditure per pupil in basic education, as well as being one of the greatest investors in higher education (Ministry of Education and Research, 2017). Hence, Norway seems to have less social inequality in the educational system, compared to other countries in the world. Nevertheless, children of parents with higher education still benefit more from the education in school, than children of parents with lower education (Kunnskapsdepartementet, 2011, p. 6). In a recent news article from NRK, 17 out of 42 teachers at a primary school in

Norway stated that they've “had enough”, due to problems with bullying and violence among students, and gradual deterioration of the working environment (Mossing & Rognsvåg, 2020). The Union of Education Norway [Utdanningsforbundet] reacted after a “teacher flight” was announced at the primary school. Considering this, there is a need to attain more information about teacher turnover in Norway and Oslo, to investigate whether specific student compositions influence teachers to leave schools, and if particular student- and teacher characteristics can explain prevalent patterns in the teacher labour market.

If teacher turnover patterns and teacher sorting across different schools are related to specific student body compositions, this may have implications for schools and student achievements. Teacher mobility and attrition may affect schools and students through recruitment expenditures, unstable learning environments, new staffing of teachers, inequalities in access to experienced and/or highly skilled teachers and temporary staff. Unequal distribution of educational benefits and human capital can be exacerbated by systematic teacher sorting (Bonesrønning, Falch, & Strøm, 2005, p. 481). Ways in which teachers sort themselves across schools are influenced by, among other things, decision-makers in political institutions and schools, teacher and student behaviour (Falch & Rønning, 2007, p. 177), as well as the perceived quality of a school and “supply- and demand” of teachers (Bonesrønning et al., 2005). If the Norwegian labour market functions so that the highest rates of teacher turnover can be found in disadvantaged schools, this can have major consequences for the supply of teachers and teacher resources in the educational system. Moreover, if skilled teachers end up working with high-achieving students, and less skilled teachers work with students with low performances, this may exacerbate inequalities in educational outcomes. Rather than contributing to equal opportunities for all students, such patterns may contribute to maintaining and increasing social inequalities in the society at large (Falch & Rønning, 2007, p. 177; Lankford, Loeb, & Wyckoff, 2002). However, empirically, this study does not differentiate between teachers' certifications, specialisations or grades, but the arguments are still highly relevant.

This thesis combines insights on social inequalities, segregation and the educational system to study the teachers' labour market. Residential segregation, school segregation, school choices and teacher turnover can be closely related. School segregation is linked to residential segregation, which in turn is closely related to the economic resources of families (Wessel 2000; Bratbakk og Wessel 2009, referred in, Birkelund, Hermansen, & Evensen, 2010). Moreover, there is a concern that teachers' and parents' active school choices can reinforce residential segregation and school segregation (Shavit & Blossfeld, 1993, referred

in, Trumberg & Urban, 2020). Teachers' pedagogical competence and the perceived quality of the school, as well as the student composition at school-level can have significance for parents' decisions regarding choice of schools for their children. Resourceful families more commonly engage in active school choices, and the ethnic and socio-economic composition in schools is believed to be important factors behind school-choices (Trumberg & Urban, 2020, p. 2).

With regard to a system with “free school choice” [fritt skolevalg], such as in the Norwegian municipality Oslo, social-, economic- and geographical differences and teacher mobility and attrition can be understood in light of each other. With large differences between Oslo East and West with regard to population composition and housing structure (Wessel, 2017, p. 81), free school choice, where intake area is for guidance only, seems to reinforce parents' active choice of schools for their children (Utdanningsetaten Oslo kommune, 2017). In Oslo, the level of socio-economic segregation in primary- and lower secondary schools is high, and increasing (Hansen, 2017). According to an article in the newspaper *Aftenposten*, several Norwegian parents in Oslo have chosen to move their children from the most immigrant-dense city centre schools, and to schools with less minority students in Oslo (Lundgaard, 2009). Moreover, recent findings from Oslo, show that “native families with pre-school children systematically move away from schools with high shares of students with non-Western immigrant backgrounds.” (Rogne, Borgen, & Nordrum, 2021, p. 18). Individual, strategic parental behaviour and/or absence of opportunities for others can contribute to segregation in schools and neighbourhoods, which in turn might influence teachers' propensities to exit a school and/or the profession.

If free school choice leads to increased ethnic and socio-economic school segregation, so called attractive schools might be appealing for both good students and good teachers, whereas less attractive and less advantaged schools might have higher rates of teacher exits among skilled teachers (Sandsør, 2020). Previous international research on teacher mobility has shown that signs of poor teacher quality influence the best teachers to exit (Feng, Figlio, & Sass, 2018). Therefore, if I find similar results as the international studies, and the highest rates of teacher turnover are found in schools in Norway and Oslo with high rates of minority students, low-achieving students, and families with low income (Barbieri et al., 2011; Boyd et al., 2011; Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007), the societal- and individual consequences are potentially major. Overall, this study can contribute with information to the field of social inequalities in education, and segregation in schools- and neighbourhoods in Norway and Oslo.

This thesis provides new and insightful knowledge by combining a sociological framework with descriptive and analytical evidence based on high-quality data on teacher mobility in lower secondary schools in Norway. The framework in the majority of previous Norwegian research on teacher mobility and attrition have been obtained from the point of view of economics, and the data material covering the school years is relatively outdated¹.

I address the association between student composition, measured by the share of minority students, and teacher mobility and attrition in Norway and Oslo, respectively. By analysing individual-level register data using panel data methods, I seek to answer the following research questions:

- 1) *Is there a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Norway and/or Oslo?*
- 2) *Is there a positive association between the proportion of students with a minority background and teachers' propensity to leave their profession in Norway and/or Oslo?*
- 3) *Whether and how does the association between the proportion of minority students and teacher mobility and/or teacher attrition vary with teacher characteristics in Norway and/or Oslo?*

1.1 Definitions and Operationalisations

1.1.1 Defining Teachers

Teachers are defined according to the Norwegian standard classification of occupations. I use the occupational codes- and classifications, “STYRK 98” and “STYRK 08”, developed by the Statistics Norway (2016). Job codes from the ”PAI-register” [Personaladministrativt informasjonssystem] and “SST” [Statens sentrale tjenestemannsregister] also contribute to the teacher-definition (KS, 2020 October 26; Villund, 2006). I include teachers who have worked in lower secondary schools (8th-10th grade) at some point between 2003—2014 in Norway and Oslo. An extended description of the selection of teachers follows in the methods chapter.

¹ The study by Falch and Strøm (2005) investigated teacher mobility in primary and lower secondary schools for the school years 1992-1993 to 1999-2000. Another study by Falch and Rønning (2007, p. 179) investigated teacher turnover, covering all Norwegian teachers in public schools for the school years 1998-1999 to 2001-2002.

1.1.2 Defining Teacher Mobility, Teacher Attrition and Teacher Turnover

Teacher mobility refers to “the movement of a teacher from one school to another school [...]” (Djonko-Moore, 2016, p. 1065). Traditionally, scholars differentiate between three categories of teacher mobility: *stayers*, *movers*, and *leavers* (Goldtring et al. 2014, referred in Vagi & Pivovarova, 2017, p. 782). *Stayers* are teachers who remain in a teaching position from one year to the next. *Movers*, defines teachers who leave a teaching job during a school year, either for another school (*intradistrict movers*), or another school districts (*interdistrict movers*) (Lankford et al., 2002). *Leavers* categorises teachers who leave the profession completely and coincides with the term *teacher attrition*. The *teacher attrition rate* is the percentage of teachers “at a given level of education leaving the profession in a given school year” (UNESCO Institute for Statistics, 2020). A high teacher attrition rate signifies high levels of teacher turnover. *Teacher turnover rate*, denotes to the “number of teachers per year who move from one teaching job to another or leave teaching altogether” (Cochran-Smith, 2004, p. 388). Throughout the thesis, *teacher turnover* is an umbrella-term for all quit-actions. When using the word teacher mobility, I refer to *movers* from a school, and while using the word teacher attrition, I signify *leavers* from the teaching profession.

1.1.3 Defining Teacher Characteristics, Student Characteristics and School Characteristics

Teacher characteristics and *student characteristics* refer to “measurable or categorical demographic data, such as age, gender and race” specific to a particular individual (Djonko-Moore, 2016, p. 1065). *School characteristics* defines what describes a particular school and distinguishes schools from each other. In Norway, the lower secondary schools are quite uniform in terms of “curriculum taught, teaching methods and the number of hours the teacher has to spend in the classroom” (Falch & Strøm, 2005, p. 616). However, schools do differ in terms of factors like physical environments and working conditions. Following Falch and Strøm (2005), I regard both the student- and teacher composition as crucial factors of the working conditions.

1.1.4 How to Operationalise the Minority Student- and Minority Teacher Composition?

The main explanatory variable is the proportion of students with a *minority background* at school-level. International research on teacher mobility and attrition has focused on different concepts like “racial background”, “minority background” and “ethnic background”. The term “race” may seem to have different connotations in the US than in Norway. In US literature, a narrow understanding of the word “race” links the word primarily to phenotypes (i.e. observable physical characteristics), in which skin colour and appearance are predictors of which category to “belong to” (Birkelund, 2021, p. 83). A study that investigates racial minority students is not necessarily equivalent to a study of ethnic minority students. Studies of “racial minority” students are not necessarily looking into the pedagogical difficulties or integration issues, whereas studies of “ethnic minority” students may focus on additional language difficulties or issues regarding integration and equal enhanced opportunities in the society. Despite the diverging terminologies, it may still indicate that there is a dichotomy – separating a collective group from the numerical majority, which can be used to compare certain groups in the population.

I use the terms “minority background”, “minority students”, “minority teachers”, “native majority teachers” and “native majority population”. The concept *minority* may refer to a subjective dimension in terms of shared beliefs or historical or cultural differences, and/or an objective dimension which includes geographical belonging, like birthplace. Concepts like “ethnicity” and “ethnic minority” may seem to refer to the subjective dimension (see e.g., Birkelund & Mastekaasa, 2009a; Eriksen & Eraker, 2010, p. 254; Weber, 1978, p. 389). Moreover, the concept “ethnicity” is supposed to capture historical or cultural differences between groups of people, but have also been used synonymously with, for example, immigrants who come from the same country (Birkelund & Mastekaasa, 2009a, p. 16). I apply the term “ethnic school segregation”, due to its well-established use in a societal context and sociological framework.

To identify teachers, students and parents with a *minority background*, I turn to the objective dimension. Using administrative register data, I combine Statistics Norway's standard classifications for immigration category and country background to define individuals with a *minority background*. An immigrant refers to foreign-born individuals with two foreign-born parents, and a descendant denotes a Norwegian-born with two foreign-born parents (Statistics Norway, 2008, October). Country background is based upon information on

the country of origin for parents or grandparents. Each country has its uniquely corresponding number, which the coding is based upon. If one of the parents or grandparents is foreign-born, this information is used. If the parents are foreign-born from different countries, the mothers' country of origin is used (Statistics Norway, 2005). Using the terms "minority students" and "minority teachers", I refer to a group indicator that comprises individuals with non-western immigrant background and non-western descendant background. Thus, I distinguish between the frequently used dichotomy "western" and "non-western", which may be criticised for being old-fashioned. However, I argue that it serves a purpose in this thesis. For a non-western country background, it refers to individuals with country background from Middle East and North Africa ("MENA"), Eastern European non-EU countries ("NON-EU28 countries"), Oceania excluding Australia and New Zealand, Asia excluding "MENA", Africa excluding "MENA" and South and Central America.

1.2 Thesis Structure

In Chapter 2, I present the analytical approach and framework. By using a customised version of Colemans' macro-micro-macro model (1986), I imply that socio-economic segregation and distribution of teachers occurs at a macro-/meso-level, and that individuals' actions, like teacher mobility and attrition appear at a micro-level. Chapter 3 offers the theoretical perspectives. I apply a theory of action, called the DBO model and address push- and pull-factors. I suggest that analytical sociology can be used to investigate how macro-/meso-level conditions and structures can be transformed to individual actions, like teacher mobility and attrition. In Chapter 4, I review the research literature on teacher mobility and attrition. Moreover, I present my hypotheses about the association between the share of minority students at school-level and teacher mobility and attrition in Norway and Oslo. Chapter 5 consists of the procedures for the sample restrictions I made, operationalisations of variables and a discussion of the methods I use. Chapter 6 reports the descriptive statistics. In Chapter 7, I present the results from the Linear Probability Model analyses, as well as sensitivity tests. Finally, Chapter 8 contains a discussion of the results in light of previous theoretical expectations and previous research. In addition, I present limitations and suggestions for future research, and concluding remarks on the association between student composition and teacher mobility and attrition.

2 Analytical Approach and Background

In this chapter I give an overview of the analytical approach and present a customised version of Coleman's macro-micro-macro model (1986). In light of Coleman's model, the structural conditions; the ethnic and socio-economic school segregation and teacher sorting and distribution of teachers at a macro-level are the focus in this chapter.

2.1 Analytical Sociology and Middle Range Theories

I turn to analytical sociology and emphasise theories of the middle-range and mechanism-based explanations to investigate the associations between the share of minority students, and teacher turnover in lower secondary schools in Norway and Oslo.

Analytical sociology can be understood as a strategy for understanding the social world, and society at large (Hedström & Bearman, 2009). The approach is placed within a position called “structural individualism”, which is concerned with that “social facts should be explained as the intended or unintended outcomes of individuals' actions.” (Hedström & Bearman, 2009, p. 3). For example, to explain social facts such as patterns of segregation, typical beliefs and common ways of acting is needed to provide detailed, clear and precise mechanisms that bring forth these social facts. Robert K. Merton's notion of middle-range theories refer to theories located in the “middle”, between grand theories covering the society as a whole, and theories with small sets of explanatory factors (Hedström & Udehn, 2009).

2.2 Mechanism-based Explanations and Coleman's Macro-micro-macro Model

Following analytical sociology and Merton's notion of middle-range theories, I suggest that mechanism-based explanations of social phenomena and James Coleman's (e.g., 1986) macro-micro-macro model can constitute a framework to study teacher mobility and teacher attrition.

The concept *mechanism* has been defined in numerous ways (see e.g., Hedström, 2005; Hedström & Bearman, 2009). For example, a “[...] social mechanism is a precise, abstract, and action-based explanation which shows how the occurrence of a triggering event regularly generates the type of outcome to be explained.” (Hedström & Swedberg, 1998,

referred in Hedström & Bearman, 2009, p. 6). In a mechanism-based explanation, “a mechanism can be seen as a systematic set of statements that provide a plausible account of how *I* [the input] and *O* [the output] are linked to one another.” (Schelling, 1998, referred in Hedström & Swedberg, 1998, p. 7).

As advocated by Hedström and Swedberg (1998), descriptive analyses are unsatisfactory in terms of explaining how and *why* a particular social phenomenon occurs, continues and potentially changes over time, and thus mechanism-based explanations are important. A “black-box” explanation presents an observed regularity between two types of events or variables – the input and output (Hedström & Swedberg, 1998, p. 9). However, the explanation avoids giving the causal mechanism(s), that can link the input and output. Importantly, mechanisms let us to explain, but not predict certain outcomes. I study individuals' previous actions and despite that I cannot predict future actions, explanations of previous actions might contribute to greater understanding of the current situation, since teacher turnover is still occurring.

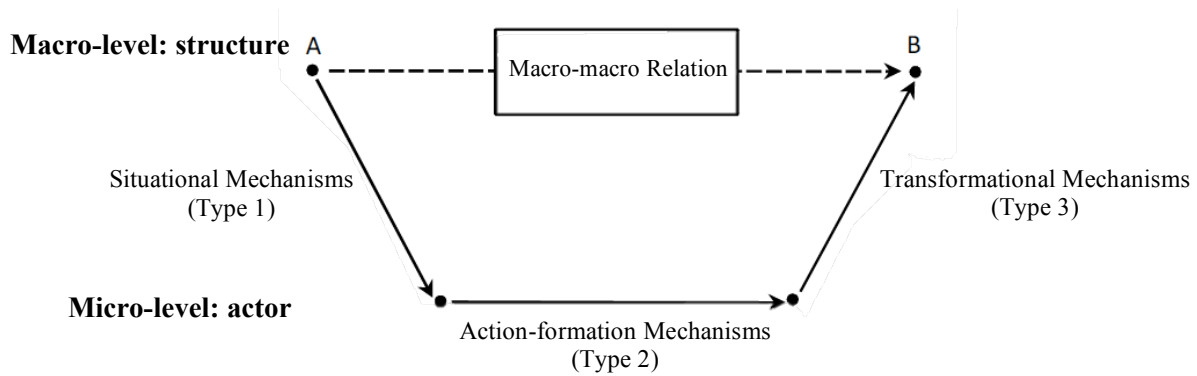
I turn to Coleman's macro-micro-macro model to study the link between the share of minority students and teacher turnover. Coleman emphasised that “all theories about macrophenomena must have firm microfoundations in the form of a theory of purposive action” (Hedström & Udehn, 2009, p. 32). Hence, essential for explaining the social facts on the macro-level (Hedström & Bearman, 2009), it is important to give an explicit identification of the microfoundations, or social “cogs and wheels” (Elster, 1989, p. 3, referred in Hedström & Swedberg, 1998). The micro-macro link can be used to examine how individual patterns of action and interaction on at micro level can produce patterns on a macro-level. In line with Coleman (see e.g, 1986), and a suggested typology proposed by Hedström and Swedberg (1998), Coleman's macro-micro-macro model is illustrated in Figure 2.1.²

Despite that I place school segregation and the distribution of teachers at a macro-level

² Figure 2.1. illustrates the typology of mechanisms put forward by Hedström and Swedberg (1998, pp. 21-22). The figure is also inspired by Hermansen (2009). The first relation between macro and micro, called “Situational (Contextual) Mechanisms” (Type 1) is characterised by internal processes (social- and psychological), in which collective structures can affect the individual. The micro to micro relation, called “Action-formation Mechanisms” (Type 2) is also characterised as internal, and illustrate how conditions shape and are transformed to individual actions. Last, the “Transformational Mechanism” (Type 3) includes several actors, and are specified as external, in which individual actions and interactions can contribute to “emergent” collective patterns on macro-level. However, the Type 3 relation has been regarded as the most complicated link in the macro-micro-macro model to prove in the social sciences (Elster, 2011, pp. 130-131).

in society, in line with Merton and the middle-range theories, organisations like schools typically operate at a meso-level of society.

Figure 2.1: Coleman's macro-micro-macro model and typology of social mechanisms



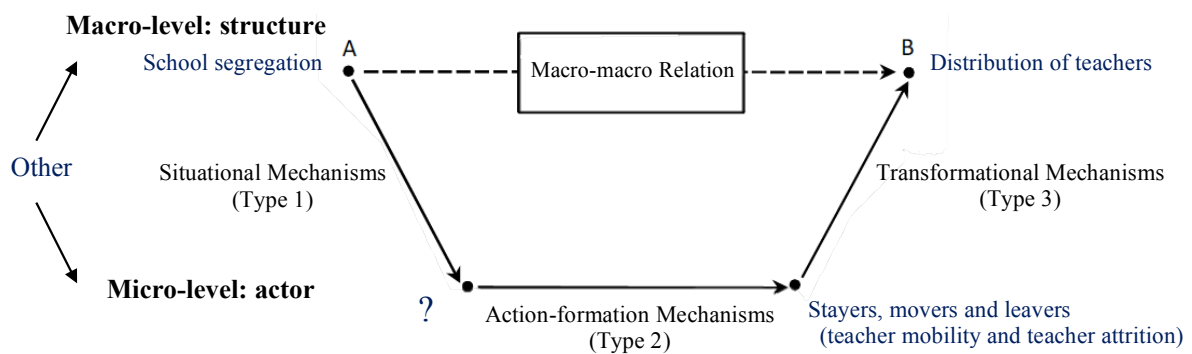
In this chapter, I give a brief review of previous literature into macro-phenomena like school segregation and the distribution of teachers. Hence, I document a “black-box” explanation at macro-level, between school segregation and distribution of teachers in schools. I argue that both school segregation, teacher turnover and distribution of teachers can be linked. Previous international research has documented that more skilled and experienced teachers have tended to prefer schools serving students with higher student achievements, less minority students, higher income students and schools seen as safer and with fewer disciplinary problems (Boyd, Lankford, Loeb, & Wyckoff, 2005; Clotfelter, Ladd, & Vigdor, 2005; Feng, 2009; Greenberg & McCall, 1974; Hanushek et al., 2004; Horng, 2009; Kalogrides et al., 2013; Scafidi et al., 2007). Hence, school segregation and student composition has been shown to influence teacher turnover, which in turn has been shown to impact on the distribution of teachers. The main focus is, however, the association between the share of minority students (macro-/meso-level) and teacher mobility and attrition (micro-level). I will not primarily focus on the potential link (Type 3 in Figure 2.1) between the micro- and macro-level.

Description comes logically and analytically before explanation and understanding (Birkelund, 2010). Due to relatively little research on this topic in Norway, macro-/meso-level descriptive statistics are presented in Chapter 6. The distribution of teachers, their characteristics and corresponding student compositions in lower secondary schools in Norway and Oslo, build a theoretical framework for the main analyses. Yet the next step is trying to specify the *causal mechanisms* behind social phenomena (Birkelund, 2010; Mastekaasa, 2010), like teacher turnover. Whether and how is student composition linked to teacher

mobility and attrition? In the main analyses in Chapter 7, I focus on the macro-micro-link between student composition and individuals' actions, such as teacher mobility and attrition at the micro-level.

By addressing push- and pull-factors, and applying a theory of action called the DBO model, I investigate how macro-/meso-level conditions and structures can result in teacher turnover. I examine whether the student composition can constitute the “question mark” (micro-level in Figure 2.2), but I also take into account that there are “Other” driving forces and mechanisms behind teacher turnover. For example, particular teacher characteristics, working conditions and school characteristics, as well as unobserved factors can influence teachers' desires, beliefs and opportunities to exit a school or the teaching profession.

Figure 2.2: Customised macro-micro-macro model including the suggested theoretical framework



2.3 School Segregation

To investigate the potential link between the share of minority students and teacher turnover, I give a brief review of what we know about macro-level phenomena such as school segregation, followed by a section on the distribution of teachers in schools. School segregation is usually measured by student characteristics at school-level and schools recruiting students with diverse backgrounds (Birkelund et al., 2010), and is closely related to residential segregation (Wessel 2000; Bratbakk og Wessel 2009, referred in, Birkelund et al., 2010). Both socio-economic status, ethnicity, race, culture and religion, as well as other factors may contribute to segregation (Rogne et al., 2021, p. 2).

Empirically, I review several findings from Oslo. This city is known for a sharp divide between Oslo East and West concerning population composition and housing structure

(Wessel, 2017, p. 81). Therefore, it is reasonable that the school segregation is higher in urban cities with diverse populations and homogenous residential areas. A Norwegian report by Birkelund et al. (2010, p. 20), found a strong negative correlation (Pearsons $r = -0.83$) between the share of students with parents with higher education and the share of minority students at lower secondary schools in Oslo. Hence, the main pattern was clear, schools with a low share of minority students also had high shares of parents with higher education, and vice versa. Furthermore, a recent paper by Rogne et al. (2021, p. 18), investigated native flight motivated by the school preferences of parents in Oslo, and concluded that “native families with pre-school children systematically move away from schools with high shares of students with non-Western immigrant backgrounds.”

There are reasons to suppose that free school choice, in primary and lower secondary school and/or higher secondary school, can reinforce the school segregation. In Norway, pupils in primary and lower secondary school have the right to go to their local school, and the catchment areas of the schools are defined by the municipality (The Norwegian Directorate for Education and Training, 2014). Thus, the family's place of residence generally influences which compulsory primary school a child belongs to. Hence, there are reasons to expect that these mechanisms also work in primary and lower secondary schools in Oslo, since parents have the opportunities to leave their local school by applying to another nearby schools (Rogne et al., 2021). Overall, the level of socio-economic segregation in primary- and lower secondary schools in Oslo is high, and still increasing (Hansen, 2017).

2.4 Teacher Sorting and Distribution of Teachers

Teacher mobility and attrition might lead to teacher sorting. Teacher quality is important for student achievements and the educational system (Falch & Strøm, 2005; Kunnskapsdepartementet, 2009). Thus, it is vital to recruit and retain skilled teachers in schools with a socially or economically disadvantaged student body. However, findings from the US have shown that schools with high shares of ethnic or racial minority students, low-income students and low-achieving students have been more likely to have fewer skilled and/or qualified teachers (see e.g., Clotfelter et al., 2005; Goldhaber, Choi, & Cramer, 2007; Lankford et al., 2002). Additionally, teachers in such schools have been more likely to move to a new school district (Hanushek et al., 2004).

Norwegian findings have suggested that the supply of certified teachers is unevenly

distributed across schools and especially negatively influenced by students with minority backgrounds (Bonesrønning et al., 2005). Certified teachers have also seemed to prefer large schools with few minority students (Falch & Strøm, 2005, p. 612). However, the ethnic segregation is not as severe as in the US (Bonesrønning et al., 2005). Empirically, this study does not differentiate between teachers' certifications, specialisations or grades. However, this above-mentioned information can be important to understand how school segregation, teacher turnover and the distribution of teachers might be interrelated.

3 Theoretical Perspectives

This chapter gives an overview of relevant theoretical perspectives, serving as analytical tools in the study of the association between student composition and teacher mobility and attrition. To fully apply the *customised macro-micro-macro model*, I consider the push- and pull-factors by Gambetta (1987), as well as the DBO model (Elster, 2015; Hedström, 2005), as a theory of action and interaction.

3.1 Mechanisms Behind Teacher Mobility and Attrition – How and Why Are Teachers Leaving?

Teacher mobility and teacher attrition are driven by several different mechanisms. Gaining more information about the association between the share of minority students and teacher turnover might contribute to improved stability within a school and learning context, as well as the teacher labour market. Moreover, it can potentially illustrate exposed areas, in which the teacher turnover rates might be higher at schools with particular student body compositions.

3.1.1 Push- and Pull-factors

Choices made by individuals in the labour market and specifically teachers' mobility patterns, may be driven by different mechanisms. Arguably, the theory of *push- and pull-factors* can be used to approach mechanism-based explanations of individual actions at a micro-level. According to Gambetta (1987), there are different views of the individual agent. The *push-factors* are linked to causality and the *pull-factors* to intentionality. *Push-factors* are either 1) understood as external constraints where the individual has no choices (*structuralist approach*), or 2) as a result of social- or psychological causes, non-transparent for the individual's consciousness, which push the agents towards a given course of action (Gambetta, 1987, pp. 8, 11). *Pull-factors* are linked to an intentional agent, which through personal preferences is capable of planning its life- and career course based on an evaluated probability of success (Gambetta, 1987, p. 61).

In line with the pushed-from-behind-view (Gambetta, 1987), push-factors can be

linked to current factors or circumstances, that can influence teachers' desires to exit a particular school or the teaching profession. In contrast, pull-factors are regarded as factors that influence, motivate and/or attract teachers to other opportunities, either move to a competing school, another profession or choose final retirement³.

In light of international research, teacher mobility and attrition can be seen as a result of involuntary demand reductions made by the schools and school districts and/or “voluntary supply choices by individual teachers” (Gritz & Theobald, 1996, p. 486). Reductions in the teacher force or a closure of a school are considered to be external push-factors, outside of the individual's desires or control. While, in accordance with pull-factors, individuals are “capable of purposive action and weighing the available alternatives with respect to some future reward” (Gambetta, 1987, p. 7), which may influence the individual to voluntarily exit a school or the profession, given the opportunity to do so. Based on the focus on voluntary exits and the intentional actions in the labour market, I mainly focus on pull-factors throughout this study.

3.1.2 The DBO Model

Several factors may influence teacher's propensity to exit a school and/or the teaching profession. In line with mechanism-based explanations and analytical sociology (Elster, 2015; Hedström, 2005), the DBO model constitutes a comprehensive framework of theories of action and interaction. The DBO model will be used to capture some of the mechanisms that influence the actions of teachers, given the opportunities they have.

In accordance with the desire to avoid a “black-box” explanation, the DBO model can offer various mechanisms behind teacher mobility and attrition. In line with analytical sociology, theories of action and interaction, form the basis of explanatory sociological theories. When analysing actions and interactions between teachers, the DBO model can capture the notion that actions are shaped by individuals' Desires, Beliefs and Opportunities. A *desire* is a wish or longing, a *belief* is described as a statement about the world which is valid, and *opportunities* are the real action alternatives that exists independently of the actor's beliefs about them, or just the available options or means to the agent (Elster, 2015, p. 190; Hedström, 2005). Moreover, a theory of action and interaction should also “explain action in

³ In Norway, the maximum retirement age is 67-70 years (Tiplic, Brandmo, & Elstad, 2015).

intentional terms” (Hedström, 2005, p. 36), meaning that an action should be explained by referring to the upcoming situation the action was intended to produce. The mental states and motivational forces; beliefs and desires are considered as the reasoning behind actions.

In line with the intentional dimension, the concept *action* differs from *behaviour*, in which the former concept denotes intentional actions from individuals, whereas the latter merely refers to behaviour, such as sneezing while looking at the sun or snoring while sleeping (Hedström, 2005). According to the DBO model, actors do not act completely rationally, such as in rational-choice-explanations, instead they act intentionally and reasonably (Hedström, 2005, pp. 38, 61). If I assume that voluntary quit-decisions from a school and/or the profession are intentional actions, a teacher's desires and beliefs compose compelling reasons for quit-actions. Given the opportunities the teacher has, he/she can be “pushed- and pulled” to a competing school or profession in the labour market.

4 Previous Research and Hypotheses

Both sociologists, psychologists, industrial researchers and economists have studied teacher turnover. This chapter aims to establish what is previously known about this topic. Since there is relatively little research in this field from Norway and Europe, the majority of previous research I refer to, is from the US. I will also discuss data- and methodological limitations of previous research. Last, I introduce my hypotheses regarding the association between the share of minority students and teacher mobility and attrition.

4.1 Pecuniary and Non-Pecuniary Job Characteristics

Teacher mobility and teacher attrition are influenced by many factors (Boyd et al., 2005). Are teachers quitting due to dissatisfaction with pecuniary factors such as salaries, or other non-pecuniary job factors? Examples of non-pecuniary factors are that of preparation time, facilities, student- and school characteristics, class size, and/or school leadership (Boyd et al., 2005). In general, sociologists, psychologists and industrial researchers have paid attention to non-pecuniary job characteristics for worker turnover, whereas economists have focused more on pay as the leading incentive for quit-decisions of workers (Falch & Strøm, 2005, p. 611).

4.1.1 Pecuniary Factors

International economic research on teacher turnover has typically assumed that expected utility from staying in a current job is compared with expected utility potentially realised in the “next best alternative” (Mont & Rees, 1996, p. 156). Workers compare working conditions and pecuniary rewards for both the current and alternative jobs. Using an economics grounded framework, several earlier studies from the US, UK and Norway have indicated that wage premiums and salary increases have reduced teacher's exits from schools and/or teacher's propensities to quit the profession (Baugh & Stone, 1982; Brewer, 1996; Dolton & van der Klaauw, 1999; Falch, 2011; Gritz & Theobald, 1996; Imazeki, 2005; Murnane & Olsen, 1989, 1990; Rickman & Parker, 1990; Stinebrickner, 2001; Theobald, 1990). Falch (2011, p. 464) studied teacher turnover decisions in Norway, and found that the effects of a wage premium on voluntary resignations were significant, but not massive.

Despite that several studies have documented the association between pecuniary

factors and teacher turnover, several institutional and contextual conditions in Norway makes it less relevant to exclusively consider pecuniary factors. First, there is hardly any national variation in teacher pay in Norway, compared to for example the US. Rigid wages characterise the teacher labour market in most European countries (Falch & Rønning, 2007). In Norway, national bargains between the teacher union and the central government regulate teacher wages and their workload (Falch & Strøm, 2005, p. 614), and it is largely based on the level of formal education and teaching experience. Thus, schools and school districts cannot use pecuniary factors as an incentive to attract and retain teachers. However, whereas wage differences can only partially motivate job to job mobility and attrition (Falch & Strøm, 2005), non-pecuniary job attributes, like the share of minority students, can be important determinants of teacher turnover. Central in this thesis is therefore to investigate whether and how the share of minority students is associated with teacher mobility and attrition in Norway.

4.1.2 Non-Pecuniary Factors

Previous studies have suggested that non-pecuniary job characteristics are relevant factors linked to teacher mobility and quit-decisions (Djonko-Moore, 2016; Falch & Rønning, 2007; Falch & Strøm, 2005; Feng, 2009; Greenberg & McCall, 1974; Hanushek et al., 2004; Mont & Rees, 1996; Scafidi et al., 2007). Some turnover is natural and expected during each school year. Quit-decisions can be associated with teacher characteristics related to life and career stages, such as age and experience (Allensworth, Ponisciak, & Mazzeo, 2009, p. 16), or relocation due to family- and career reasons. Teachers' sex, minority background, education and/or specialisation are also demographic characteristics related to teachers' quit-decisions. In the following section I consider some non-pecuniary factors, focusing mainly on association between the share of minority students and teacher turnover.

4.2 Student Composition and Teacher Mobility and Teacher Attrition

Previous studies using US data have indicated that students' socio-economic status, proportion of minority students, and student achievements are linked to teacher turnover (Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007). Greenberg and McCall (1974), economists and pioneers in the field, found that highly

experienced teachers appear to be least likely to move to another school. Yet, if they were to move, they tended to leave schools with large concentrations of minority students, and low student achievements (Greenberg & McCall, 1974, p. 4). Findings by Hanushek et al. (2004), indicated that teacher mobility or attrition from elementary schools are linked to the concentration of racial minority students and academic achievements, although salary also had a slight impact. *Movers* in their study tended to transition to schools with lower concentrations of minority students, and higher levels of academic achievement (Vagi & Pivovarova 2017).

Table 4.1: Illustration of non-pecuniary factors on teacher turnover within the proposed analytical framework

Push- and pull-factors and the DBO model		
	Push-factors	Pull-factors
<i>Non-pecuniary factors: student composition</i>	1) <i>Structuralist approach:</i> External constraints: the sole opportunity is to work in a school with a particular student composition. E.g., high share of minority students. 2) <i>Social- or psychological causes:</i> Personal beliefs about e.g., working conditions in the teachers' current school.	Desires about more satisfying working conditions in a competing school or profession. Related to e.g. a student composition, higher self-efficacy and/or less work-related stress etc. Given the perceived risks and opportunities, teachers believe that exiting a school and/or the profession offers more favourable working conditions.

4.2.1 Beginner Teachers and Their Teacher Mobility and Attrition Paths

Beginner or *novice* teachers, defined as teachers with less than five years of experience (Vagi & Pivovarova, 2017), is a group of particular interest to researchers. Beginner teachers are most likely to have less *human capital* (Becker, 1993) in terms of both education, specialisation and seniority, compared to more experienced teachers. I differentiate between teachers' age groups as a proxy for seniority. Yet, previous studies of beginner teachers are relevant because these individuals typically are younger in age than more experienced

teachers.

According to previous research on teacher mobility using US data, beginner teachers and teachers in their first teaching assignment have been more exposed to schools with high percentages of student with low achievements, low-income students and/or minority students, and have been less likely to stay in these particular schools (Clotfelter et al., 2005; Feng, 2009; Gritz & Theobald, 1996; Lankford et al., 2002; Scafidi et al., 2007).

Two comprehensive studies using US data explored teacher turnover among beginner teachers. Findings from Scafidi et al. (2007, p. 145), showed that beginner teachers are more likely to move from schools serving students with lower income, lower test scores, or higher proportions of minority students. Exits from low-performing schools was explained by teacher preferences for fewer minority students (Boyd et al., 2005). Furthermore, schools that had the highest rates of teacher attrition were schools with large percentages of black students (Scafidi et al., 2007, pp. 157-158). Some years later, Feng (2009), distinguished between beginner public school teachers' different labour market choices. Findings showed that teachers were “significantly more likely to move away from schools with high proportions of minority, low-income, and low-achieving students” (Feng, 2009, pp. 1177, 1187). Previous US research on quit-actions among beginner teachers is relatively consistent. The findings from Scafidi et al. (2007) were “remarkably similar” to the work of Hanushek et al. (2004) and consistent with Lankford et al. (2002). *Movers* have tended to transfer to schools with lower minority student shares and higher levels of academic achievement.

Overall, previous US studies focusing on the link between student composition and teacher mobility and attrition have found fairly similar tendencies, where minority students repeatedly have been associated with teacher turnover (Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007).

Regarding teacher turnover in the US, it is key to consider the organisation *Teach for America (TFA)* and its program.⁴ Schools across the US staff “graduates of elite colleges to teach in low-income urban and rural schools for a two-year commitment”, as part of the TFA program (Heilig & Jez, 2010, p. 1). TFA teachers help combat issues of teacher shortages and low-quality teachers, yet constant turnover and costs of continual recruitment and training are key challenges linked to this program. On average, TFA teachers are more likely to leave than teachers from more traditional teaching routes (see e.g., Boyd et al., 2011, p. 305). High rates

⁴ For the sake of brevity, I do not go into detail about TFA. For further description, see for example Heilig and Jez (2010).

of teacher turnover are anticipated since the two-year commitment in for example urban or rural schools with low-income families can be seen as a short-term stopover for some teachers.

4.3 Teacher Mobility and Attrition: The Case of Norway

4.3.1 Societal and Institutional Arrangements

Substantial differences between countries should be expected to lead to differences between the international findings and national findings. First, Norway and its social-democratic welfare state differs from the liberal welfare states in the US and the UK, where the majority of research on this topic comes from. The welfare state of a country influences the institutional- and labour market context, as well as salary policies. Second, the ethnic and socio-economic segregation in schools and neighbourhoods in Norway is not as severe as the situation in the US.

Importantly, it is not without difficulties to compare the societal and institutional contexts in different countries. Features of the Norwegian school system and labour market differ to the US and the UK. Thus, I expect a less strong association between student composition and teacher turnover in Norway. The lower secondary schools across Norway are relatively similar in terms of organisation and schooling. The local governments in Norway are responsible for the public primary and lower secondary education, from 1st to 10th grade, and enrolment in both is “free of user charges” (Falch & Strøm, 2005, p. 613). Unlike school districts in the US, local governments in Norway perform numerous institutional tasks, and provide several services such as preschool education, elderly care, infrastructure, as well as primary and lower secondary education (Falch & Strøm, 2005, p. 613). In the US, both local states and parents financially make contributions to several schools, and free school choice exists within several of the local governments. Hence, local school variations are expected to be higher in the US.

Hiring decisions and allocation of teachers can influence the distribution of teachers across schools, but these procedures are not identical across countries. In contrast to the US school system, where the allocation of teachers between schools in school districts is determined by for example the school district authorities, local governments in Norway are not directly involved in hiring decisions (Falch & Strøm, 2005). In Norway, school principals have the mandate to determine the outcome of hiring processes at each particular school. In

addition, according to legal rule in Norway, a teacher position can only be appointed to an applicant without formal certification when there are no certified teachers that willingly take the job (Falch & Strøm, 2005).

Institutionally, there are differences between the Norwegian setting and the US setting in terms of involuntary and voluntary quits. In Norway, the majority of the transitions between schools are seen as voluntary quits. Teachers are linked to the schools, and they can only be replaced against their will if the number of students at their particular school is exposed to serious reduction, related to for example a closure of the school (Falch & Rønning, 2007, p. 179). However, in an US setting, teachers are linked to the school districts, which enables the districts, to some degree, to instruct the teachers to switch schools within the school district. Therefore, studies using US data both cover transitions as a result of teacher preferences and school districts' preferences. I do not differentiate between involuntary and voluntary quits and/or school closures, due to insufficient data.

4.3.2 Oslo and the Oslo-school

Based on previous literature using US data, there are reasons to consider the association between the share of minority students and teacher turnover to be different in Oslo than in Norway at large. With large differences between Oslo East and West with regard to population composition and housing structure (Wessel, 2017, p. 81), there are several minority-dense parts within a relative small geographical area. For example, for school year 2019/2020 there were in total eight schools with more than 90% minority students in Oslo, and four out of these schools were either combined primary- and lower secondary schools or solely lower secondary schools (Oslo kommune Statistikkbanken, 2019). The majority of the immigrant population with low socio-economic status have settled in the eastern part of Oslo, and the ethnic majority have tended to “move out of neighbourhoods with a high proportion of ethnic inhabitants”, thus the differences between Oslo East and West are enhanced (S. N. Fekjær & Birkelund, 2007, p. 311). In addition, children of immigrants also settle in a way that maintains, and to some extent contributes to an increase in the ethnic segregation in Oslo (Wessel, 2017). Moreover, among resourceful immigrants, concentrated immigrant settlement is to a lesser extent considered as attractive and desirable (Blom, 2012). Norwegian studies have found increasing social and ethnic segregation in Oslo (Bjordal, 2016; Hansen, 2017), but despite the tendency that immigrant and minority people are overrepresented in urban areas, the level of ethnic and residential segregation is less than in for example the US (Falch

& Strøm, 2005, p. 616), and of a moderate level in an international context (Blom, 2002).

Furthermore, socio-economic and ethnic residential segregation is linked to segregation in schools in Oslo. Hence, the structural school components, equal to components of neighbourhoods, are to a large degree determined by segregation processes along ethnic and socio-economic lines, with some schools that might handle more difficult situations than other schools (Olsson & Modin, 2020, p. 159). A possible reason for the high and sharply rising levels of socio-economic segregation in primary schools (1st to 10th grade) in Oslo, is the large proportion of students with a minority background, which often have parents in the lower income categories (Hansen, 2017, p. 264).

There are also reasons to believe that the socio-economic and ethnic segregation in schools and neighbourhoods in Oslo, is further exacerbated by free school choice. Despite the local school principle [Nærskoleprinsippet] and boundaries for school districts in primary school (1st to 10th grade), free school choice seems to reinforce parents' active choice of schools for their children (Utdanningsetaten Oslo kommune, 2017). The public schools in Oslo have “guiding admission areas”, but parents are able to apply for another school than the school assigned to them, both within and outside of the admission area (Haugen, 2020). In two Norwegian studies, Bjordal (2016) and Hansen (2017) have found that school choice increases segregation in primary and lower secondary schools. Moreover, school segregation is not only explained by segregated housing, but school choices in Oslo increases segregation in local communities, since two schools located close together have very different student compositions (Haugen, 2020, p. 68). Moreover, according to Sandsør (2020, p. 3), free school choice in upper secondary school can influence teacher mobility. Previous research from US on teacher mobility, shows that signs of poor teacher quality influences the best teachers to exit (Feng et al., 2018). Hence, if free school choice leads to increased segregation, attractive schools might be appealing for both effective students and effective teachers, whereas less attractive schools might have higher teacher exit rates among effective teachers.

Apart from student characteristics, the schools' locations can be essential for teachers and have an impact on their quit-actions. Findings from Norway, have shown that the quit rates from schools are “higher in large local governments than in small local governments”, but this may be linked to more school choice alternatives in larger areas (Falch & Strøm, 2005, p. 625). Previous US research has suggested that teacher turnover rates tend to be particularly high urban schools, especially schools in large urban regions, compared to other areas (Lankford et al., 2002), and also in urban and rural districts with the most low-income students (Imazeki, 2005). Schools in urban areas with economically disadvantaged and

minority students appear particularly vulnerable for teacher turnover (Hanushek et al., 2004). In the study by Lankford et al. (2002), the findings showed that teachers who exit urban schools and high-poverty schools are likely to have greater skills than the teachers who choose to stay in a particular school. The findings also showed that novice teachers in urban schools in New York City are far more likely to leave public school teaching in this state, compared to other teachers in the same state (Lankford et al., 2002, p. 49).

The average number of individuals moving in and out of Oslo is likely to be high, compared to the average number of relocations in Norway as a whole. Regional differences in living costs and opportunities (Falch & Strøm, 2005) in Norway, might influence the degree of relocations and in return influence teacher mobility- and attrition rates. According to an article in the *Finansavisen*, there is a rapid rise of housing prices in Oslo (Løvteit, 2020), and has been for several years. Moreover, the labour market pressure may be higher in a greatly populated city like Oslo. These factors may constitute *push-factors* that force individuals to move out of Oslo, and exit a school or the profession, independent of the student composition. Statistics Norway have shown that young people move more often than older people, and that many people move out of Oslo to the neighbouring municipalities (Mårdalen, 2019). The total number of relocations (out of Oslo), between years 2003—2020, were between approximately between 29 000 to 44 000 (rounded up) per year (Statistics Norway, 2021). In comparison, relocations out the neighbouring municipality Bærum, for the same period, were between 6 000 to 8 000 per year.

4.3.3 Minority Students and Potential Link to Teacher Mobility and Teacher Attrition

The main explanatory variable, share of minority students, tries to capture a certain student composition that possibly requires more resources and more “culturally responsive training”⁵ in a school-setting. In addition, some teachers might hold biases or have prejudices against certain student compositions (Abacioglu et al., 2019). In this section, I provide several possible mechanisms or reasons for how the share of minority students can be linked to

⁵ Culturally responsive teaching (CRT) is defined as “using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them” and has been linked to increased engagement and academic achievement in school (Abacioglu, Volman, & Fischer, 2020, p. 737).

teachers' leaving a school or the teaching profession.

The first explanation is that high shares of minority students at school-level can require more demanding teacher tasks. Complex teacher tasks can be demanding, and demanding working situations might create desires to leave a particular school or the teaching profession (Tiplic et al., 2015). Expectations about more demanding working conditions can be one of the reasons why, especially newly qualified teachers in Norway have tended to avoid low-performing and multicultural schools (Bonesrønning et al., 2005; Falch & Strøm, 2005). Students with minority backgrounds have rightful claims to additional language instruction until they have a good command of Norwegian language (Bonesrønning et al., 2005). In line with Falch and Strøm (2005, p. 617), instruction of students with targeted resources is anticipated to require more teacher effort than the instruction of students without these targeted resources, due to language problems and a more demanding communication with parents. Cooperation with parental groups with minority backgrounds and low education might also be more challenging for teachers. Qualitative results from interviews in a Norwegian master's thesis in adapted education regarding cooperation between teachers and minority parents, showed that low-educated minority parents had little knowledge of the school's expectations, and were not aware of their responsibilities regarding children's training and education. However, engaging parents with minority background was not more difficult for teachers in general (Aghdam, 2009, pp. 70-71).

Another explanation, in line with the first idea, is that teachers prefer pleasant working conditions over less satisfying ones (Falch & Rønning, 2007). An international study showed that the main source of satisfaction among teachers in Australia, New Zealand, England and US is “the opportunity to make a difference and contribute to children's development.” (Scott, Stone & Dinham, 2001, referred in E. M. Skaalvik & Skaalvik, 2011, p. 369). Moreover, to work with youth and to contribute to society are important motivations for teachers (With, 2017). Findings from the US, have shown that the most “effective” teachers, who promote positive student outcomes, are “more likely than other teachers to stay in low-performing schools with more challenging teaching environments” (Goldhaber et al. 2007, referred in Allensworth et al., 2009, p. 5). If teachers in schools with high shares of minority students in Norway and Oslo face more demanding working conditions or struggle to realise certain teacher ambitions, can it be associated with teacher mobility and attrition?

For constructing further explanations behind teacher turnover, I review whether minority students and low student performances is associated. In Norway, politicians have expressed concerns about whether ethnically segregated schools have a negative impact on

the learning environment of students (Hardoy & Schøne, 2013, p. 2). Several studies from the US have reported that ethnic minority students score lower on academic achievement compared to their ethnic majority peers (Dee, 2005; Glock, 2016), however there are variations across students' ethnic origin. Findings from Norway have indicated that student achievements have a negative impact on teacher turnover, and that teachers tend to exit schools with low student performances (Falch & Rønning, 2007, pp. 187, 194). Moreover, school classes with high proportions of minority students are likely to have a higher share of students with language problems and students with low school performance (S. N. Fekjær & Birkelund, 2007). For immigrants, a lack of mastery of the official language in a country is an obvious cause of poorer educational performances (Birkelund & Mastekaasa, 2009a). Moreover, it is well established that immigrants and children of immigrants in Norway achieve poorer grades and test scores than children of Norwegian background (Birkelund & Mastekaasa, 2009b). Bakken (2003), also concluded that minority language students in Norway gain lower grades than other student groups in school.

However, not all minority groups perform poorly in the Norwegian school system. Previous research from Norway has shown that there are considerable differences between individuals with different country backgrounds (Birkelund & Mastekaasa, 2009a, p. 227; N. S. Fekjær, 2006; Høydahl, 2008). For example, individuals with Vietnamese origin have tended to perform relatively well in the educational system in Western countries, compared with most other minority groups (see e.g., S. Fekjær & Leirvik, 2011, p. 118). Moreover, S. N. Fekjær and Birkelund (2007), investigated the effect of ethnic composition in *upper* secondary school in Oslo on educational achievement and educational attainment, and found no negative effect of ethnic composition on students' grades and educational attainment. In Norway, minority language students do more homework than majority students and several minority students have higher educational aspirations compared to majority students (Hegna, 2014, p. 100), and students with non-western immigrant parents have tended to choose ambitious educational choices (Birkelund & Mastekaasa, 2009b). Among descendants of immigrants, immigrant parents do encourage their children to pursue higher education, and these mechanisms are often referred to as “immigrant drive” (Birkelund & Mastekaasa, 2009a). There is a strong recruitment to professional educations like dentistry, pharmacy, law, engineering and medicine among several descendant groups and these educations expresses status, gratitude or appreciation among the ethnic networks of the families (S. Fekjær & Leirvik, 2011; Leirvik, 2016). The performance gap in the Norwegian educational system can in large parts be linked to minority language students growing up in families with poorer

economy, lower educational level and less access to for example books and PC (Bakken, 2003).

Overall, based on diverse findings concerning minority students, the expectations about the association between the share of minority students and teacher mobility and teacher attrition is not entirely clear-cut.

4.3.4 Are Minority Students Associated with Teacher Mobility and/or Teacher Attrition in Norway?

Previously there has been relatively little research on teacher mobility and attrition in Norway and Oslo. The findings on the association between minority students and teacher mobility and/or teacher attrition are also mixed. Two Norwegian studies, with a perspective of economics, concerning student composition and teacher mobility are interesting. Considering that several of the international and national studies have different aims, the findings from Falch and Strøm (2005) are in line with previous international research indicating that teachers have tended to leave schools with high shares of ethnic or racial minority students (Greenberg & McCall, 1974; Hanushek et al., 2004; Scafidi et al., 2007), whereas Falch and Rønning (2007) diverges from the other studies.

Falch and Strøm (2005, p. 611) used data covering Norwegian primary and lower secondary schools and findings showed that teachers' propensity to exit is especially high in schools with high proportions of minority students and students with special needs. Two years later, Falch and Rønning (2007) investigated teachers' decisions to exit schools, both in primary school and lower- and upper secondary school, and teachers that leave public schools completely. Their findings indicated that *student performances* have a negative effect on teacher turnover, and that teachers tend to leave schools with low student performances (Falch & Rønning, 2007, pp. 187, 195). However, their findings contradicted previous research since “the share of students with special needs and the share of minority students, and the amount of extra resources directed to these students”, only have a small and insignificant effect on teacher turnover in Norway (Falch & Rønning, 2007, p. 189).

Previous national studies focusing on teacher attrition have largely focused on several individual, organisational and contextual factors (see e.g., Gjefsen & Gunnes, 2015; Mausestagen, 2013; C. Skaalvik, 2020; E. M. Skaalvik & Skaalvik, 2011, 2018). A Norwegian study stated that the strongest predictor of motivation to leave the teaching

profession is lack of job satisfaction (E. M. Skaalvik & Skaalvik, 2011, p. 369), and this might be linked to student composition at school-level. Hence, from a research and policy perspective (Barbieri et al., 2011), this study offers important contributions to understanding the association between the share of minority students and teacher mobility and attrition.

4.3.5 Does the Association Between Minority Students and Teacher Mobility and/or Attrition Vary with Teacher Characteristics?

To investigate the association between the minority student share and teacher turnover, I am also interested in whether the association vary with teacher characteristics. Teachers may desire different working conditions and have different job opportunities in the labour market. I specifically look into previous research on the teacher characteristics like sex, immigrant background, age and experience.

4.3.5.1 Teachers' Sex

Individual characteristics may lead to different turnover patterns between male and female teachers. A shared assumption in previous international literature is that female teachers have higher propensities to leave teaching than male teachers, with the intention to take care of children (Falch & Strøm, 2005, p. 618). Teachers' sex and age are possibly capturing some effects of family situation. With regard to family setting, Scandinavian countries have “generous rules for leave due to birth [...] and heavily subsidized governmental childcare” (Falch & Strøm, 2005, p. 618). A Swedish study of teacher attrition among beginner teachers showed that there was no statistical differences in the attrition rates between male and female teachers, when parental leave was taken into account (Lindqvist, Nordäng, & Carlsson, 2014, p. 98). Thus, the picture is anticipated to be different in Norway than for example in the US, yet possibly similar to the findings from Sweden.

In Norway, studies have indicated that male teachers have a higher propensity to exit a school than female teachers. Falch and Strøm (2005, p. 623) found that female teachers had a 0.6 percentage point lower probability for teacher mobility from a school, compared to male teachers. Moreover, another study supported that male teachers have a higher propensity to leave the profession (With, 2017). In an article from the Union of Education of Norway, 37

percent of male teachers who started teaching in 2006 had left the profession in 2017, compared to 31 percent of female teachers (Lund, Vik, & Gosh, 2017).

In contrast, previous research from the US, with relatively old data, has shown that women have been more likely to leave teaching, compared to men, and this has been related to family reasons and child rearing (Murnane & Olsen, 1989; Stinebrickner, 1998). Dolton and van der Klaauw (1999) found that family reasons are less significant for quit-decisions, whereas Stinebrickner (2001) stressed that women's marital status and number of children are important predictors of exits out of the workforce (Stinebrickner, 2001, pp. 224-225).

Several studies on this topic using US data have also suggested that there are differences between men and women concerning teacher attrition. Gritz and Theobald (1996) found that male teachers have remained in their first teaching position longer than female teachers in similar environments, and especially at secondary level. Findings from a public school in Wisconsin showed that female teachers were less likely to leave the teaching profession if they began teaching at an older age, whereas men were more likely to leave teaching if they began at older age (Imazeki, 2005).

All these studies have focused on various determinants of teacher turnover and used different measures of mobility, which is important to notice when comparing the studies. Several studies do not seem to differentiate between exits from the teaching profession due to temporary parental leave or other reasons. Falch and Strøm (2005), however, did not classify teachers on parental leave as quitters in the analyses. However, the general pattern is that there are differences between Norwegian and US research. Findings from Norway showed that male teachers have a higher propensity to exit a particular school or the teaching profession (Falch & Strøm, 2005; With, 2017), whereas it seems to be the opposite case in the US (Gritz & Theobald, 1996; Murnane & Olsen, 1989; Stinebrickner, 1998).

4.3.5.2 Teachers' Own Ethnic/Minority/Racial Background

Previous research using US data has shown that there are distinct differences in teachers' mobility patterns related to teachers' ethnic or racial minority backgrounds. As previously discussed in the introductory chapter (Section 1.1.4), the terms “ethnic” and “racial” minority backgrounds are not identical terms, yet try to capture dichotomies between a majority and minority in a given population.

Dissimilarities in mobility patterns have been linked to the interaction between particular student compositions and teachers' racial backgrounds. White male teachers in the

US have been significantly more likely to leave a school or the teaching profession if the proportion of non-white students increases (Imazeki, 2005). Similarly, if the share of white students decreased and the black student shares increased, white and Hispanic teachers have been more likely to exit schools (Boyd et al., 2005). Moreover, a study indicated that white teachers have higher job satisfaction- and degree of commitment in schools where students and colleagues are the same race (Mueller et al. 1999, referred in Djonko-Moore, 2016, p. 1068).

US research has shown that not all teachers exit schools with high shares of black students (Boyd et al., 2005; Hanushek et al., 2004; Imazeki, 2005). Imazeki (2005) indicated that non-white women are more likely to exit a school and/or leave the teaching profession in general, but the effect is reduced if they work at schools with larger proportions of non-white students. Moreover, black teachers have tended to change to schools with higher black concentrations than the schools they exited (Hanushek et al., 2004, p. 340). A black teacher who grew up in a poor neighbourhood may think it is more “personally rewarding to teach economically disadvantaged black students than white students from affluent families”, despite that the former group, in some areas, may be regarded as more demanding to teach (Feng, 2009, p. 1171). Similar motivational tendencies have been reported in Norway. Qualitative interviews with students with an immigrant background studying to become teachers in Norway have shown that they considered themselves to be important future role models for students with immigrant background, and believed their language skills would be valuable for students with the same language background (Island, 2007, referred in, Spernes, 2016).

The potential underlying mechanisms connecting ethnicity and/or race to teacher mobility may be challenging to disentangle (Hanushek et al., 2004, p. 340). It might be dissimilarities in teacher preferences and/or patterns for residential settlements. If teachers desire to work closer to where they live, and there is large ethnic and socio-economic residential segregation, minority teachers might live in neighbourhoods with large concentrations of minority students and thus work in schools serving high shares of minority students.

Overall, according to international findings teachers tend to favour working at schools with students of the same racial group. Studies have shown that teachers from a racial minority background practice different mobility patterns, compared to majority teachers. Thus, indicating that several minority teachers have preferences for working with students

with minority backgrounds (Boyd et al., 2005; Feng, 2009; Hanushek et al., 2004; Imazeki, 2005).

4.3.5.3 Teachers' Age and Experience

In regard to teacher mobility patterns, teachers' age and experience seems to be important characteristics. There is mixed evidence of age on teacher mobility and teacher attrition. International findings show that teacher mobility from schools is higher among teachers who are young or old in age, compared to middle-aged teachers (Allensworth et al., 2009; Barbieri et al., 2011; Boyd et al., 2011; Efers, Plecki, & Knapp, 2006; Gilbert, 2011). In regard to teacher attrition from the profession, as indicated by previous US studies (e.g., Eberts, 1987; Greenberg & McCall, 1974; Hanushek et al., 2004; Mont & Rees, 1996), the probability that a teacher leaves his/her current job is high during the first years of teaching. Then it gradually decreases after a few years, and again increases as coming closer to the teachers' retirement age. So, teacher attrition rates are higher among those recently graduated or near retirement (Grissmer & Kirby, 1992; Guarino et al., 2006, referred in, With, 2017). Results from Norway have indicated that “the turnover rate is declining in age” (Falch & Strøm, 2005, p. 619), with on average higher turnover rates among young teachers than older teachers. Moreover, inexperienced teachers in Norway have tended to have the highest attrition rates, yet according to With (2017) the average attrition rates presented have been relatively low in comparison to attrition levels from countries like the US and the UK.

After a few years of repeated job changes, most workers settle down – at least for some time. Greenberg and McCall (1974), stated that highly experienced teachers appear to be the least likely to move to another school. The researchers suggested that this was seemingly because experienced workers have already found a teaching position to their liking and because the time they have spent in their current assignment represents an important investment in specific human capital (Becker, 1993; Greenberg & McCall, 1974, p. 500). Moreover, desirable positions in the teacher labour market might be less accessible for young teachers due to, among other things, lack of specific human capital. The mobility and attrition patterns are often illustrated as an U-shaped pattern, in which beginner teachers leave at higher rates than experienced teachers, and several teachers leave the teaching profession before maximum retirement age (Tiplic et al., 2015, p. 452).

Summarised, the general pattern concerning the association between age, experience and teacher mobility and teacher attrition is clear. Teachers' propensity to exit a particular school is higher among young teachers, than old teachers (Barbieri et al., 2011; Boyd et al.,

2011; Elfers et al., 2006; Falch & Strøm, 2005; Gilbert, 2011). Moreover, the propensity to leave the profession and the teacher attrition rates tend to be higher among beginner teachers and teachers near retirement age (Eberts, 1987; Greenberg & McCall, 1974; Mont & Rees, 1996; With, 2017), often illustrated by the U-shaped pattern (Tiplic et al., 2015).

4.4 Limitations of Previous Research

4.4.1 A Pragmatic Framework without Theoretical and Generalisable Theories?

The majority of the international and Norwegian literature in this field has arguably used estimation strategies related to a “pragmatic” framework – a policy-oriented and practical-related approach. Studies have offered political and practical advice to school districts and decision makers, in order to preserve teachers (Vagi & Pivovarova, 2017, p. 783). As suggested by Feng (2009, p. 1187), “[offering] differential pay to teachers willing to teach in such “hard-to-staff” schools could overcome the non-monetary disadvantages these schools face but would be costly”.

Recently, teacher mobility research has been criticised, for its lack of theoretical and generalizable theories. Vagi and Pivovarova (2017) investigated 40 teacher mobility studies, published the last 10 years and criticised the research for its shortcomings of theories. The researchers suggested to incorporate an organisational psychological framework to provide perspectives focusing on institutional characteristics, and thereby are able account for several teachers- and school-level factors. Despite the informative theoretical proposals⁶ from the comprehensive review article, not all of these perspectives are appropriate for the purposes of this thesis, but the criticism is still highly important for the research field.

On the other hand, it is difficult to estimate the connection between teacher characteristics and student characteristics, and this might contribute to the amount of teacher mobility studies with a so called pragmatic focus. Scafidi et al. (2007, p. 152) have claimed that their results and other studies in this field are best seen as being descriptive analyses. In other words, studies that map which schools that have the highest teacher turnover rates, bring

⁶ For the sake of brevity, I will not go into detail about the theoretical suggestions. For elaboration, see Vagi and Pivovarova (2017, pp. 784-789)

forth information to policymakers. As claimed by Scafidi et al. (2007, pp. 151-152) it can be extremely difficult to credibly estimate the *causal* impact of school characteristics, and illustrate that teaching mobility happens because of the student composition with particular student characteristics. Following Scafidi et al. (2007) and their arguments, analyses in this field can be demanding to accomplish, and the credibility of various studies can be questioned. Some “variation in school characteristics across teachers is generated by the decision of teachers and districts”, and these decisions are partly conditioned by unobserved preferences and quality of teachers (Scafidi et al., 2007, p. 152). To be able to partly solve these problems, I include school-fixed effect models and control for potentially confounding time-invariant variables. In Chapter 5 I elaborate the methods further.

4.4.2 Data- and Methodological Limitations of Previous Research

Despite an extensive number of international studies covering teacher mobility and teacher attrition, there are considerable reasons to interpret the findings with cautions. Several previous studies have been exposed to data shortages in different areas, which then have led to methodological limitations. First, several studies using US data have only covered specific states. This is methodologically problematic because the data does not cover teacher mobility outcomes outside of the particular state. Teachers who move to another school outside of the particular state are then implicitly treated as if they leave the educational sector, due to missing data (Falch & Strøm, 2005, p. 612). To avoid methodological limitations regarding geographical selection in this thesis, I first study teachers in lower secondary schools in Norway at large, before I address teachers in Oslo.

Limitations about data material have been pointed out by Stinebrickner (2001). According to him, several studies have used data from a particular school district or the educational system in a specific state (e.g, Gritz & Theobald, 1996; Mont & Rees, 1996; Murnane & Olsen, 1989). “Teacher specific” data can be problematic because researchers then lack information about labour activities of each teacher, both before and after the particular teaching job in the specific geographical area. In practice, with district or state specific data, researchers are not able to distinguish between teacher mobility (*movers*) and teacher attrition (*leavers*), due to lack of information about the career starting point and/or the career destination. To be able to differentiate between moves within and between school districts (Falch & Rønning, 2007), it requires extensive data material that covers more than one school district.

In the next chapter, I will elaborate on the particular data and methods in this thesis. Following previous critics of research in this field, and examples of methodological- and data limitations (see e.g., Falch & Strøm, 2005; Greenberg & McCall, 1974; Hanushek et al., 2004; Stinebrickner, 2001), I try to overcome some of the limitations by using comprehensive register data. To my advantage, administrative register data facilitates the use of individual data about teachers, students and their parents. For example, I use non-identifiable organisation numbers in order to identify *movers* from schools, and occupational codes- and classifications for the main registered occupation to identify *leavers* out of the teaching profession.

4.4.2.1 Strong Correlation Between Variables and Multicollinearity

Despite that previous international research has concluded that teacher mobility from schools and teacher attrition from the profession is associated with student- and school characteristics, several of these variables can be correlated. Boyd et al. (2005) have emphasised that several school attributes are usually correlated. Scafidi et al. (2007, pp. 146-147) have pointed out that variables such as students' test scores and poverty rates to a large extent“ are highly correlated with the proportion of minority students in the school”.

Based on the assumption that student- and school characteristics are highly correlated, I exclude several predictor variables. Low scores on student- and school characteristics can work as *push- and pull-factors* for teachers who exit a particular school and/or the teaching profession. There are, however, reasons to think that the share of minority students is, partly, correlated with socio-economic factors and student achievements. *Multicollinearity* refers to the situation of high correlation among predictor variables. With highly correlated predictor variables, there is less unique variation available which makes it more challenging to identify the separate effects and the relative importance of the predictor variables on teacher turnover (Gordon, 2015, p. 449; Mehmetoglu & Jakobsen, 2017; Ringdal, 2018).

In line with previous research in Oslo (see e.g., Birkelund et al., 2010, p. 20), I expect⁷ that parallel with an increase in the share of minority students, the share of low socio-economic status will also increase. I therefore use the share of minority students at school-

⁷ I ran an examination for multicollinearity with several explanatory variables in Stata. None of the variables violated general values for correlations or tolerance values, yet for Oslo, some of the student characteristics were to a larger degree correlated with the share of minority students than in Norway.

level as the main explanatory variable. In the sensitivity tests in Appendix B, I address more student- and school characteristics related to socio-economic status, students' academic achievements and special Norwegian language training at school-level.

4.5 Summary and Hypotheses

Previous international research has documented an association between student composition and teacher turnover. Teachers are more likely to leave schools with student- and school characteristics such as high proportions of minority students, low-income and low-achieving students (Feng, 2009; Greenberg & McCall, 1974; Scafidi et al., 2007), and school districts that have high percentages of minority students and students living in poverty (Gritz & Theobald, 1996). Regardless of experience, *movers* tend to transition to schools with lower concentrations of minority students and higher levels of academic achievement (Hanushek et al., 2004).

With a few exceptions, there is little research in this field in Norway. Additionally, there is mixed evidence of the association between student composition and teacher mobility and teacher attrition. Falch and Strøm (2005) suggested that in Norway, teachers' propensity to quit is especially high in primary and lower secondary schools with high shares of minority students and students with special needs. However, two years later, findings from lower secondary schools showed that the proportion of minority students, students with special needs, and the amount of extra resources directed to these students, only have small and insignificant effects on teacher turnover in Norway (Falch & Rønning, 2007).

4.5.1 Sets of Hypotheses

In this chapter, I put forward four sets of hypotheses in regard to previous research and theories considered above. The four sets of hypotheses concern the association between the student composition and the different outcome variables. The first two sets of hypotheses cover the association between the share of minority students at school-level and teacher mobility from lower secondary schools, in Norway and Oslo. The third and fourth set of hypotheses entails the association between the share of minority students in lower secondary schools and teacher attrition from the teaching profession, in Norway and Oslo.

In all of the following hypotheses, I argue that they correspond with expectations from

previous theories of push- and pull-factors and the DBO model (Elster, 2015; Gambetta, 1987; Hedström, 2005), as well as the macro-micro-macro model with typologies of mechanisms (Coleman, 1986; Hedström, Swedberg, Elster, & Hernes, 1998). Based on the DBO model, individuals are considered as intentional agents, and quit-actions in this study are considered to be intentional actions. Teachers have considered and evaluated quit-actions before leaving a school and/or the profession. Moreover, a desire can only influence a teachers' actions if he/she has the opportunity to act in a certain way. Furthermore, collective structures at a macro-/meso-level (e.g. school segregation of the minority student share) might *push* and *pull* an intentional teacher from a school or profession if he/she believes that the working conditions are more satisfying in a competing school or another profession. Arguably, the desire for more rewarding working conditions might be related to the student composition. Thus, at micro-level, the conditions affected by the collective structures might be shaped and transformed to individual actions like teacher mobility and teacher attrition.

The hypotheses suggested are in accordance with previous research, stating that high proportions of minority students have been linked to teacher turnover (Falch & Strøm, 2005; Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007). Moreover, the hypotheses concerning student composition and teacher attrition might be linked to the notion that the strongest predictor of motivation to leave the teaching profession in Norway is lack of job satisfaction (E. M. Skaalvik & Skaalvik, 2011).

As before-mentioned, Oslo is an important venue for studying this topic. International studies have shown that schools in urban areas, and especially schools with economically disadvantaged students and minority students have appeared to be vulnerable, with particularly high teacher turnover rates (Hanushek et al., 2004; Imazeki, 2005; Lankford et al., 2002). In addition, Oslo has relatively large socio-economic differences and school- and neighbourhood segregation. Moreover, as pointed out by S. B. Fekjær and Birkelund (2009), free school choice has been regarded as a contributor to increasing ethnic school segregation in secondary schools in Oslo. Hence, since this city stands out on several factors related to the share of minority students, compared to Norway at large, this thesis offers an important societal and research contribution by studying the Oslo-school separately.

Teachers are heterogeneous, so I expect that the association between the proportion of minority students and teacher mobility and attrition to be different across different teacher groups. International research has stated that female teachers are more likely to leave the profession, compared to men (Gritz & Theobald, 1996; Murnane & Olsen, 1989; Stinebrickner, 1998, 2001). However, Norwegian studies have shown that male teachers have

a higher propensity to exit a school (Falch & Strøm, 2005) and to leave the teaching profession (With, 2017), compared to female teachers. Based on the mixed evidence, I maintain the approach and expectations in line with Norwegian research for the following hypotheses. Furthermore, international studies have shown that teachers from racial minority backgrounds have practiced different mobility patterns, compared to majority teachers. Racial minority teachers have seemed to prefer working with students with racial minority backgrounds (Boyd et al., 2005; Feng, 2009; Hanushek et al., 2004; Imazeki, 2005). Moreover, it is likely that beginner teachers are younger than experienced teachers, and therefore age and experience can be linked. Previous international studies have also shown that teacher mobility is higher among teachers who are young or old in age, compared to middle-aged teachers (Allensworth et al., 2009; Barbieri et al., 2011; Boyd et al., 2011; Elfers et al., 2006; Gilbert, 2011), and that the probability that a teacher leaves his/her current job is high during the first years of teaching and close to his/her retirement age (Eberts, 1987; Greenberg & McCall, 1974; Mont & Rees, 1996). Early exits from the teaching profession have been more common among beginner teachers (Chang, 2009, referred in E. M. Skaalvik & Skaalvik, 2018; Tiplic et al., 2015) and teachers near retirement (Grissmer & Kirby, 1992; Guarino et al., 2006, referred in, With, 2017).

Previous research in this field is diverse in terms of aims of the studies, variables and findings. Importantly, student- and school characteristics are usually correlated (see e.g., Boyd et al., 2005; Scafidi et al., 2007), Hence, the proportion of minority students at school-level is the main explanatory variable.

The first two sets of hypotheses focus on the association between the minority student share and teacher mobility:

***H1a:** There is a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Norway.*

***H2a:** There is a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Oslo.*

The next hypotheses include interaction terms regarding particular teacher characteristics in order to investigate the association between the minority student share and teacher mobility:

***H1b:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary school is stronger for male teachers in Norway.*

***H1c:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for teachers with native majority background in Norway.*

***H1d:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for young teachers in Norway.*

***H2b:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for male teachers in Oslo.*

***H2c:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for teachers with native majority background in Oslo.*

***H2d:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for young teachers in Oslo.*

The third and fourth set of hypotheses focus on schools with students with a minority background and teacher attrition:

***H3a:** There is a positive association between the proportion of students with a minority background and teachers' propensity to leave their profession in Norway.*

***H4a:** There is a positive association between the proportion of students with a minority background and teachers' propensity to leave their profession in Oslo.*

The following hypotheses include interaction terms regarding particular teacher characteristics in order to investigate the association between the minority student share and teacher attrition:

***H3b:** The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for male teachers in Norway.*

***H3c:** The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for teachers with native majority background in Norway.*

***H3d:** The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for young teachers in Norway.*

***H4b:** The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for male teachers in Oslo.*

***H4c:** The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for teachers with native majority background in Oslo.*

***H4d:** The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for young teachers in Oslo.*

5 Data and Methods

This chapter will explain the data construction and the study's methodological design. I give a review of register data, describe data sources, data processing and operationalisation of variables. I consider the potential strengths and limitations of the research design and data samples. Last, I describe the statistical methods I use in the analyses.

5.1 Register Data and Data Sources

The data material for the analyses consists of administrative register data managed by Statistics Norway, as well as data from the Directorate of Education. By partaking in the project *Ethnic Segregation in Schools and Neighbourhoods: Consequences and Dynamics*, I have access to the above-mentioned data sources. The longitudinal data material covers individual-level data from Statistics Norway, and the data from the Directorate of Education covers organisational school-level data.

Several registers constitute the data material, such as the Population Register, the National Educational Database [NUDB], the Income and Tax Register and the Register of Business Enterprises. These registers include information about the whole population in Norway. Furthermore, individuals are often identified, which means they are given a serial number that uniquely identifies each individual over time, and enables a connection of information from several of these registers. In addition, I utilise data from the primary- and lower secondary school information system [GSI]⁸. This latter register collects a comprehensive amount of data about each primary- and lower secondary school in Norway.

The samples in this study originate from datasets covering years 2003—2014, which include the entire Norwegian resident population and inhabitants alive at some point since 2003. The longitudinal dimension of the datasets facilitates the possibility to study teacher mobility and attrition for approximately a decade. The primary sample contains individuals that have been working as teachers, at some point, between 2003—2014. For example, if an individual only worked as a teacher for two years during this time period, he/she is included in the sample. The secondary sample, which I link to the primary sample, consists of

⁸ In Norwegian: “Grunnskolen informasjonssystem”. In the following, I will use the term GSI when referring to this data material.

students in lower secondary school (8th-10th grade) in Norway, as well as socio-economic and demographic characteristics for their parents.

Register data are “[...] population-wide, longitudinal, and have a negligible or controllable attrition.” (Lyngstad & Skardhamar, 2011, p. 618). Thus, register data are not affected by attrition (beyond migration and death), or systematic under- and over-reporting (Lyngstad, 2010b). However, changes in registration procedures which can create gaps in time series are a problem of register data (Lyngstad & Skardhamar, 2011). An example of obstacles such as this is related to data sets of occupation titles. The occupational codes- and classifications from “STYRK 98” and “STYRK 08” (Statistics Norway, 2016) which cover the same occupations, do not necessary have identical classifications. The classifications from 2008 consists of three fewer digits in the occupation titles compared to the ones from 1998. In the analyses, according to the methodological design conditioned on occupational codes and classifications, it may seem like teachers leave the profession. However, the change might be due to registration procedures and new classification codes. Yet, I have tried to include all relevant and updated occupational codes and classifications to avoid misinterpreting some teachers as *leavers*.

Other disadvantages of register data are that the variables included in registers and data collection are not completed by the researcher and relevant information may be unavailable (Thygesen & Ersbøll, 2014, p. 551). Register data enables the identification of patterns and connections based on the extensive coverage of the entire resident population. However, register data do not include any data on *subjective*⁹ information about the registered individuals. Various features of teachers' intentional aspects and labour market actions caused by these subjective elements are unavailable. For example, subjective perceptions of a teaching position, attitudes towards specific student compositions and teacher motives can affect teachers' propensity to leave a school and/or the teaching profession. These conditions are not included in register data.

Some previous international studies using survey data (e.g., Djonko-Moore, 2016; Dolton & van der Klaauw, 1999; Stinebrickner, 1998), have chosen a research design that enables them to study beliefs and perceptions, such as teachers' beliefs about low-achieving students, students in poverty with minority background, as well as perceptions about the

⁹ Survey data can offer subjective information about school climate, like teachers' perceptions of student behaviour (see e.g., Djonko-Moore, 2016). However, common limitations of survey data are for example non-response and that respondents fall out of the study (attrition) (Mehmetoglu & Jakobsen, 2017).

school climate and environment. However, survey data suffers from common validity problems due to inaccurate formulations of questions raised and self-presentation. I argue that using administrative register data foster accuracy because it enables me to study a representative sample of teachers, schools, students and parents. The data is therefore more generalisable to the targeted teacher population and student compositions. Hence, administrative register data offers high levels of both internal and external validity.

A potential disadvantage of the data from the Directorate of Education is that it might have been affected by under- or over-reporting by each separate school. All school units and/or municipalities report and approve the quality of the data from its own area (The Norwegian Directorate for Education and Training, 2020). Plotting of data by school administrations and low registration frequency (Thygesen & Ersbøll, 2014, p. 554), can cause errors and implications for the time series in the datasets. This is an inevitable disadvantage of the data source I use.

5.1.1 Defining Teachers

The occupational title *teacher* is a broad category in terms of teaching level, specialisation and field of application, and thus needed to be defined according to the purpose of the thesis. *Teachers* are defined according to Norwegian standard classifications of occupations, by the use of the occupational codes- and classifications, “STYRK 98” and “STYRK 08”, developed by the Statistics Norway (2016). The first classification uses a seven-digit occupational code to report occupations, whereas the second classification for occupational titles only has a four-digit code. In addition, job codes from the “PAI-register”¹⁰ and “SST”¹¹ also contribute to the teacher-definition. Both these latter registers also use seven-digit codes and have different digits to separate the registers from each other. Furthermore, teachers are not defined according to their education or educational level in this thesis.

The sample restriction of teachers in this study is performed in accordance with the teaching-level in focus. I am interested in individuals that have operated as a *teacher* at some point between years 2003—2014 in lower secondary schools in Norway. Lower secondary

¹⁰ The PAI-register [Personaladministrativt informasjonssystem] is a data base for information about salary and personnel data for employers in county municipalities, municipalities and companies that are part of the bargaining area of KS (KS, 2020 October 26)

¹¹ SST [Statens sentrale tjenestemannsregister] used to register-based statistics, such as employment, sickness absence and wage statistics (Villund, 2006).

school is compulsory in Norway. Thus, it is reasonable that there is relatively homogenous teaching across schools and hardly any student selection to this school-level. Despite differences, both public-, private- and special lower secondary schools are included in the sample. Upper secondary school-level, however, is not the focus in this study, because it includes, among other things, various fields of specialisation, and hence selection of students and teachers and heterogeneous teaching across schools.

The procedure of narrowing the occupational title teacher is as follows. First, I had to include all occupational codes that capture the teaching profession in Norway, regardless of teaching level or field of study. Then I excluded occupational codes linked to teaching titles in primary school [barneskole] and upper secondary school [videregående skole]. I also excluded occupational codes linked to specific learning situations, such as vocational teachers, cultural school teachers, and civil defence teachers. However, I included occupational titles that do not necessarily cover teachers in a classroom environment, but still are expected to interact with student compositions in lower secondary schools, such as principals, school inspectors and counsellors.

There are some limitations concerning the sample of teachers in this study. First, based on the occupational- and job codes and classifications, I was not able to strictly exclude teachers outside of lower secondary school-level. For example, a teacher employed at a combined school (1st to 10th) might be captured by a code for teachers in primary school [grunnskolen], and is then included in the study. Other exceptions can be individuals working with students, either below or above 8th to 10th grade, not particularly specified by the classifications of occupations and job codes. Second, since teachers are defined according to the occupational codes and classifications, and not by education or educational level, I also include temporary positions and assistants in a teaching position. There are reasons to think that assistants in temporary job positions might be more likely to exit a school or the teaching profession, compared to teachers in a permanent position. These mobility patterns of temporary positions can in turn influence the estimates in this study. First, non-certified teachers can only be hired on short-term contracts up to 1 year” (Bonesrønning et al., 2005, p. 460). Second, according to a report from Statistics Norway, individuals who are “[...] employed for one year or less have a greater share of jobs with temporary employment than those with longer contracts.” (Sundt & Næsheim, 2020, p. 5). Substitutes/on-call substitutes in teaching can, partly, be an important reason why several individuals rapidly change between organisations and work locations (Sundt & Næsheim, 2020).

Furthermore, there are reasons to believe that schools with high turnover rates might

serve more temporary positions, assistants and/or less certified teachers, and that schools with high shares of minority students might be more strongly exposed to a workforce of temporary positions, assistants and/or less certified teachers, and then more turnover. Research from Norway has shown that the share of minority students has a negative effect on supply of teachers (Bonesrønning et al., 2005, p. 465). In Norway, the legal rule is that a teaching position can merely be employed to an applicant without formal certification when there are no certified teachers that willingly take the job (Falch & Strøm, 2005). Unfortunately, due to lack of information to distinguish between temporary or permanent teachers, temporary positions and assistants are treated as equal to other teachers in the analyses.

5.1.2 Merging, Appending and Methodological Restrictions

Merging and appending of variables was completed in Stata 16.1 software. In general, the procedures of merging, appending [adding something to the end] and collapsing [making dataset of summary statistics] several different data sources consisted of several stages and were done as follows. The aims of the procedures of data processing were to have population register files of only one record per teacher, per year and organised as a panel dataset. In addition, I wanted to link teachers to aggregated information about students and their parents, as well as “GSI” information at school-level.

I first began with one of the population register files that covered teachers, and merged it with several other register files. Before I merged the files of working conditions and occupations, I appended all files for employment during the years 2003—2014. Here, the administrative register data structure influenced the original datasets and the final analyses samples. According to the panel data design, the same units of analysis are recorded over time (Mehmetoglu & Jakobsen, 2017) and then covers several records per individual, per year. In practice, people can have several jobs and/or employers (i.e. several duplicators) per year, during 2003—2014. However, in line with the preferred panel data structure, I was only able to keep one duplicator per year (i.e. one employer, per individual, per year), and therefore had to delimit the original datasets.

In this study, the job with the highest registered numbers of working hours (hours per week), measured December 2 each year, constitutes each individuals' main occupation. If some individuals work as part-time teachers, next to another job with more working hours per week, the registered job is not as a teacher. Arguably, a more accurate measure of individuals' main occupation would be to choose the job that provides the highest monthly income.

However, due to lack of appropriate data, the total number of working hours per week constitutes the main occupation. Unfortunately, a potential disadvantage of job delimitation can be that I may not capture the individuals' true main occupation. If some employers have registered full time employment for their workers, even though the workers are not operating full time (i.e. 37,5 hours per week), I cannot overcome these incorrect registrations by employers.

Second, continuing with three separate register files in Stata covering students, their mothers and their fathers, I performed similar merging procedures for these register files. Merging and appending of several files for students' mothers and fathers was done separately, and then merged individually by connection keys into the dataset of students. Each individuals' unique national identification numbers were used to connect different individuals together, as well as data sources. Followed by the merging of school-level information, GSI, to the dataset of students and their parents, I collapsed the whole dataset in order to obtain aggregated values and information at a school-level. Based on individual information about each student and its parents, it then resulted in aggregated information about the student body composition at each school, such as the means, sums and proportions of different variables.

A disadvantage of the data was that the values for the main independent variable, the proportion of minority students, had several missing values for the sample in Norway at large, in contrast to no missing values for the sample for Oslo. First, while restricting the sample, several registrations of individuals working as teachers between 2003—2014, resulted in 1 044 736 records of teachers in Norway. However, 615 536 of these observations had missing values on the aggregated school-information regarding the proportion of minority students. These missing values contributed to more than 50% of the total observations. Since missing data can lead to practical problems regarding statistical procedures and analytical problems, such as biased parameter estimates (Mehmetoglu & Jakobsen, 2017, p. 338), I chose to redo some procedures of the sample restrictions. Thus, I did the merging of teacher register files with aggregated school-level information again, and returned back to the 2 388 381 observations of teachers between years 2003—2014. Instead of keeping all merged observations, I only kept those organisational numbers which matched perfectly with both files of teacher and aggregated school-level information. Thus, I deleted 1 397 801 observations, which only included information about teachers without aggregated school-information. Then, the dataset of teachers matched with aggregated school-level data covered 990 580 observations for the whole period.

The dataset after age and register status restrictions covered information on 852 365

teachers between years 2003—2014, aged 18 to 70, and resident in Norway. In all analyses, I am only interested in individuals who were in a teaching position, in schools at some point between 2003—2014. Hence, I restricted the sample to only include those working as teachers according to occupational codes, conditioned on “STYRK 98” and “STYRK 08” occupational codes and classifications (Statistics Norway, 2016), and job codes from the “PAI-register” and “SST” (KS, 2020 October 26; Villund, 2006). In addition, to be able to operationalise the teacher mobility variables for *movers* from schools, year 2014 was deleted in all samples. This delimitation reduced the total number of observations on teacher mobility. However, I do not have data to interpret quit-actions after year 2014, so deletion of that year was of crucial importance to avoid biased effects or incorrect interpretations.

The complete dataset for the first main analysis (1a) of teacher mobility, contains information on 429 199 teachers between years 2003—2013. For the subset of the first main analysis (1b), I specifically address the situation in Oslo, which reduced the dataset considerably. I deleted 819 556 individuals from dataset after age and register status restrictions, and this resulted in 32 809 teachers in Oslo, between years 2003—2013. Both the second main analysis (2a) and the subset of the second main analysis (2b) of teacher attrition, contain information on the same number of individuals as the first teacher mobility analysis. The only difference being that the outcome variables in the analyses are different. Important to notice, the samples of Norway also include Oslo, which might explain extremes in several different values in the analyses.

Table 5.1: Number of individuals in each sample and after the procedure of the sample restrictions

	Analysis	Time period	Number deleted	Total
Original dataset (valid occupational codes within the time period between 2003—2014).		2003—2014		990 580
Keeping only those resident in Norway.		2003—2014	49 061	941 519
Keeping only those alive and resident between 18-70 years of age.		2003—2014	89 154	852 365
Starting point after above-mentioned restrictions.		2003—2014		852 365
Sample restricted only to those working as teachers in Norway.	1a) Teacher mobility (movers) in Norway.	2003—2013	423 166	429 199

Sample restricted only to those working as teachers in Oslo.	1b) Teacher mobility (movers) in Oslo.	2003—2013	819 556	32 809
Sample restricted to those working as teachers in Norway.	2a) Teacher attrition (leavers) in Norway	2003—2013	423 166	429 199
Sample restricted to those working as teachers in Oslo.	2b) Teacher attrition (leavers) in Oslo.	2003—2013	819 556	32 809

5.1.3 The Analysis Sample

The analysis sample consists of all employers who have worked as a teacher (defined in Section 5.1.1), at some point between years 2003—2014, and school-level information about the lower secondary schools. In the first- and second part of the main analysis, I study lower secondary schools from all over Norway to avoid methodological limitations related to geographic selection.¹² However, a subset of both the first and second analyses is dedicated to an analysis of teacher mobility and teacher attrition in Oslo. Note, that the main analyses in Norway also includes Oslo in the samples. Thus, the upper values for, among other things, share of minority students at school-level in the sample of Norway, are likely to be schools in minority-dense areas in Oslo.

5.2 Operationalisation of the Variables

5.2.1 Dependent Variables: Teacher Mobility and Teacher Attrition

The outcome variables are *teacher mobility* and *teacher attrition* at individual level. The variables are coded as dummy variables, meaning that they equal 1 to indicate observations in a specific state or condition, and 0 otherwise (Angrist & Pischke, 2015, p. 57).

In the first part of the first analysis (1a), the dependent variable measures whether the teacher stays or moves from his/her respective lower secondary school between years 2003—2013. In (1a), 0 in the dummy variable denotes that the teacher stays at the school (*stayers*), and 1 means that the teacher leaves the school, for another school (i.e. a change in teaching position and/or employment status). I condition the sample to only include teachers, to

¹² This methodological limitation and disadvantage of previous international studies was pointed out by for example Stinebrickner (2001) and elaborated in Chapter 4.4.2.

investigate the teacher mobility from and between schools. In the second part of the first analysis (1b), I specifically address teacher mobility from lower secondary schools in Oslo by operationalising the dependent variable in an identical matter as in the first analysis.

The second analysis (2a), focus on *teacher attrition*, and the dependent variable measures whether the teacher stays in the teaching profession entirely during years 2003—2014. Teacher attrition is also coded as a dummy variable, where 0 denotes that the teacher stays in the teaching profession, and 1 means that the teacher leaves the teaching profession for another profession (*leavers*). The second part of the second analysis (2b), focuses on *teacher attrition* in the Oslo-school, with the same operationalisation of the dependent dummy variable.

Teacher mobility from a school and attrition from the teaching profession is coded according to organisational numbers for companies and occupational codes and classifications. The binary *teacher mobility* variable is identified by the length of registered employment linked to particular schools, measured by their organisational numbers for companies. Non-identifiable organisation numbers uniquely identify companies and enterprises (Statistics Norway, 2003, November 18). Moreover, the limitation of individuals having missing data on occupational codes and classifications, is handled by dropping these individuals. The binary *teacher attrition* variable is identified according to occupational codes, conditioned on “STYRK 98” and “STYRK 08” occupational codes and classifications (Statistics Norway, 2016), and job codes from the “PAI-register” and “SST” (KS, 2020 October 26; Villund, 2006).

5.2.2 Independent Variable: Student Composition of Minority Backgrounds

In this analysis, the proportion of students with a *minority background* at each lower secondary school is the main explanatory variable. The process of constructing this variable entailed several stages.

To capture the proportion of students with a minority background, I constructed a group indicator for immigrants and/or descendants with non-western country background.¹³ In

¹³ See Section 1.1.4 for Statistics Norway's definition of an immigrant, descendant, country background, and included countries in my delimitation to non-western country background.

this study, individuals belong to the minority background group if they are of non-western country background, as well as either immigrant or descendant. The minority background dummy variable is coded 1 for non-western immigrants and descendants, and 0 for all others. Last, the final explanatory variable was constructed by having aggregated school-level measures of the non-western immigrant and descendant dummy variable. By calculating the mean of those who scored 1 on the dummy variable, I ended up with the proportion of students with minority background at each school-level cohort.

5.2.3 Control Variables

To capture the association between proportion of minority students and teacher mobility and attrition, I control for year, average number of students at school, average teacher density at school, teachers' sex, whether teachers' have an immigrant background, teachers' age group and whether teachers' have children. I also introduce school-fixed effects (school-FEs).

The year variable is categorical and covers years 2003—2013, in order to observe quit-actions for the all school years 2003—2004 to 2013—2014. I control for year to capture the possible influence from aggregate (time-series) rising trends in the data over the time period. Thus, I avoid the risk of omitted variable bias (Mehmetoglu & Jakobsen, 2017). Thereby, I control for various factors that change each year, and that for example are common to all schools for a given year, like the financial situation or labour market factors at a macro-level which might influence teachers' turnover rates differently from year to year.

5.2.3.1 School Characteristics

Since there are large variations in the settlement patterns in Norway (Falch & Rønning, 2007), there are differences between school sizes and the smallest and largest schools. Thus, I include control variables for average number of students at school (8th—10th grade), and average teacher density (total number of students per teacher) are continuous.

5.2.3.2 Individual Teacher Characteristics and Teacher Compositions

Sex is a binary variable, which takes the value 0 for male, and value 1 for female.

Teachers' children¹⁴ is a binary variable, which takes the value 0 for no children, and value 1 for 1 child up to 15. I do not differentiate between the total number of children, rather if the teacher is a parent or not.

Teachers' immigrant background is a categorical variable with 6 values. The variable was made with values as follows: 0 for natives, 1 for non-western immigrant, 2 for non-western descendant, 3 for western immigrant, 4 for western descendant and 5 for other.

Teachers' age group is a dummy variable, divided into 6 categories: 1 for age 18—24, 2 for age 25—34, 3 for age 35—44, 4 for age 45—54, 5 for age 55—64 and 6 for age 65—70. Minors¹⁵ and individuals over an age of 70 are dropped. Young and old teachers can have different mobility patterns, and older teachers also have the opportunity to retire from the profession. I do not have information about final retirement, but include those up to 70 years old in order to also capture these retirement patterns too.

5.2.3.3 Interaction/Moderation Effects

In a subset of both the analyses for Norway and Oslo (1a and 1b), I include the control variables and interaction models. By using non-additive models, I am able to test the interaction effects (Mehmetoglu & Jakobsen, 2017), in which the moderator can affect the relation between the independent variable, proportion of minority students, and dependent variable, teacher mobility or teacher attrition. In the interaction models, I use teachers' sex, teachers' immigrant group and teachers' age group as moderators, respectively, while including all the other control variables. Last, in a subset of both the second analyses for Norway and Oslo (2a and 2b), I include the control variables, and use similar interaction models with teachers' sex, teachers' immigrant group and teachers' age group as moderators, as previous described in analyses 1a and 1b.

¹⁴ In regard to family status, school-aged children can influence the costs of moving, and especially if the moves require a residential change (Falch & Rønning, 2007).

¹⁵ Legal age in Norway is set to 18.

5.3 Methods

5.3.1 Ordinary Least Squares and Linear Probability Model

Ordinary Least Squares (OLS) regressions and Linear Probability Models (LPM) with school-fixed effects (school-FEs) are used to map the association between the share of minority students and teacher mobility and attrition in Norway and Oslo, respectively.

The common linear regression with the OLS estimator method is based upon a linear relationship between the independent variable and the dependent variable (Ringdal, 2018). The estimators give “the sample estimates of the intercept and slope that minimize the sum of the squared errors” (SSE), which is the distance between the observed values of the dependent variable and the estimated conditional means (Angrist & Pischke, 2015, p. 58; Gordon, 2015, p. 118). The OLS estimator method offers parameter estimates by choosing the regression line that makes SSE as small as possible (Skog, 2004, p. 222). Moreover, I add both school-level and individual-level control variables that are likely to influence teacher turnover rates. By holding control variables constant in the multiple linear regression models, I estimate the effect of the minority student share on teacher mobility and/or teacher attrition (Angrist & Pischke, 2015, p. 57; Mehmetoglu & Jakobsen, 2017, p. 81; Ringdal, 2018).

LPM is a linear regression with a binary dependent variable with values of 0 and 1 (Ringdal, 2018; Tufté, 2000). The estimated coefficients in the LPM can be interpreted as changes in proportions or probabilities of having the value 1 on the dependent variable as a result of one unit's change in an independent variable (Tufté, 2000, p. 13).

The dependent variable in the first analysis (1a) is a binary variable, coded as whether the teacher stays or moves from his/her respective lower secondary school. In the analyses, the coefficient for movers offers differences in probabilities of teachers leaving their schools relative to the reference category of teachers staying at their schools. The teacher mobility outcome variable therefore captures whether there is a change in employer for each teacher. By multiplying the probabilities with one hundred, the differences in teacher mobility rates between stayers and movers are given in percentage-points.

In the second analysis (2a), the dependent variable is run as a binary variable of whether teachers stay in the teaching profession or leave it. The statistical procedure is identical to the first main analysis, except that this dummy variable and probabilities denote the differences in teacher attrition rates between teachers who stay in the teaching profession and those who exit the teaching profession. In the subset of the analysis, the situation in Oslo

is addressed with similar statistical procedures as above-mentioned.

5.3.1.1 Average Marginal Effects

To interpret the absolute probability for the association between the share of minority students and teacher mobility and teacher attrition, I calculate the average marginal effects (AME) from the LPM models. AME gives a single estimate for the average effect of x_i on $P(y = 1)$ (Mood, 2010, pp. 75-76). Namely, I get an average effect estimate of how the probability of teacher mobility (in 1a and 1b) or teacher attrition (in 2a and 2b) increases or decreases, for one unit increase in the explanatory variable for each observation. In the analyses in Chapter 7, I report the percentage points differences on the probability of teacher mobility or teacher attrition, when the proportion of minority students increases with a 100 percentage points at school-level.

The operationalisation of the measure of the share of minority students can be nuanced. When calculating the AME in Chapter 7, I look at the change in probability for teacher mobility or teacher attrition, by a 100 percentage points increase in the share of minority students. This measure may be evaluated as an unrealistic increase at school-level, yet I argue that the measure offers a readable approach. Moreover, by dividing the coefficients by 5 or 10, respectively, I can get the change in probability for teacher mobility or teacher attrition, by a 20 or 10 percentage point increase in the share of minority students.

5.3.2 Linear Probability Regression or Logistic Regression

Although LPM regressions can be regarded as easy to interpret, several weaknesses of the method have been put forward. LPM is commonly compared with logistic regression¹⁶ when studying dichotomous variables (Hellevik, 2007, p. 13; Mood, 2010; Ringdal, 2018; Tufte, 2000). In this study, I find it convenient and feasible to use LPM as a statistical method. Importantly, results from both linear and logistic significance probabilities have turned out nearly identical (Hellevik, 2007; Mood, 2010). Moreover, to reach more “intuitive concept of probability” (Gordon, 2015; Mehmetoglu & Jakobsen, 2017, p. 163; Tufte, 2000) in logistic regression, I would calculate the AME. Thus, deriving AME from logistic regression would

¹⁶ For introduction to the logistic regression model (see e.g., Hellevik, 2007; Mehmetoglu & Jakobsen, 2017; Ringdal, 2018; Skog, 2004; Tufte, 2000).

have been considered as a “complicated detour” (Mood, 2010, p. 78).

Several researchers have, however, problematised weaknesses of LPM, due to the violating of the preconditions for ordinary linear regression (Mood, 2010, p. 78; Ringdal, 2018; Skog, 2004, p. 353; Tufte, 2000, p. 13). First, a weakness of LPM is that the models can show meaningless predictions, due to the possibility of predicated probabilities that are out of range, i.e. higher than 1 and lower than 0. The first problem is not severe unless many predicted values fall above 1 or below 0 (Long, 1997, referred in Mood, 2010; Tufte, 2000, p. 15).

Second, LPM violates the premises that the error variance is normally distributed, and that “the variance of the errors are homoscedastic – constant across levels of X.” (Gordon, 2015, p. 443; Tufte, 2000, p. 13). Non-normally distributed error variance does not affect the coefficient estimates. However, the premise can be importance for the precision of the statistical conclusions (Tufte, 2000, p. 13). Moreover, when the error variance is heteroskedastic, it can lead to underestimated and/or overestimated standard errors for some predictor variables (Gordon, 2015, p. 444; Mehmetoglu & Jakobsen, 2017, p. 233). Heteroscedasticity can, however, easily be corrected for (Mood, 2010). In statistical software, like Stata, the use of robust standard errors changes the standard errors and produces test statistics that offer “reasonably accurate *p*-values” (Gordon, 2015, p. 445; Mehmetoglu & Jakobsen, 2017, p. 235; Mood, 2010). In addition, violating the “homoscedasticity assumption seems to be of little practical importance, as an empirical comparison of results show nearly identical outcomes of the two kinds of significance tests.” (Hellevik, 2007, p. 59). Using and deriving AME from logistic regressions and comparing it with LPM coefficients gives nearly identical or as good as identical results (Hellevik, 2007; Mood, 2010).

The third weakness of LPM, related to the function form of the association, can be seen as the most critical issue. OLS regressions and LPM, assumes linear associations, however if non-linear associations are present, negative probability predictions outside the 0-1 interval can occur (Hellevik, 2007, p. 61; Mood, 2010, p. 78; Ringdal, 2018, p. 451; Tufte, 2000, pp. 13-16). According to Tufte (2000, p. 16), the problem of functional form is not only covering a technical question, but also a theoretical question. Assumptions of linear models and associations can be theoretically and empirically questioned in many contexts. For example, a relevant question to ask is whether it is reasonable to assume that the probability of having high salaries increases linearly with increased education, regardless of how great this probability is in advance. (Tufte, 2000, p. 16)

Despite the discussed weaknesses, I have chosen to use LPM models. The models in

this study, while relatively complex, can be of particular interest for policymakers, decision-makers and other interested parties, and the results should therefore be intuitively and readily available for those (Gordon, 2015; Mood, 2010; Tufte, 2000, p. 8).

5.3.3 School Fixed Effects and Within- and Between-Variation

When running OLS regressions on the bivariate associations between the share of minority students and teacher mobility and attrition (in analysis Chapter 7), there exists an uncertainty regarding what type of effect I am measuring (Mehmetoglu & Jakobsen, 2017, p. 242). If certain schools with a high share of minority students, also have some unobserved characteristics that contribute to generally higher teacher mobility and attrition rates than other schools, the OLS regression could become biased since *the share of minority students* variable also captures the effect of these variables. However, with rich administrative register data and the longitudinal panel data structure with repeated observations on each unit, I am able to use fixed effects models. In Chapter 7, several of the models are run both with and without fixed effects at school-level; school-fixed effects (school-FEs).

The school-FE models account for any measured and unmeasured variables with *fixed* characteristics of lower secondary schools across time, like for example the location of schools. In school-FE models I can control for time-invariant variables, and thus handle problems with spurious relationships (Mehmetoglu & Jakobsen, 2017, pp. 241, 248). In addition, school-FE models offer a “purer” and more plausible measure of the link between the share of minority students and teacher mobility and attrition, because I can adjust for unmeasured characteristics of the schools, that might bias my results (Gordon, 2015; Ringdal, 2018, p. 510). Using school-FE models to investigate the effect of variation in the share of minority students across years within the same school, I try to “break any remaining correlation” between minority concentration and unobserved student characteristics and their schools (Hermansen & Birkelund, 2015, p. 627; Hoxby, 2000). For example, schools may differ in terms of teaching environment or student-, parental- and co-worker composition at school-level including different abilities, intelligence, ambitions, motivation, aspirations, and/or degree of courtesy etc. Stable school characteristics, that may influence teachers' decisions to exit a particular school and/or leave the teaching profession are accounted for in the school-FE models.

Strengths of the school-FE model is that it investigates the relation between share of minority students and teacher mobility and attrition, within each school. By looking at the

variation *within* each lower secondary school (Allison, 2005), I reduce the variance in the variables by excluding the variation *between* the schools (Ringdal, 2018, p. 510). On the other hand, including school-FE and only the schools that experience variation in the share of minority students – the within-school-variation – it results in a considerable reduction of the sample. Hence, I run the risk of having too little variation for the estimation of an association, and that the school-FE models cannot explain the variation between schools. Therefore, to address these issues, I estimate models both with and without school-FEs to investigate whether there are considerable differences in the outcomes.

5.3.3.1 Within- and Between-School-Variation

In the analyses in Chapter 7, I run both the bivariate baseline model and the model with control variables, with and without school-FEs. Arguably, with and without school-FEs models are of societal and research importance, because both the variation across schools and within schools is interesting. The models without school-FEs (Model 1.0 and Model 2.0 in all analyses) offer estimates from comparisons between units in their average outcomes (Mehmetoglu & Jakobsen, 2017). If schools with high proportions of minority students to a large degree differ from schools with low proportions of minority students, this is interesting for the associations in this study. The models without school-FEs also resemble the correlation between the share of minority students and teacher turnover, without controlling for any variables, and are identical¹⁷ to the scatterplots in the descriptive analyses in Chapter 6.

Furthermore, the models with school-FEs (Model 1.1 and Model 2.1 in all analyses) are also important, due to the assumption that I come closer to a *causal* analysis of the association between the share of minority students, and teacher turnover. As mentioned, since school-FE models controls for unmeasured variables, with constant values across time and constant effects, I receive more valid and credible estimates of the *causal effects* of the minority student share (Ringdal, 2018, pp. 509, 512). By including school-FE models, I investigate whether year-to-year variation in the minority student share at school-level, is systematically linked to year-to-year variation in teacher mobility and teacher attrition. Hence, I control for stable school characteristics and each school is compared against its own school

¹⁷ Identical in the sense that they do not include several individual-level and school-level control variables. However, the bivariate models in Chapter 7 includes control for year.

characteristics and estimates. By relying on the variation in minority student composition across years, I try to capture the *causal* effect of the share of minority students at school-level on teacher mobility and attrition, within the same schools (Hermansen & Birkelund, 2015).

Importantly, implementing models with school-FEs raise the potential issue of confounding time trends. Measured and unmeasured time-varying confounders can create bias between independent- and dependent variable (Columbia University, 2019). In school-FE models, the “design automatically control for confounders that remain constant (fixed) over time” (Greenland, 1996). For example, the location of the schools (situated in a specific neighbourhood and/or school district). However, the school-FE models are not able to control for confounder variables that change over time at school-level, which are not included and controlled for in the analyses. Several unmeasured time-varying variables can potentially confound the coefficients in the models. For example, if a school receives a new principal and this coincides with mechanisms linked to the increased share of minority students and increased teacher mobility or attrition rates, I am not able to control for this. In the sensitivity analyses in Appendix B, I include more time-varying control variables that may confound the variables in the analyses.

5.4 Statistical Inference and Causal Effects

Regarding generalising the findings to population data, one of the purposes of significance tests for hypotheses is to assess the generalisability of the findings to the population (Skog, 2004, pp. 174-175). Although this thesis uses administrative register data about the actual population of interest, I have completed several restrictions of the data material. Hence, I do not use the total population in the datasets and the results in the analyses may be due to coincidences.

In all the LPM models I use robust standard errors and 95% confidence intervals. The 5% significance level is in line with conventional norms and rules in social science. On the other hand, there has been an ongoing research debate of whether significance tests, *p*-values and rule of 0.05 serves its purpose in research, or if it rather prevents scientific progress (Pripp, 2015). Furthermore, in large-scale register-based studies, “unimportant differences may become statistical significant” (Thygesen & Ersbøll, 2014, p. 555). Hence, it is equally important to study the size of the parameter estimates and whether the findings are relevant for the society, students and schools, as well as policymakers and decision-makers. Despite

the discussion of the confidence levels and limitation of register-based data, I rely on the 5% level as the conventional norms in social sciences. Yet, results close to the threshold can be nuanced and should be interpreted with some cautions.

In light of the macro-micro-macro model and in accordance with Elster (2011, pp. 130-131), the micro-macro link (Type 3 relation in Figure 2.2) has been considered as the most complicated link to prove in the social sciences. Though I apply school-FE models and try to approach a more *causal* analysis (Ringdal, 2018) of the association between the share of minority students and teacher mobility and attrition, I focus on associations in this study. *Causal* analyses of the share of minority students and teacher turnover is challenging and complicated to address, due to several potential confounding time trends- and factors, as well as the notion that several students- and school characteristics usually are correlated. Social mechanisms can be used to explore how individual action and interaction contribute to “emergent” collective patterns on macro-level. To specify *causal mechanisms* is, however, a comprehensive and very difficult matter (Mastekaasa, 2010, p. 121). In line with mechanism-based explanations and analytical sociology, I try to explain some potential “cogs and wheels” through which teacher mobility and attrition may be brought about (Hedström & Ylikoski, 2010).

6 Descriptive Statistics: Student Compositions and Teacher Mobility and Attrition

In this chapter, I describe some of the main features of the data material for the period of 2003—2013. First, I present descriptive statistics for the dependent and independent variables. Second, I show the association between minority student share and teacher turnover. I also look at the distribution of teacher characteristics at individual-level, in order to identify central characteristics of the teachers in the sample. Last, I show the student- and school characteristics at school-level, in order to descriptively map student compositions across lower secondary schools in Norway and Oslo, respectively. In line with the customised macro-micro-macro model (Section 2.2), these descriptive statistics are part of a macro-level analysis, which offers important information about the school situation in Norway at large and Oslo.

6.1.1 Dependent Variables: Teacher Mobility and Teacher Attrition

Table 6.1 displays the distribution of the dependent variables, teacher mobility from schools and teacher attrition from the profession. This shows that teacher turnover rates are from 12% to 18% (rounded up), in Norway and Oslo between the years 2003—2013. These rates refer to the average percentage of employees who leave lower secondary schools or the teaching profession, based on annual observations. Interestingly, the average numbers of *movers* and *leavers* are greater in Oslo than it is nationally. The average teacher mobility rate is 17.57% in Oslo, which is approximately 4 percentage points higher compared to Norway at large. With regard to teacher attrition, the average rate is 14.43% in Oslo, which is approximately 2 percentage points higher than in Norway. Moreover, as elaborated in the literature chapter (Section 4.3.2), the numbers of relocations out of Oslo are on average relatively high. These relocation patterns may be potential factors linked to the increased number of *movers* and *leavers* in Oslo, compared to the country as a whole.

Table 6.1: The distribution of teacher mobility and teacher attrition in Norway and Oslo, 2003—2013

	All teachers		Stayers		Movers/leavers	
<i>Stayers or movers</i>	N	%	N	%	N	%
1a) Teacher mobility in Norway	429 199	100	371 597	86.58	57 602	13.42
1b) Teacher mobility in Oslo	32 809	100	27 046	82.43	5 763	17.57
<i>Stayers or leavers</i>						
2a) Teacher attrition in Norway	429 199	100	376 522	87.73	52 677	12.27
2b) Teacher attrition in Oslo	32 809	100	28 074	85.57	4 735	14.43

6.1.2 Independent Variable: The Minority Student Share

Table 6.2 and Figure 6.1 show the distribution of the samples in Norway and Oslo on the proportion of minority students at school-level between years 2003—2013. The average shares of minority students at lower secondary schools are 0.147 and 0.344 in Norway and Oslo, respectively. As expected and discussed in Section 4.3.2, there are on average more minority dense areas in Oslo than in Norway. However, the amount of variability in the estimates, measured by the standard deviation is approximately equal in both samples. Furthermore, the expectations regarding Oslo, compared to Norway are further strengthened since there are relatively large differences between the sample in Norway and Oslo. As illustrated in Table 6.3, the share of minority students at school for the highest values, 50.1% to 100%, the distribution is in the expected direction. In Oslo, about 34% of the total sample include lower secondary schools with more than 50.1 % minority students, compared to the Norway at large with approximately 11% of the total sample.

Table 6.2: The distribution of the proportion of minority students at school-level in Norway and Oslo, 2003—2013

	Norway and Oslo				
Variable	Obs.	Mean	Std. Dev.	Min	Max
Proportion of minority students at school-level in Norway	14 444	0.1471802	.2718279	0	1
Proportion of minority students at school-level in Oslo	740	0.3440743	.2798278	0	1

Figure 6.1: Histogram over the distribution of the minority student share at school-level in Norway and Oslo

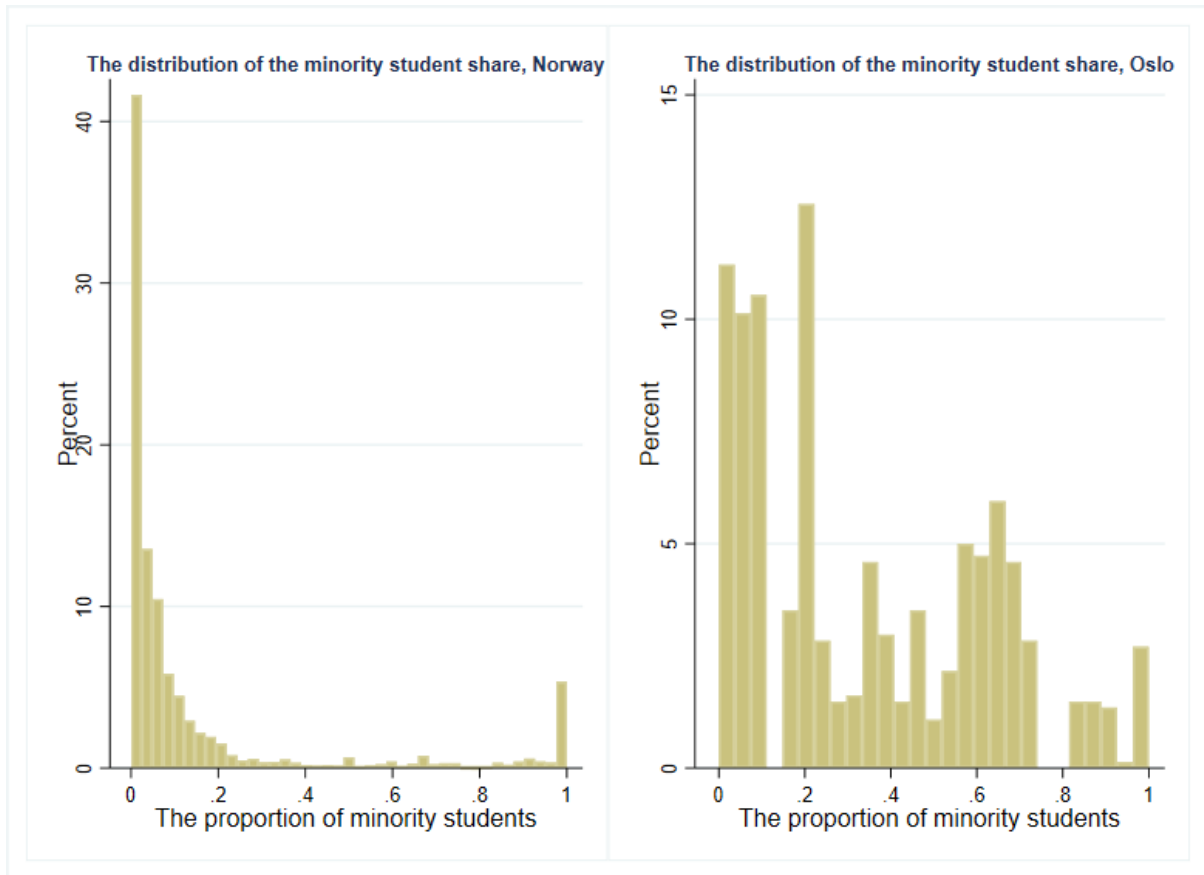


Table 6.3: The distribution of various shares of minority students at school-level in Norway and Oslo, 2003—2013

The share of minority students	Norway		Oslo	
	N	%	N	%
0—10.0%	10 404	72.03	225	30.41
10.1%—20.0%	1 537	10.64	56	7.57
20.1%—30.0%	433	3.00	94	12.70
30.1%—40.0%	207	1.43	68	9.19
40.1%—50.0%	169	1.17	37	5.00
50.1%—100%	1 551	10.74	248	33.51
<i>Missing</i>	143	0.99	12	1.62
<i>Total (N)</i>	14 444	100.00	740	100.00

6.1.3 Association Between the Minority Student Shares and Teacher Mobility and Attrition

Figure 6.2, 6.3, 6.4 and 6.5 show the association between the minority student share and teacher mobility and teacher attrition, both for Norway and Oslo, respectively. The figures also display histograms over the distribution of the proportion of minority students at school-level in Norway and Oslo, between years 2003—2013, as well as the distribution of teacher mobility (*movers*) and teacher attrition (*leavers*).

By including the above-mentioned associations in graphs, I visualise the associations simply without any control variables. Thus, I present visual representations of the bivariate relationship between the minority student share and teacher mobility and teacher attrition in Norway (N = 14 444) and Oslo (N = 740). The scatterplots show the associations without equal-sized bins, and the red fitted line is generated by lowess smoothing¹⁸.

By looking at the scatterplots with lowess line, the association between the share of minority students and teacher mobility and teacher attrition is practically horizontal and uncorrelated in Norway and Oslo, respectively. Notably, these graphs only visualise the association without any control variables. Thus, the visualised scatterplots here are equal to Model 1.0, without school-FEs and without control variables, in the regression analyses in Chapter 7. Moreover, by comparing the histograms of the proportion of minority students in Norway and Oslo (see e.g. Figure 6.1), I see that there is more variation in the distribution in Oslo, compared to Norway.

¹⁸ Instead of assuming a type of distribution beforehand and using a parametric fitting which can give a misrepresented curve of the data, I use non-parametric smoothers. Lowess generates “locally weighted scatterplot smoothing” (stata.com, 2021), with smoothed values linked to each variable, for each year. Thus, lowess measures the best fitted curve without anticipating that the data must fit a certain distributional shape.

Figure 6.2: The association between the minority student share and teacher mobility in Norway, 2003—2013, and histogram over the distribution of the minority student share and teacher mobility

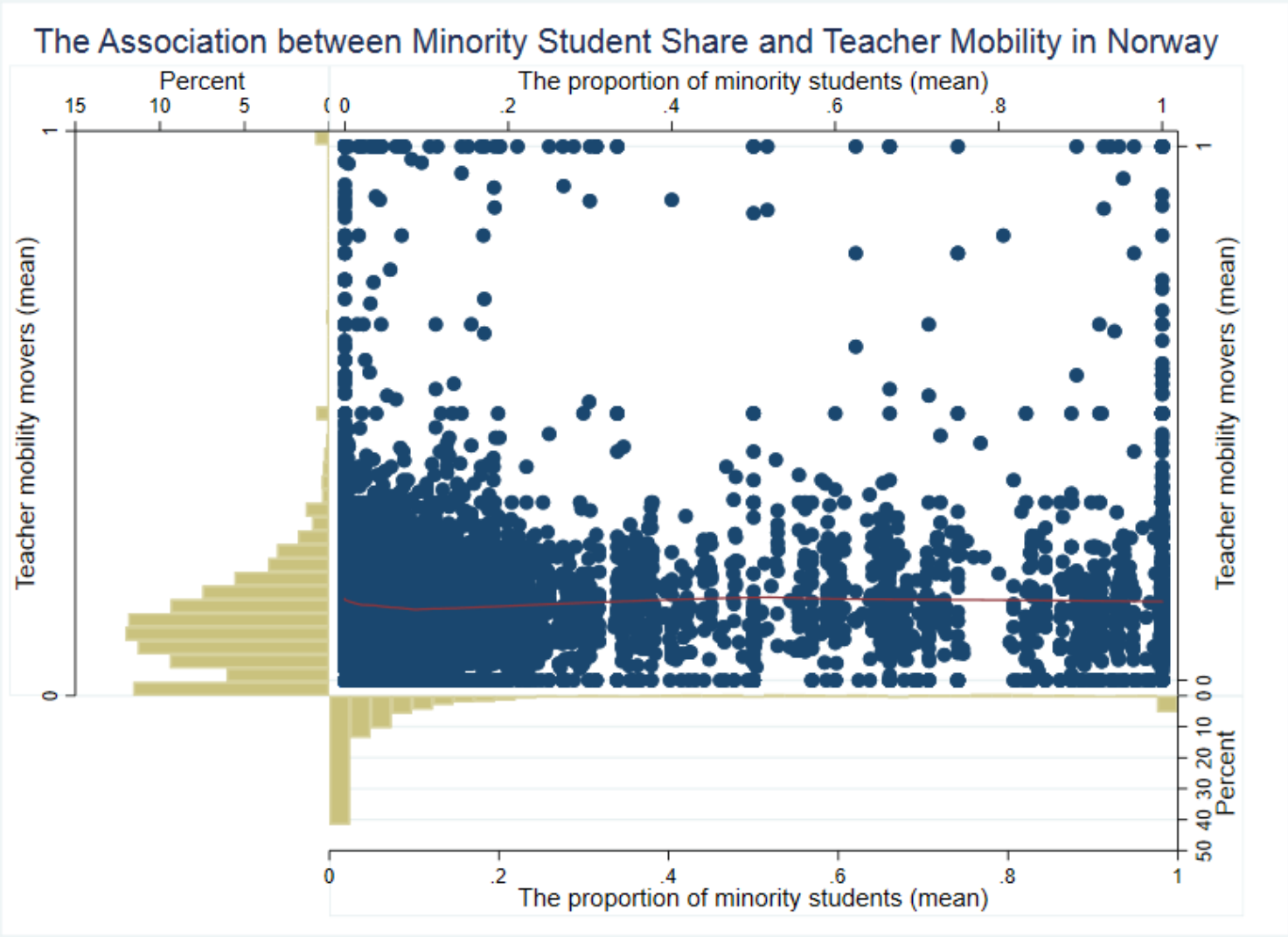


Figure 6.3: The association between the minority student share and teacher mobility in Oslo, 2003—2013, and histogram over the distribution of the minority student share and teacher mobility

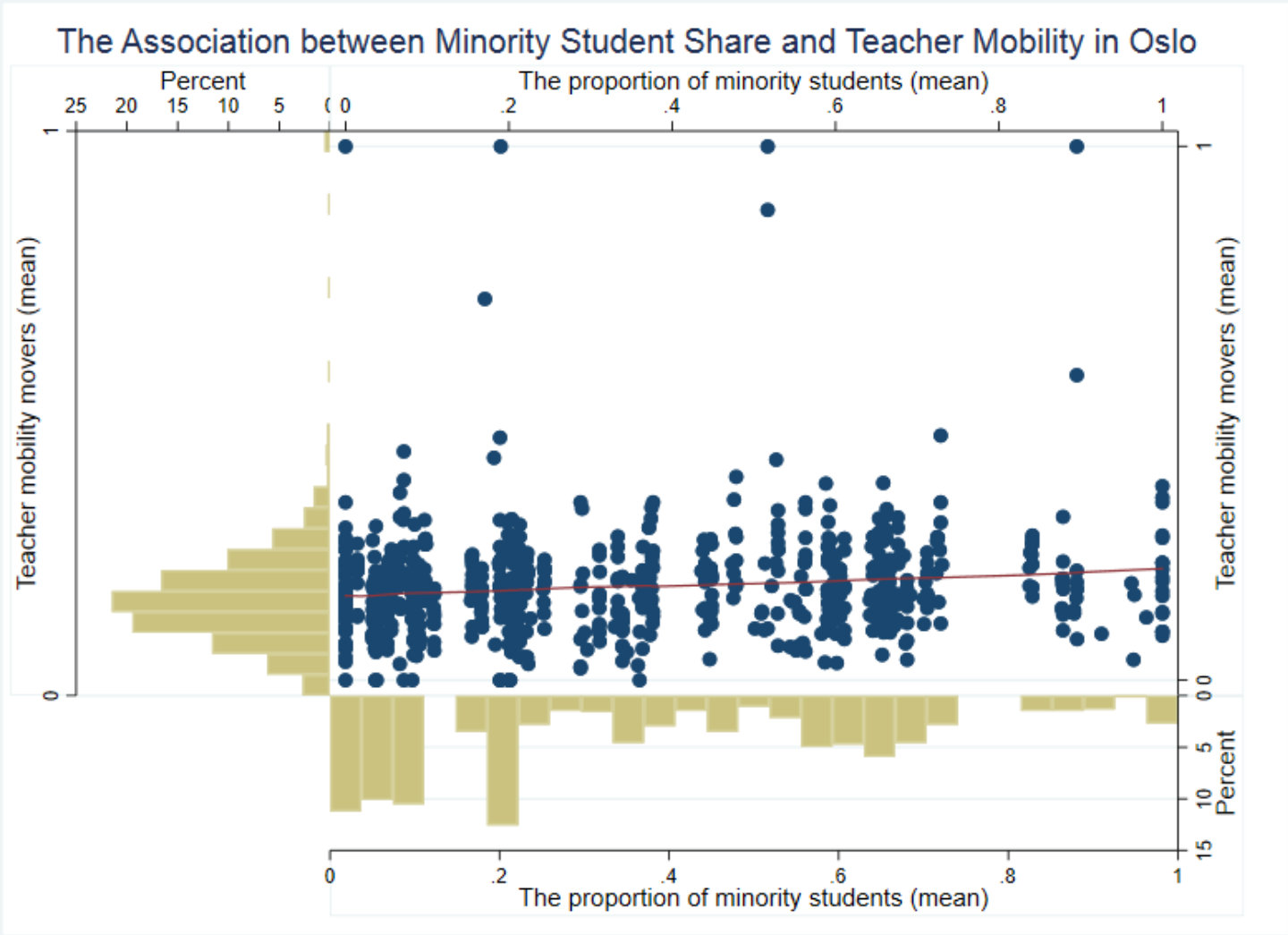


Figure 6.4: The association between the minority student share and teacher attrition in Norway, 2003—2013, and histogram over the distribution of the minority student share and teacher attrition

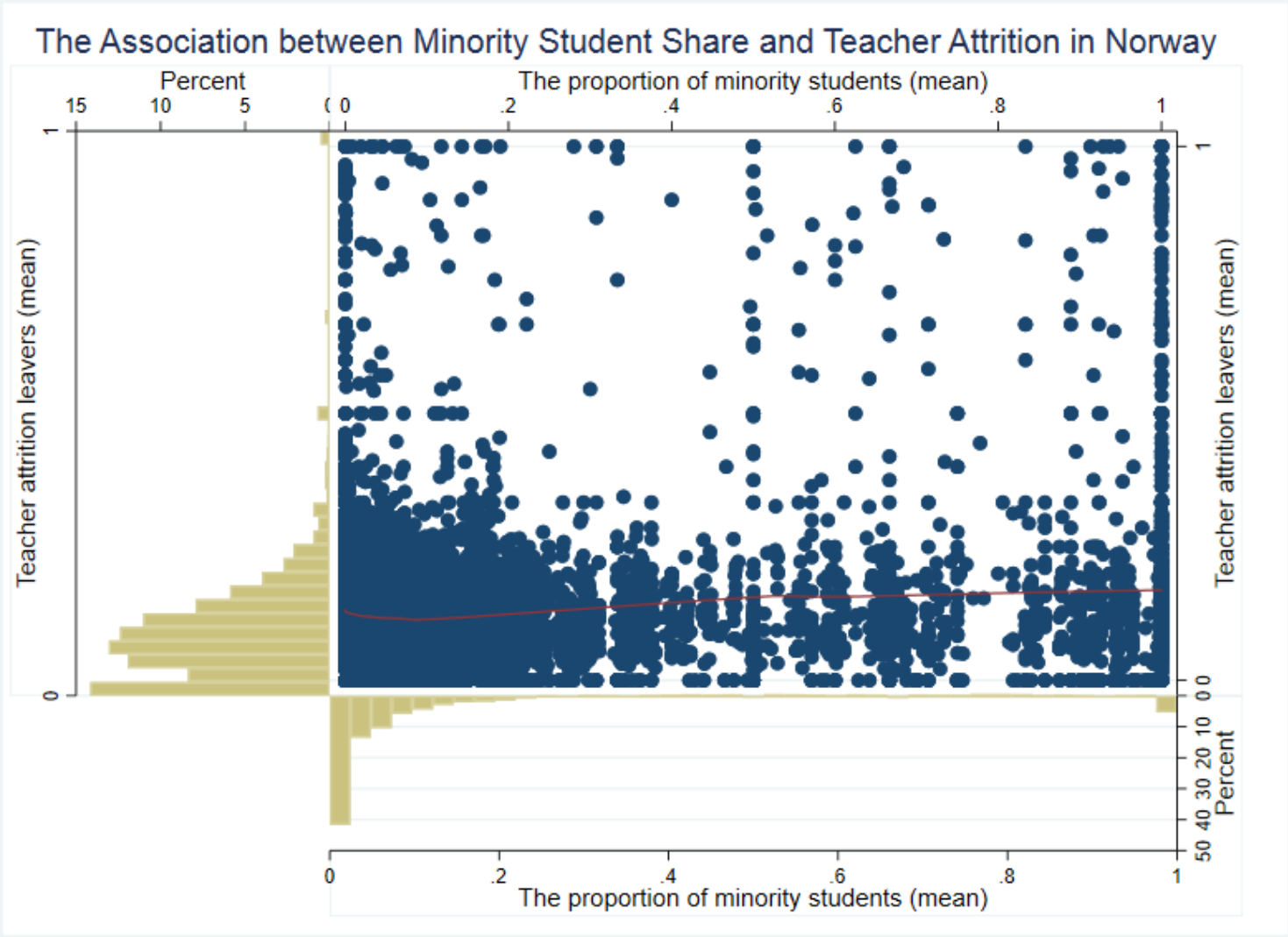
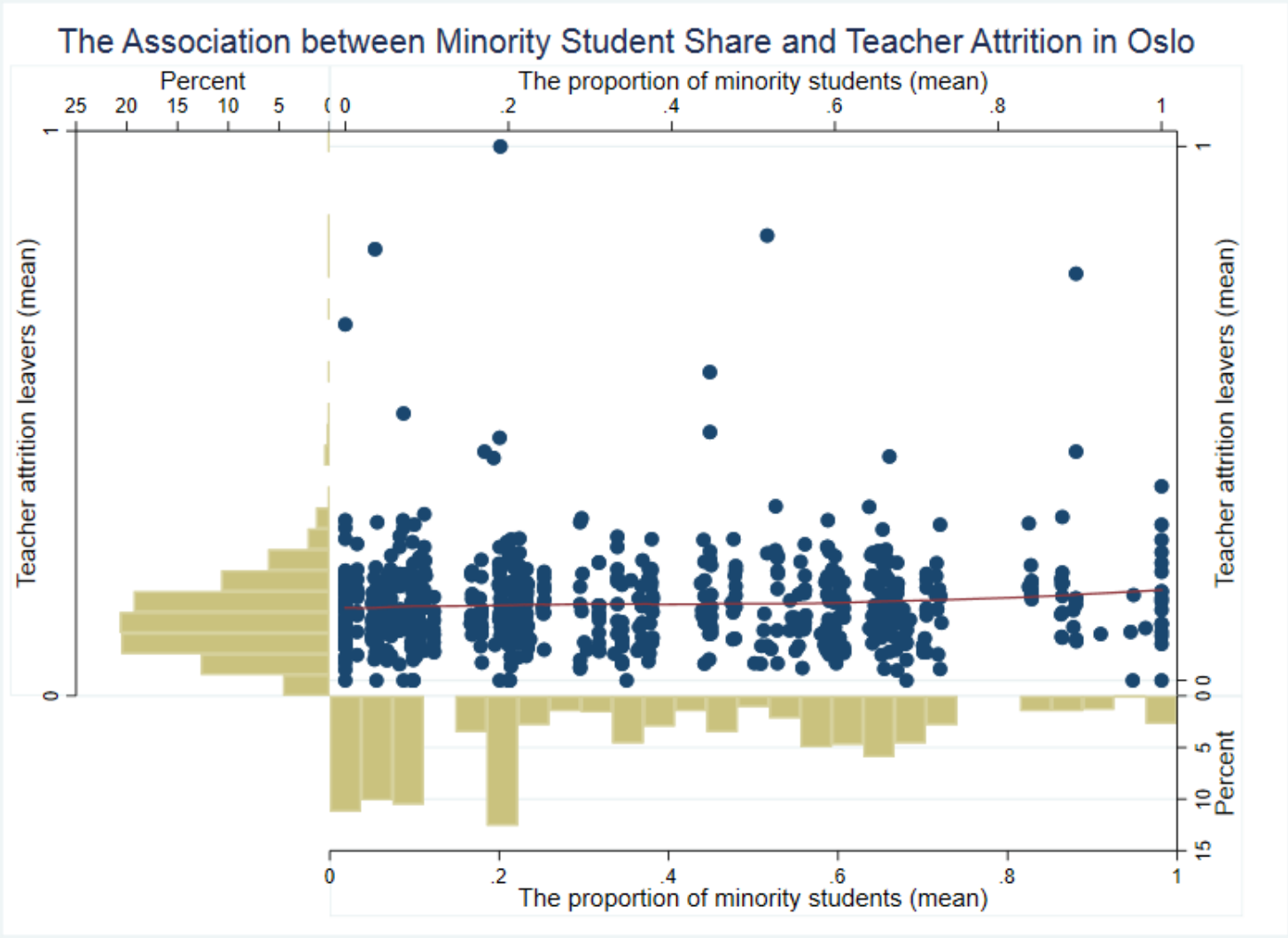


Figure 6.5: The association between the minority student share and teacher mobility in Oslo, 2003—2013, and histogram over the distribution of the minority student share and teacher attrition



6.1.4 Control Variables

6.1.4.1 Individual Teacher Characteristics

Table 6.4 shows the distribution of the samples in Norway and Oslo on the control variables regarding individual characteristics. About 65% of the individuals in the sample in Norway are female teachers, and about 68% in Oslo. Thus, the majority of teachers are women. This is also in line with the news article statement that the proportion of male teachers has fallen sharply in the Western world in recent decades (Skjong, 2018). The table also shows that the majority of teachers have children. Teachers with children constitute about 87% of the total sample of teachers in Norway, and about 75% in Oslo. About 91% of the teachers in Norway have a native majority background, compared to about 83% in Oslo. The percentages of teachers with minority background is higher in Oslo than in Norway at large, which is in line with my expectations. With regard to age groups, a great minority of the teachers, both in Norway and Oslo, are in the youngest (18—24) and oldest (65—70) age groups. However, for the second youngest age group, there are some variation between Norway and Oslo. In Norway, about 23% of teachers belong to this age group, whereas in Oslo, an even larger percentage of teachers, approximately 34%, are 25 to 34 years old.

Table 6.4: The distribution of the control variables, by samples in Norway and Oslo, years 2003—2013

	Norway		Oslo	
	N	%	N	%
Sex				
Male (ref.)	149 380	34.11	10 256	31.26
Female	282 819	65.89	22 553	68.74
<i>Missing</i>	0	0.00	0	0.00
<i>Total (N)</i>	429 199	100.00	32 809	100.00
Children	N	%	N	%
No children (ref.)	55 188	12.86	8 348	25.44
Children (1—15)	374 011	87.14	24 461	74.56
<i>Missing</i>	0	0.00	0	0.00
<i>Total (N)</i>	429 199	100.00	32 809	100.00
Immigrant group	N	%	N	%
Native majority (ref.)	388 915	90.61	27 360	83.39

Non-western immigrant	7 436	1.73	1 382	4.21
Non-western descendant	456	0.11	246	0.75
Western immigrant	12 930	3.01	1 297	3.95
Western descendant	556	0.13	55	0.17
Other	18 906	4.40	2 469	7.53
<i>Missing</i>	0	0.00	0	0.00
<i>Total (N)</i>	429 199	100.00	32 809	100.00
Age group	N	%	N	%
Age: 18—24 (ref.)	13 007	3.03	1 733	5.28
Age: 25—34	99 556	23.20	10 851	33.7
Age: 35—44	108 747	25.34	6 919	21.09
Age: 45—54	100 595	23.44	5 886	17.94
Age: 55—64	99 399	23.16	6 777	20.66
Age: 65—70	7 646	1.78	617	1.88
<i>Missing</i>	249	0.06	26	0.08
<i>Total (N)</i>	429 199	100.00	32 809	100.00

6.1.4.2 School Characteristics

Table 6.5 shows the distribution of school characteristics at school-level in Norway and Oslo, between years 2003—2013. Interestingly, almost all of the average scores for the variables are higher in Oslo than in Norway. The schools are on average serving more children and teachers in Oslo, compared to Norway as a whole. With regard to teacher density, there are on average 8 students per teacher at schools in Oslo, compared to about 7 students per teacher at schools in Norway. Moreover, on average about 8 students per school receive special Norwegian language training in schools in Norway, compared to on average about 49 students per school in Oslo. However, there is more dispersion of the estimate in Oslo ($SD = 57.41$), compared to Norway ($SD = 19.69$). Overall, this indicates, as expected, that Oslo has more minority-dense areas and school segregation compared to the average in Norway. Moreover, the average annual hours registered for special education, and especially for the average annual hours registered for special Norwegian language training are higher in Oslo, compared to Norway.

Regarding the control variables (see Section 5.2) in the multiple regression analyses, I only utilise some of the student- and school characteristics displayed in Table 6.5. However, I include more control variables in the sensitivity test in Section 7.3, and present the results in Appendix B.

Table 6.5: Descriptive statistics of school characteristics at school-level in Norway and Oslo, years 2003—2013

Variable	Norway					Oslo				
	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
Proportion of minority students	14444.00	0.15	0.27	0.00	1.00	740.00	0.34	0.28	0.00	1.00
Average number of students, 8 th —10 th grade	13072.00	155.98	139.01	1.00	608.79	740.00	236.08	165.10	2.00	608.79
Average number of students with special Norwegian language training	13061.00	7.91	19.69	0.00	242.00	740.00	48.95	57.41	0.00	242.00
Average primary school credits	14444.00	35.48	11.43	0.00	60.30	740.00	34.71	12.12	0.00	58.00
Average national test scores	11893.00	26.71	3.88	3.00	44.67	649.00	27.17	5.85	6.00	36.18
Average parental income	14444.00	660640.72	229683.53	0.00	1949749.13	740.00	761104.86	287671.29	339681.00	1949749.13
Proportion of parents with higher education	14444.00	0.15	0.16	0.00	1.00	740.00	0.28	0.23	0.00	1.00
Average annual hours registered for special education	13072.00	1886.65	1875.75	0.00	17298.00	740.00	2737.55	2558.04	0.00	17298.00
Average annual hours registered for special Norwegian language training	13072.00	278.29	530.06	0.00	5362.00	740.00	1141.04	1363.04	0.00	5362.00
Average total number teachers, 8 th —10 th grade	12971.00	19.65	13.97	0.00	76.00	740.00	26.88	13.86	0.00	68.00
Teacher density	12913.00	6.80	2.80	0.25	18.36	718.00	7.88	3.28	0.50	13.24
Average man-years without approved teacher education	13072.00	43.55	82.19	0.00	843.00	740.00	88.62	119.90	0.00	647.00
<i>Total (N)</i>	14 444					740				

7 Results

Previous international studies suggest that teacher turnover is linked to student composition, and especially the share of students from minority backgrounds (Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007). However, in Norway there is mixed evidence on the connection between minority background students and teacher turnover (see e.g., Falch & Rønning, 2007; Falch & Strøm, 2005). This analysis therefore seeks to map the association between student composition, measured by the proportion of minority students, and teacher mobility and teacher attrition. Two main analyses are performed in Section 7.1 and Section 7.2 in order to cover teacher mobility from lower secondary schools, and teacher attrition from the teaching profession in Norway. A subset of each analysis specifically addresses the situation in Oslo, due to large differences in the student composition between schools within a geographical delimited area, compared to Norway as a whole. All analyses are run as linear probability models, with and without school-FEs, robust standard errors and 95% confidence intervals. All models with moderation effects are run with all controls and school-FEs. Last, in this chapter I include sensitivity test results.

In all the following tables and figure in Section 7.1 and Section 7.2, I present seven models. Model 1.0 investigates the bivariate association between the proportion of minority students and teacher mobility or teacher attrition. It should be noted that I control for year in all models, to capture the possible influence from aggregate (time-series) rising trends in the data from year to year. Model 1.1 is identical to Model 1.0, but includes school-FEs. In Model 2.0 and Model 2.1, I run the models with both school-level and individual-level controls. However, Model 2.0 are without school-FE, whereas Model 2.1 includes them. The main control variables are year, school-level controls (average number of students and average teacher density), as well as individual-level controls for teachers' children, sex, immigrant group and age group. Model 3, Model 4 and Model 5 include interaction models with school-FEs, to investigate moderation effects. I analyse whether there are differences regarding specific teacher characteristics, with an interaction between the proportion of minority students and teachers' sex, immigrant group and age group, respectively.

All models and tables include *average marginal effects* and report the percentage points differences for teacher mobility or teacher attrition, when the share of minority students at school-level changes. Thus, I investigate a 100 percentage point increase in the proportion

of minority students at school-level, keeping the other variables constant. The estimates in the interaction terms also report the percentage point differences for the association between minority student share and teacher mobility or teacher attrition, compared to the reference value (e.g. male, native majority background or age group 18—24).

7.1 Association Between Minority Student Share and Teacher Mobility in Norway

In Section 4.5.1, I constructed the following hypotheses for the first part of the teacher mobility analysis in Norway:

***H1a:** There is a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Norway.*

***H1b:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for male teachers in Norway.*

***H1c:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for teachers with native majority background in Norway.*

***H1d:** The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for young teachers in Norway.*

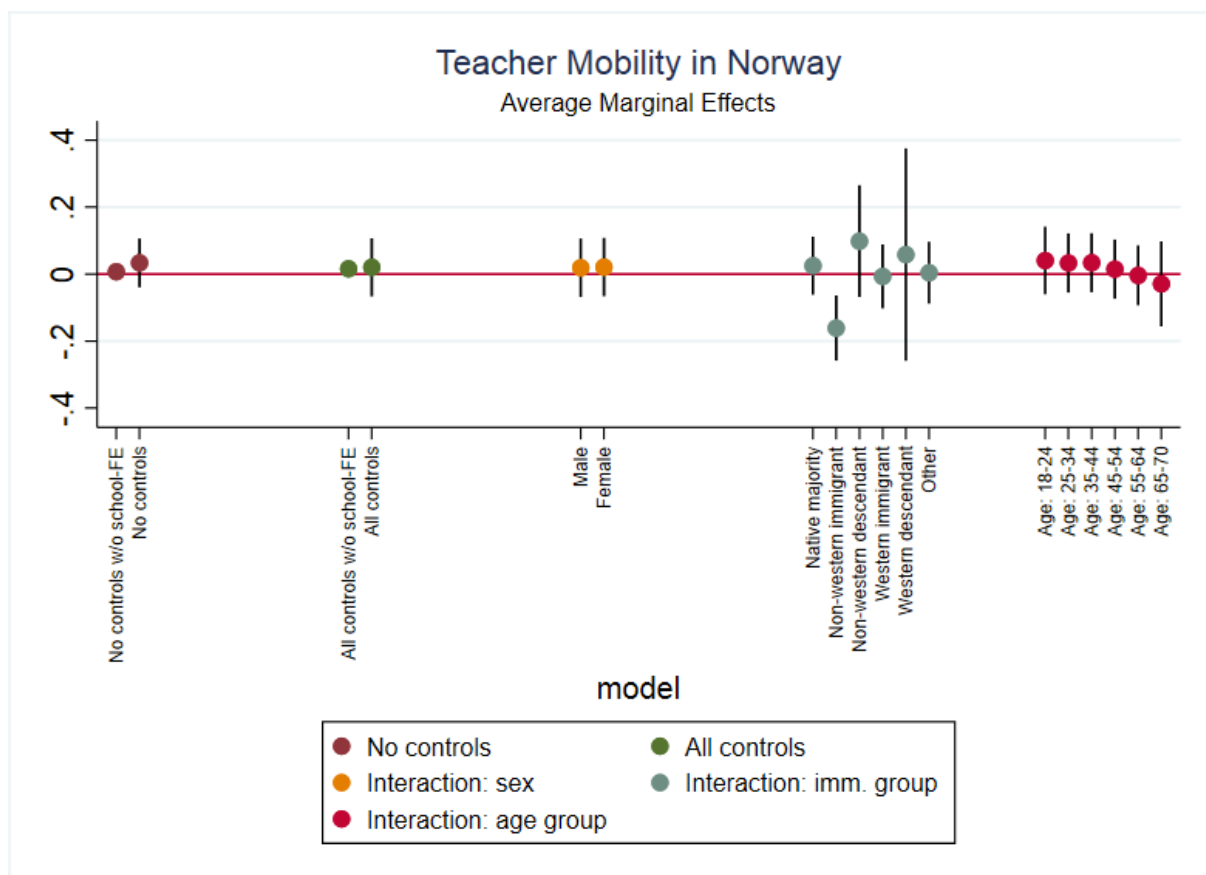
Table 7.1: The association between the proportion of minority students and teacher mobility in Norway. Average marginal effects of the proportion of minority students on teacher mobility

	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group
Proportion of minority students	0.00719 (0.00772)	0.0337 (0.0373)	0.0159 (0.0127)	0.0204 (0.0443)			
Male					0.0191 (0.0446)		
Female					0.0210 (0.0444)		
Native						0.0251 (0.0441)	
Non-western immigrant						-0.161** (0.0496)	
Non-western descendant						0.0983 (0.0850)	
Western immigrant						-0.00695 (0.0488)	
Western descendant						0.0581 (0.162)	
Other						0.00420 (0.0472)	
Age: 18—24							0.0407 (0.0517)
Age: 25—34							0.0332 (0.0451)
Age: 35—44							0.0340 (0.0450)
Age: 45—54							0.0148 (0.0451)
Age: 55—64							-0.00385 (0.0456)
Age: 65—70							-0.0291 (0.0648)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes
Children	No	No	Yes	Yes	Yes	Yes	Yes

Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	429199	429199	381814	381814	381814	381814	381814

Robust standard errors in parentheses
 * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7.1: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group



In Table 7.1 and Figure 7.1, Model 1.0 and Model 1.1 show that, on average, a 100 percentage points increase in the share of minority students is associated with a 0.7 and 3.37 percentage points increase in the probability that a teacher will leave the school. Thus, the

association is slightly stronger for within-school-variation, however, the parameter estimates for the share of minority students are relatively close to zero and statistically insignificant at a 5% level. By adding control variables in Model 2.0 and Model 2.1, the *positive* parameter estimates for the independent variable is almost identical to the models with no control variables.

By looking at Model 3, Model 4 and Model 5 in Figure 7.1 almost all parameter estimates for the association between the share of minority students and teacher mobility are either practically zero and/or statistically insignificant. Interestingly, the coefficient for the proportion of minority students on teacher mobility from schools, for non-western immigrants is -0.161, and the effect is statistically significant at $p < 0.01$. Hence, Model 4 indicates that, on average, a 100 percentage points increase in the share of minority students within a school is associated with a 16.1 percentage point reduction in the probability of teacher mobility for non-western immigrant teachers, compared to the native majority teachers. Moreover, as shown by descriptive statistics in Table 6.4, non-western immigrant teachers contribute with about 2% (rounded up) of the total sample in Norway, which also is illustrated by the relatively wide confidence interval attached to the parameter estimate of non-western immigrant teachers in Figure 7.1.

Overall, the first analysis reveals that the share of minority students does not affect the probability that teachers will leave lower secondary schools in Norway. However, the coefficient for non-western immigrant teachers stands out significantly. On average, a 100 percentage points increase in the share of minority students within schools is associated with the greatest percentage points reduction in the probability that non-western immigrant teachers will leave the school, compared to native majority teachers. In addition, I find no sex-related and age-related associations, with insignificant coefficients close to zero. Thus, I soundly reject hypotheses *H1a*, *H1b*, *H1c* and *H1d*.

7.1.1 Association Between Minority Student Share and Teacher Mobility in Oslo

In this subset, the analysis specifically addresses the situation in Oslo. Thus, I test these following hypotheses:

H2a: There is a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Oslo.

H2b: The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for male teachers in Oslo.

H2c: The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for teachers with native majority background in Oslo.

H2d: The positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools is stronger for young teachers in Oslo.

In the following Table 7.2 and Figure 7.2, the models are identical to the models in the previous analysis for teacher mobility in Norway, the only difference being that the sample only covers teachers in Oslo.

Table 7.2: The association between the proportion of minority students and teacher mobility in Oslo. Average marginal effects of the proportion of minority students on teacher mobility

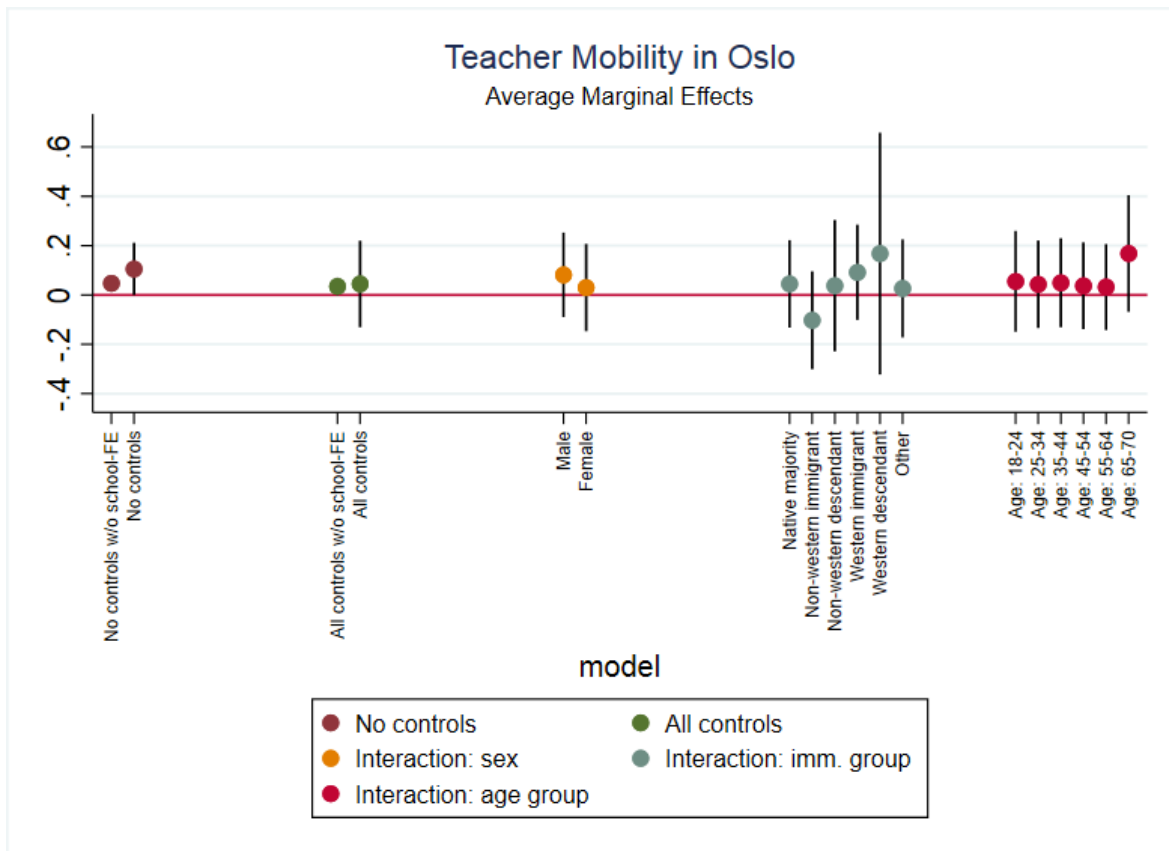
	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group
Proportion of minority students	0.0473** (0.0165)	0.105 (0.0541)	0.0347 (0.0180)	0.0447 (0.0895)			
Male					0.0813 (0.0875)		
Female					0.0299 (0.0903)		
Native						0.0450 (0.0905)	
Non-western immigrant						-0.102 (0.101)	
Non-western descendant						0.0377 (0.136)	
Western immigrant						0.0917 (0.0985)	

Western descendant	0.168 (0.250)
Other	0.0266 (0.101)
Age: 18—24	0.0550 (0.104)
Age: 25—34	0.0433 (0.0905)
Age: 35—44	0.0494 (0.0905)
Age: 45—54	0.0372 (0.0897)
Age: 55—64	0.0321 (0.0889)
Age: 65—70	0.168 (0.121)

Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes
Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	32809	32783	31657	31657	31657	31657	31657

Robust standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7.2: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group



The models in Table 7.2. and Figure 7.2 display some differences compared to the analysis for Norway in Section 7.1. Model 1.0 and Model 1.1 show that, on average, a 100 percentage points increase in the share of minority students is associated with a 4.7 and 10.5 percentage points increase in the probability that a teacher will leave the school in Oslo. The parameter estimate for the share of minority students for the between-school-variation in Model 1.0 is statistically significant at $p < 0.01$. However, the coefficient for the within-school-variation in Model 1.1 of 0.105 is insignificant at conventional levels, but close to the 5% significance threshold ($p = 0.052$). The analysis indicates that there is a small association between the share of minority students and teacher mobility between schools in Oslo. However, when including school-FEs, there is no *causal* association between the increase in the share of minority students and teacher mobility. Turning to Model 2.0 and Model 2.1, when adding all control variables, the small positive association in the previous models disappears and the parameter estimates are relatively close to zero and insignificant.

Regarding the moderation effects in Model 3, Model 4 and Model 5 in Figure 7.2, all

the parameter estimates for the interaction terms are insignificant and the confidence intervals are wide, thus, leading me to conclude that I find no sex-related, immigrant background-related or age-related associations. Interestingly, in Model 5, the coefficient for the share of minority students on teacher mobility for teachers at age 65—70 is 0.168. Importantly, the coefficient is not statistically significant, but this might indicate an age-related pattern since this estimate diverges from both the reference value and the other age groups.

All in all, the second analysis in Section 7.1, reveals that the proportion of minority students is of little importance for the probability of teacher mobility from schools in Oslo, when controlling for school-level and individual-level characteristics. The interaction terms display some different parameter estimates. However, all the moderation effects are insignificant, with relatively wide confidence intervals. Therefore, I safely reject *H2a*, *H2b*, *H2c* and *H2d*.

7.2 Association Between Minority Student Share and Teacher Attrition in Norway

Investigation of the association between student composition and teacher mobility has been central to previous studies regarding teacher mobility. In line with this, the question of an association between the student composition and teacher attrition, is also important. To what extent are teachers leaving the teaching profession related to the specific student compositions? I test these following hypotheses in the first part of Section 7.2:

H3a: There is a positive association between the proportion of students with a minority background and teachers' propensity to leave their profession in Norway.

H3b: The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for male teachers in Norway.

H3c: The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for teachers with native majority background in Norway.

H3d: The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for young teachers in Norway.

Table 7.3: The association between the proportion of minority students and teacher attrition in Norway. Average marginal effects of the proportion of minority students on teacher attrition.

	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group
Proportion of minority students	0.0697*** (0.0125)	0.0262 (0.0382)	0.000948 (0.00791)	0.0171 (0.0436)			
Male					0.0223 (0.0436)		
Female					0.0144 (0.0438)		
Native						0.0200 (0.0435)	
Non-western immigrant						-0.115* (0.0462)	
Non-western descendant						0.184* (0.0736)	
Western immigrant						-0.00556 (0.0489)	
Western descendant						0.0874 (0.151)	
Other						0.0161 (0.0465)	
Age: 18—24							0.0986 (0.0527)
Age: 25—34							0.0288 (0.0443)
Age: 35—44							0.0170 (0.0439)
Age: 45—54							0.00631 (0.0444)
Age: 55—64							0.00555 (0.0438)
Age: 65—70							-0.00740 (0.0620)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of	No	No	Yes	Yes	Yes	Yes	Yes

students

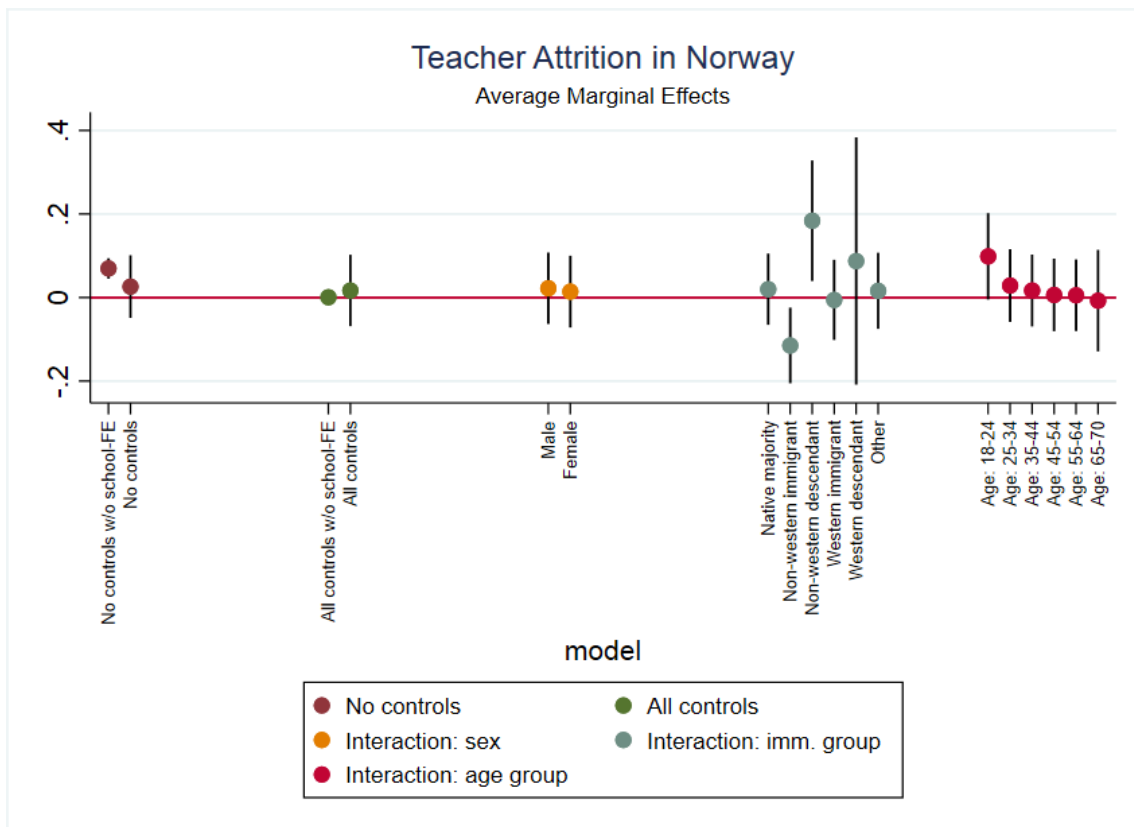
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes
Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes

N	429199	429199	381814	381814	381814	381814	381814
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Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7.3: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group



In Table 7.3 and Figure 7.3, all models without moderation effects display positive parameter estimates. Model 1.0 shows that, on average, a 100 percentage points increase in the share of minority students is associated with 6.97 percentage points increase in the probability that a teacher will leave the teaching profession. The effect for the association for between-school differences is statistically significant a $p < 0.001$. However, in Model 1.1, when including school-FEs (within-school-variation), the insignificant coefficient is 0.026. Hence, the minority student share does not affect the probability of teacher attrition in Norway. Moreover, once controlling for school-level and individual-level characteristics, the parameter estimates in Model 2.0 and Model 2.1 are also practically zero and insignificant.

Model 3, Model 4 and Model 5 in Figure 7.3, reveal some interesting results regarding the interaction terms. First, there are no differences in the moderation effects for male and female teachers, and the coefficients for the AME are insignificant. Similarly, as in the analysis for Norway in Section 7.1, it is apparent that the parameter estimate for non-western immigrant teachers stands out, compared to the coefficient for native majority teachers. On average, a 100 percentage points increase in the share of minority students is associated with 11.5 percentage points reduction in the probability that a teacher with non-western immigrant background will leave the teaching profession, compared to a teacher with a native majority background. The coefficient is significant at $p < 0.05$. Moreover, the value for teachers with non-western descendant background also stands out. However, the confidence intervals are fairly wide, and that the total number of teachers in this group is only 456, which equals to 0.11 percent of the total sample of teachers in Norway. Considering that, on average, a 100 percentage points increase in the share of minority students is associated with 18.4 percentage points increase in the probability that a teacher with a non-western descendant background will leave the teaching profession entirely, compared to a teacher with a native majority background. The effect is also significant at $p < 0.05$. Furthermore, the parameter estimates for the interaction terms with age are insignificant and the confidence intervals are wide, thus, I conclude that I find no age-related associations. However, interestingly, the parameter estimate for the youngest teachers stands out and is about 0.099, yet it is close to the 5% threshold and insignificant at $p = 0.061$.

Overall, the first analysis in Section 7.2 reveals that the share of minority students does not affect the probability that teachers will leave the teaching profession in Norway. However, on average, a 100 percentage points increase in the share of minority students is associated with the greatest percentage points reduction in the probability that non-western immigrant teachers will leave the profession, compared to native majority teachers. On the

other hand, on average, a 100 percentage points increase in the share of minority students is associated with the greatest percentage points increase in the probability that non-western descendant teachers will leave the profession, compared to native majority teachers. In addition, I conclude that I find no sex-related or age-related associations. Therefore, I reject *H3a*, *H3b*, *H3c* and *H3d*.

7.2.1 Association Between Minority Student Share and Teacher Attrition in Oslo

In this subset, the analysis specifically addresses the situation in Oslo and I test these following hypotheses:

H4a: There is a positive association between the proportion of students with a minority background and teachers' propensity to leave their profession in Oslo.

H4b: The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for male teachers in Oslo.

H4c: The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for teachers with native majority background in Oslo.

H4d: The positive association between the proportion of students with a minority background and teacher attrition from the teaching profession is stronger for young teachers in Oslo.

In the following Table 7.4 and Figure 7.4, the models are identical to the models in the previous analysis for teacher attrition in Norway, the only difference being that the sample only covers teachers in Oslo.

Table 7.4: The association between the proportion of minority students and teacher attrition in Oslo. Average marginal effects of the proportion of minority students on teacher attrition in Oslo

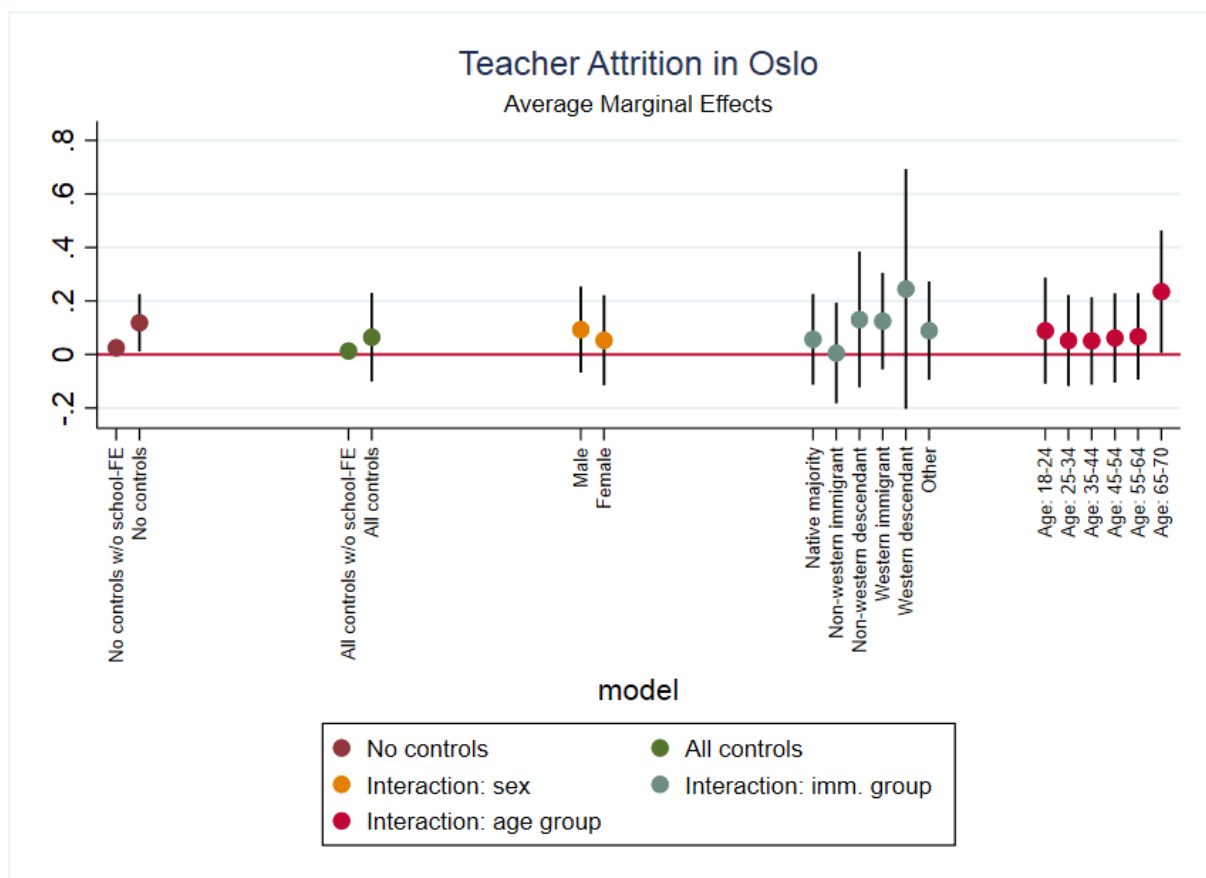
	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group
Proportion of minority students	0.0253 (0.0139)	0.119* (0.0547)	0.0134 (0.0135)	0.0647 (0.0846)			
Male					0.0931 (0.0821)		
Female					0.0531 (0.0858)		
Native						0.0569 (0.0866)	
Non-western immigrant						0.00549 (0.0959)	
Non-western descendant						0.131 (0.129)	
Western immigrant						0.125 (0.0922)	
Western descendant						0.245 (0.229)	
Other						0.0891 (0.0938)	
Age: 18—24							0.0889 (0.101)
Age: 25—34							0.0524 (0.0871)
Age: 35—44							0.0511 (0.0836)
Age: 45—54							0.0619 (0.0852)
Age: 55—64							0.0672 (0.0825)
Age: 65—70							0.235* (0.117)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes

Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	32809	32783	31657	31657	31657	31657	31657

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7.4: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group



The models in Table 7.4 and Figure 7.4 show some differences compared to the previous analysis for Norway in Section 7.2. Model 1.0 and Model 1.1 show that, on average, a 100

percentage points increase in the share of minority students is associated with a 2.5 and 11.9 percentage point higher probability of teacher attrition in Oslo. The association in Model 1.0 is insignificant. Interestingly, Model 1.1 with school-FEs shows a positive and relatively strong coefficient for the minority student share on teacher attrition from the profession. The parameter estimate is 0.119 and statistically significant at $p < 0.05$. Thus, the association is much stronger in a positive direction for the within-school-variation, than between-school-variation. The school-FEs enable us to study year-to-year variation within each school. Hence, with a positively stronger and significant association, Model 1.1 points in the direction closer to a *causal* association between the share of minority students and teacher attrition in Oslo. However, in Model 2.0 and Model 2.1, the positive association in the previous model disappears, and the average marginal effects are reduced and display insignificant results.

In order to address teacher characteristics in Oslo, I turn to the interaction models in Figure 7.4. In Model 3, the parameter estimate for male teachers is approximately 4 percentage points higher than for female teachers, but the parameter estimates are insignificant. The most interesting result in this analysis is that the association between the share of minority students and teacher attrition is positive and significant for the oldest teachers, compared to the youngest teachers. The coefficient for the proportion of minority students on teacher attrition from the profession, for teachers at age 65—70 is 0.235, and the effect is statistically significant at $p < 0.05$. Thus, Model 5 suggests that there are some differences between teacher age groups. This may indicate that the oldest teachers in Oslo, respond differently to schools with high and increasing shares of minority students, or that the oldest teachers have different attrition patterns in terms of for example choosing final retirement, compared to the youngest teachers. Importantly, the oldest teachers contribute to approximately 2% of the total sample of teachers in Oslo. The confidence interval for the oldest teachers is relatively wide, and the p -value is close to the threshold of 5 %, thus, leading me to interpret these findings with some uncertainty.

All in all, the second analysis for Oslo in Section 7.2.1, shows that once I include all school-level and individual-level controls, the proportion of minority students does not affect the probability that a teacher will leave the teaching profession in Oslo. There is a positive and significant association in Model 1.1 regarding within-school-variation, but the positive association disappears when adding all control variables in the analysis. Despite that the teacher attrition coefficient for the oldest teachers stands out, none of the coefficients confirm the hypotheses in the expected direction. Consequently, I reject $H4a$, $H4b$, $H4c$ and $H4d$.

7.3 Sensitivity Test of the Models

7.3.1 Student Composition and Correlated Variables

In order to check whether the results from the analyses are sensitive to changes in model specification, I executed some sensitivity tests. Hence, I included a variable about teachers' marital status, and control variables that were expected to be (partly) correlated with the share of minority students. Student- and school characteristics usually are correlated (see e.g., Boyd et al., 2005; Scafidi et al., 2007), such the share of minority students and socio-economic factors. As before-mentioned, Birkelund et al. (2010, p. 20) documented a negative correlation (Pearsons $r = -0.83$) between the share of students with parents with higher education and the share of minority students at lower secondary schools in Oslo. Moreover, schools with a high proportion of minority students are likely to have higher numbers of students with special Norwegian language training.

In the sensitivity test, I reran Model 2.0 (without school-FEs) and Model 2.1 (with school-FEs) with additional control variables. I added control variables like the average number of students with special Norwegian language training, students' average primary school credits¹⁹, average parental income, the proportion of parents with higher education, average man-years without approved teacher education, and teachers' marital status. As anticipated and illustrated in tables and figures in Appendix B, the average marginal effects for the coefficients in the models were overall quite similar, with minimally reduced effect size.

Largely, when adding (partly) correlated variables, I expected that the variables would “pull” in the same direction, and thus lead to similar or smaller coefficients in the analyses. The overall findings from all four sensitivity tests are in line with my expectations and the association between the share of minority students and teacher mobility and/or teacher attrition is insignificant and close to zero. I reran all analyses (1a, 1b, 2a, 2b), observing robustness across them all, as illustrated in Appendix B.

¹⁹ Primary school credits [grunnskolepoeng] are a total score calculated on the basis of all the final grades and examination grades included in the diploma of lower secondary school, and form the basis for admission to upper secondary school (The Norwegian Directorate for Education and Training, 2020).

8 Discussion and Concluding Remarks

In this study, I present the first sociological contribution to understanding the association between the share of minority students and teacher mobility from lower secondary schools and/or attrition from the profession in Norway and Oslo, respectively. With a few exceptions, there are little previous research in this field in Norway. Hence, I first utilised a descriptive approach, followed by linear probability models, with and without school-FEs, to try to understand this process. I presented the average marginal effects of the proportion of minority students on teacher mobility and/or teacher attrition. By situating the thesis within analytical sociology, I have tried to come closer to an understanding of the potential factors or mechanisms that may cause teacher mobility and attrition.

In this chapter, I discuss and contextualise my findings and explain the shortcomings of this study.

8.1 How is the Minority Student Share Associated with Teacher Mobility and Attrition in Norway?

Based on the results in Chapters 6 and 7, I deduce some conclusions. Taking into account theoretical expectations and previous research, I anticipated that there would be a positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools in Norway (*H1a*), and teachers' propensity to leave their profession in Norway (*H3a*).

For the teacher mobility and attrition analyses in Norway, I find no associations present and *H1a* and *H3a* are therefore rejected. Figure 7.1 and Figure 7.3 give relatively clear evidence that once I include school-FEs and all school-level and individual-level controls, the proportion of minority students does not affect the probability that teachers will exit lower secondary schools and/or the teaching profession in Norway. Overall, these findings contradict both my theoretical expectations and previous research on this topic. My findings challenge previous international research²⁰ which has indicated that the share of ethnic or racial minority background students is associated with teacher turnover (see e.g.,

²⁰ Notice that several of these studies investigated only beginner teachers, whereas this study does not distinguish between teachers of different seniority.

Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007). The findings also differ from the findings by Falch and Strøm (2005), who concluded that teachers in Norway have tended to leave schools with high proportions of minority students and high shares of students with special needs. Still, they emphasised that no conclusions could be drawn about *causal* effects of student composition on teacher mobility. The results in my thesis are, however, in accordance with Falch and Rønning (2007, p. 189), who found that the share of minority students, only had a small and insignificant effects on teacher mobility and attrition in Norway. Crucially to recall, the latter study primarily focused on the effect of student achievement on teacher turnover which resulted in significant associations. On the whole, the results in my thesis do not support the theoretical expectations that concentration of minority students serve as a *push-factor* for teacher turnover.

The discrepancy between these findings and the majority of the international research literature could be due to substantial differences between countries. First, the Scandinavian social-democratic welfare state in Norway influences the Norwegian educational system (Haugen, 2020, p. 69), as well as policies related to the labour market and salaries. Important features of the Norwegian school system and labour market differ substantially from the US and/or the UK, where most previous studies on this topic has taken place. The local school variations are anticipated to be higher in the US than in Norway, due to local state- and parental financial contributions to schools, as well as free school choice within several local governments. Lower secondary schools in Norway are relatively similar in terms of organisation and schooling. Moreover, local governments in Norway are responsible for the free public education, from 1st to 10th grade (Falch & Strøm, 2005, p. 613). The level of ethnic and socio-economic segregation in schools and neighbourhoods are also generally lower in Norway, compared to the US (Falch & Strøm, 2005). Moreover, as illustrated in Table A.1 (in Appendix A), the within-school variation in the share of minority students at school-level in Norway is only about 1.2 percentage points each year. These small year-to-year changes in the share of minority students within schools in Norway might also contribute to the null findings in the fixed effects models (though models without fixed effects produce similar results). In addition, in Norway progressive resource allocations have policies aiming to allocate more resources to schools with more disadvantaged students (Rogne et al., 2021, p. 19; Taguma, Shewbridge, Huttova, & Hoffman, 2009). Such policies may, to some degree, influence teachers to not systematically leave schools with high shares of minority students or the teaching profession.

Moreover, this study may be diverging from the Norwegian findings on this topic, obtained from economics, due to different estimation methods and more recent data sets. For example, Falch and Strøm (2005, p. 623) used data between 1992—2000, and found that teachers' propensity to quit was about 0.4 percentage points higher for schools with 10% minority students, compared to a school with no minority students. Recall, that this study uses data between 2003—2013, and measures the probability of teacher mobility and attrition at a 100 percentage points increase in the share of minority students at school-level. Moreover, on average, Norwegians have relatively tolerant attitudes towards minorities (Blom, 2011, referred in, Rogne et al., 2021). It is reasonable that the general attitudes in the population adapt to the growing minority population in Norway, and that the more recent data material and another measure of the share of minority students may contribute to the diverging findings.

8.1.1 How Does the Association Between Student Composition and Teacher Mobility and Attrition Vary with Teacher Characteristics in Norway?

The third research question concerns whether and how the association between the proportion of minority students and teacher mobility and/or teacher attrition vary with teacher characteristics. In light of theoretical expectations and previous research, I expected that the presumably positive association between the proportion of students with a minority background and teacher mobility and attrition to be stronger for male teachers (*H1b* and *H3b*). In addition, stronger for teachers with native majority background (*H1c* and *H3c*) and stronger for younger teachers (*H1d* and *H3d*). Some of the findings regarding these interaction terms are in line with previous research, yet the analyses do not overall support the hypotheses and all of them are rejected.

Furthermore, the analyses show practically no differences between men and women, which led me to reject *H1b* and *H3b*. Even though the coefficients for teachers' age groups in Norway are insignificant (as illustrated in Figure 7.3) and I concluded there to be no overall age-related associations in Norway, the coefficient for the *youngest teachers* shows an interesting tendency. On average, an increase in the share of minority students is associated with 9.9 percentage points increase in the probability that the youngest teachers will leave the teaching profession. The coefficient is insignificant, yet near the conventional threshold at $p =$

0.061. National and international findings have indicated that teacher attrition is often higher during the first year of teaching (see e.g., Eberts, 1987; Greenberg & McCall, 1974; Hanushek et al., 2004; Mont & Rees, 1996; E. M. Skaalvik & Skaalvik, 2018; Tiplic et al., 2015), and among those recently graduated (Grissmer & Kirby, 1992; Guarino et al., 2006, referred in, With, 2017). Young teachers could be unprepared to meet the demands of a teaching job, and the working environment in a school (Vagi & Pivovarova, 2017, p. 783). As my data also includes assistant teachers and temporal positions, that are likely to more rapidly change between organisations and work locations (Sundt & Næsheim, 2020), this may contribute to the findings for younger teachers. For example, assistant teachers may be young students, teaching part-time, or young assistants using teaching as a “back-up plan”, in order to build personal and financial resources in preparation for another career (Watt & Richardson, 2008, p. 423). Despite that the age-related tendency for teacher attrition are in line with previous research, the insignificant coefficients for the young teachers led me to reject *H1d* and *H3d*.

8.1.1.1 Differences Between Non-Western Immigrants and Non-Western Descendants in Norway

I found no evidence of an association between the share of minority students and teacher mobility and attrition in Norway, yet the interaction models with teachers' immigrant group produced interesting results. For *non-western immigrant* teachers, on average, an increase in the share of minority students is associated with significantly *lower probabilities* of exiting their school and the teaching profession, compared to native majority teachers. This is in accordance with international studies that have suggested that minority teachers have tended to desire schools with higher shares of ethnic or racial minority students, and that the likelihood of teacher mobility is reduced if minority teachers work at schools with larger proportions of minority students (Boyd et al., 2005; Feng, 2009; Hanushek et al., 2004; Imazeki, 2005). The results are in accordance with the idea that teachers are motivated by “the opportunity to make a difference and contribute to children's development.” (Scott, Stone & Dinham, 2001, referred in E. M. Skaalvik & Skaalvik, 2011, p. 369). Qualitative interviews with teacher students with immigrant background in Norway, have emphasised that many considered themselves to be future role models for students with immigrant backgrounds, and an important teacher resources due to their additional language skills (Island, 2007, referred in, Spernes, 2016). The findings supported my theoretical expectations that some minority teachers may have different desires than the native majority teacher population. However, it

may also be the case that non-western immigrant teachers have less job opportunities in the labour market, and thus have lower propensities to exit a school or the teaching profession in Norway at large. *H1c* and *H3c* are, rejected since the hypotheses do not capture the results in the expected direction – the association between the minority student share and teacher mobility and attrition is not stronger in a positive direction or significant for the native majority teachers.

In addition, the share of minority students is associated with significantly *higher probabilities* of leaving the profession for *non-western descendant* teachers, compared to native majority teachers. The significantly *higher probabilities* of leaving the profession for non-western descendant teachers in Norway, may suggest mechanisms related to several social phenomena. First, given that I include assistant teachers and temporal positions, these individuals may believe that teaching can offer “skills and experiences that may be applied in other domains and contexts outside of school classrooms”, and hence use a temporal position in teaching as a stepping stone into other professions or careers (Watt & Richardson, 2008, pp. 418, 423). Moreover, non-western descendant assistant teachers might use the profession to gain individual and economic resources before starting another career (Watt & Richardson, 2008, p. 423). Additionally, it is likely that second-generation immigrants in Norway have improved human capital (Becker, 1993), in terms of linguistic skills, educational qualifications, work experience (Hermansen, 2013) and cultural skills, and therefore may have other desires and opportunities than the first-generation immigrants in the labour market.

Second, the findings may support the expectation that descendants of immigrants do have other desires, beliefs and opportunities than the native majority teachers in Norway, but also different from first-generation immigrants. The *higher probabilities* of leaving the profession among non-western descendant teachers in Norway may capture assistant teachers, working part-time, while studying to embark on another profession. Moreover, it can possibly be interpreted in accordance with previous Norwegian research about the *immigrant drive* and selection to professional educations among descendants of immigrants. First, at a macro-level in the Norwegian society and among several immigrant families and ethnic networks in Norway, the teaching profession is not considered as one of the professional subjects (e.g. medicine, dentistry, pharmacy, law, engineering) that yield status (Leirvik, 2016). Career ambitions and values among immigrant parents are transferred to their children (Hegna, 2010, referred in, Leirvik, 2016), and for several students with an immigrant background, choosing a teaching career is not desirable in terms of status (Henriksen, 2006; Støren, 2010, referred in, Spernes, 2016). By internalising macro-level structures, a teacher with an immigrant

background may desire a high-status professional education, such as medicine or law, that yields more status in certain ethnic networks in Norway. Thus, if non-western descendant teachers have the opportunities, they may work as part-time *assistant* teachers, while studying to embark on another profession.

On the other hand, mechanisms in accordance with immigrant drive and status professions may not be present among all immigrant groups in Norway. Immigrants coming from some countries possibly possess more resources compared to others, which in turn may influence aspirations (Borjas, 1992, referred in, S. N. Fekjær, 2007). This study has not identified or categorised the professions individuals choose after leaving teaching, and I have not used information about the teachers' parents. The *immigrant drive* and selection-mechanism are therefore only two of many possible interpretations of why teachers who are descendants of non-western immigrants have a higher propensity to leave the profession when the minority student share increases, compared to the native majority population. *H1c* and *H3c* are rejected, and the topic calls for more research in order to link this association for non-western descendant teachers to the mechanisms of immigrant drive.

8.2 How is the Minority Student Share Associated with Teacher Mobility and Attrition in Oslo?

Since Oslo is a city with relatively large socio-economic differences, ethnic residential segregation and schools with very different student compositions, I assumed that the association between student composition and teacher turnover could turn out different in Oslo, compared to Norway.

The descriptive statistics in Chapter 6 show that average turnover rates for teachers are higher in Oslo, than Norway as a whole. This corresponds with national findings where the quit-rate is higher in large local governments (Falch & Strøm, 2005, p. 625). Moreover, previous international research has suggested that teacher turnover rates tend to be particularly high in urban schools, especially in large urban regions (Lankford et al., 2002). Urban inner-city schools are more likely to have teachers who exit their schools, when comparing with teachers in other areas (Ingersoll 2001; Lankford et al. 2002, referred in, Feng, 2009, p. 1171).

In regard to the findings on the association between the share of minority students and teacher mobility and attrition in Oslo, Figure 7.2 and Figure 7.4 need to be further nuanced.

By looking at the first two bivariate models in the figures, these show relatively similar results, which contradict the findings from Norway as a whole. The associations for the within-school-variations are stronger in a positive direction than the between-school-variation results in both analyses in Oslo. The coefficient at 0.105, based on within-school-variation in the teacher mobility analysis is insignificant near the threshold at $p = 0.052$. However, the coefficient at 0.119, based on within-school-variation in the teacher attrition analysis is significant at $p < 0.05$. All coefficients might be due to coincidences (Thygesen & Ersbøll, 2014), yet significant or insignificant at the 5% threshold, the results based on the within-school-variation show similar tendencies in both analyses for Oslo. The analyses based on the variation in student composition within schools suggest that teachers in Oslo do tend to change workplaces or professions when the share of minority students at their school increases.

The differences in within-school-variation findings between Norway and Oslo might indicate that the share of minority students is, to a larger degree, associated with teacher mobility and attrition in Oslo, than in Norway at large. However, the positive associations for the within-school-variation in Oslo, might be due to unmeasured time-varying characteristics at certain schools. Such characteristics might confound the relation of interest, and to a larger degree than in the rest of Norway. The models of within-school-variation for Oslo suggest that teachers' propensity to quit are influenced by the share of minority students. However, it is challenging to capture *causal* mechanisms behind teacher mobility and attrition. There might be several potential confounding time trends and student- and school characteristics are usually correlated (see e.g., Boyd et al., 2005; Scafidi et al., 2007). Parallel with an increase in the share of minority students, the share of low socio-economic status probably also increases. In Oslo, Birkelund et al. (2010, p. 20), documented a strong negative correlation (Pearsons $r = -0.83$) between the share of students with parents with higher education and the share of minority students in lower secondary schools. In addition, in this study, once adding control variables and with or without school-FEs, in both analyses for Oslo, the positive associations in the previous models disappear and are insignificant, and $H2a$ and $H4a$ are safely rejected.

The average increased turnover rates of *movers* and *leavers* in Oslo, compared to Norway, might be linked to the average relocations in and out of Oslo, regional differences in living costs and opportunities, increasing housing prices and a tight labour market within a limited geographical are, as elaborated in the chapter about Oslo (see Section 4.3.2). Unfortunately, this thesis does not include control variables for regional characteristics (see e.g., Falch & Strøm, 2005; Hanushek et al., 2004; Imazeki, 2005), and further research is

needed to assess the validity of these above-mentioned interpretations.

Overall, the findings from Oslo contradict previous research and my theoretical assumptions, similarly as for the analyses for Norway. Schools in urban areas with disadvantaged student compositions (including high concentration of ethnic or racial minority students), have appeared particularly vulnerable for teacher turnover in the US (Hanushek et al., 2004). However, I am not able to conclude that the share of minority students is statistically linked to teacher mobility and attrition in Oslo.

8.2.1 How Does the Association Between Student Composition and Teacher Mobility and Attrition Vary with Teacher Characteristics in Oslo?

Based on theoretical assumptions and previous research, I anticipated that the positive association between the proportion of students with a minority background and teacher mobility from lower secondary schools and teacher attrition from the teaching profession in Oslo would be stronger for male teachers (*H2b* and *H4b*), stronger for teachers with native majority background (*H2c* and *H4c*) and stronger for younger teachers (*H2d* and *H4d*). Despite that some interaction models showed some interesting patterns in line with previous research and our expectations, I rejected these hypotheses.

Like the analyses for Norway as a whole, I concluded that there are no sex-related associations in Oslo and I rejected *H2b* and *H4b*. However, compared to the analyses in Norway, the sex-interaction term coefficients in both analyses for Oslo are 4 to 5 percentage points higher for male than female teachers. Arguably, these tendencies are in accordance with Norwegian studies indicating that male teachers have a higher propensity to leave a school (Falch & Strøm, 2005) and to leave the teaching profession (With, 2017), than female teachers, yet the coefficients are insignificant.

Regarding the interaction models for teachers' age group in Oslo, *H2d* and *H4d* are rejected. Yet, the association between the share of minority students and teacher attrition is, on average, positive and significant for the oldest teachers, relative to the youngest teachers. Previous national and international research has pointed to a U-shaped attrition pattern (Tiplic et al., 2015), where more teachers leave the teaching profession close to or before maximum retirement age (Grissmer & Kirby, 1992; Guarino et al., 2006, referred in, With, 2017). It is plausible to think that the oldest teachers, working in schools in large urban regions (Lankford

et al., 2002) and large city-centre schools, with high shares of minority students, might have other desires and opportunities than the youngest teachers. Based on the evidence here, the oldest teachers have a higher propensity to be *pushed* out of the teaching profession, and *pulled* towards their additional opportunity: final retirement. Teacher attrition has also been associated with high levels of stress and burnout among teachers (Chang, 2009, referred in, E. M. Skaalvik & Skaalvik, 2018), and there are reasons to think that schools in Oslo serving more students, might increase these *push-factors*. Overall, despite some of the findings being in line with previous research, the overall age-related associations did not support the hypotheses in the expected direction. Thus, I rejected *H2d* and *H4d*.

8.2.1.1 Minority Teachers in Oslo

In Oslo, I found no immigrant background-related associations, and soundly rejected *H2c* and *H4c*. Interestingly, while the analyses of the national sample in the previous section are in accordance with previous research suggesting that minority teachers possibly desire to work with minority students (see e.g. Boyd et al., 2005; Feng, 2009; Hanushek et al., 2004; Imazeki, 2005), the findings from Oslo contradict my initial expectations.

To interpret the different results concerning minority teachers in Norway and Oslo, the context of Oslo is important. First, in the interpretation of the analyses for Norway, I suggested in line with previous international studies, that non-western immigrant teachers have other preferences than the native majority population (see e.g., Boyd et al., 2005; Feng, 2009; Hanushek et al., 2004; Imazeki, 2005), and therefore have higher propensities to stay in a school and the teaching profession if the share of minority students increases. However, the analyses in Oslo do not confirm these expectations. Oslo has higher concentrations of minorities and more minority-dense areas, so it is likely that teachers work in a school with high concentrations of minority students. Thus, different population composition²¹ might contribute to the differences between Norway and Oslo. Furthermore, for the analyses for Norway, it is possible that non-western immigrant teachers, who desire schools with minority students, have higher propensities to stay at a school with high and increasing minority student share because such schools are more uncommon in Norway at large, relative to Oslo.

²¹ The immigrant density and share of minority students in schools varies across Oslo, but the general population composition consists of several individuals with an immigrant background.

Second, job prospects for teachers with an immigrant background in Oslo, might contribute to the diverging findings between the analyses for Norway at large and Oslo. As the Norwegian study by Evensen (2010, p. 188) showed, descendants of immigrants living in Oslo, had almost identical job prospects as the native majority population in Oslo and identical job prospects as the native majority population residing in Norway in general. With relatively similar job opportunities between the descendants of immigrants and native majority in Oslo, this might lead me to find no immigrant group-related associations in Oslo, compared to Norway at large. On the other hand, Birkelund, Heggebø, and Rogstad (2016), documented in a randomised field experiment in Oslo, that unemployed minorities with Pakistani/Muslim names had lower job chances than unemployed individuals with a majority background. Importantly, this latter study only investigated some particular minority group names and individuals being unemployed. The diverging findings between the analyses for Norway and Oslo regarding teachers' immigrant group in my thesis, might be due to coincidences in the analyses. However, more research is needed to establish if different population compositions and/or different job projects in Oslo contribute to the diverging results related to teacher characteristics in Norway and Oslo.

8.3 School Fixed Effects and Causal Interpretations

By including school-FE models, I am able to control for confounding, time-invariant variables, and thus receive a “purer relationship” between the share of minority students and teacher mobility and attrition (Mehmetoglu & Jakobsen, 2017, p. 248). Arguably, I come closer to a *causal* analysis and more plausible measure of the potential associations, because I can adjust and avoid unmeasured characteristics of the schools, that might bias our results (Gordon, 2015; Hermansen & Birkelund, 2015; Ringdal, 2018, p. 510).

A limitation, however, by using school-FE models is that the models exclude much of the variation between schools likely to be associated with both socio-economic and ethnic school segregation and teacher turnover. Methodologically, the school-dummies contribute to a reduction in the variation in the analyses, where I am only left with the within-school-variation²². Hence, I run the risk of having too little variation to estimate an association. Analytically, in the school-FE models I exclude variation between schools that can actually be

²² As illustrated in Table A.1 in Appendix A.

interesting for the association between the share of minority students and teacher mobility and attrition. If there is the case that schools with high proportions of minority students to a large degree differ from schools with low proportions of minority students, this is also interesting. Therefore, to address these issues, I have estimated the models both with- and without school-FEs. In the bivariate models, without control variables, for the teacher attrition analysis, I observed that the significant association of the share of minority students on teacher attrition, disappeared once including school-FEs. However, the overall pattern in Oslo, for teacher attrition, was the opposite case. Including school-FEs, lead to a positive and significant association between the share of minority students and teacher attrition. Regardless if I compare schools with different shares of minority students, or change in the minority student shares within schools, once I include control variables I receive approximately similar results.

8.4 Consequences of Teachers Leaving the Profession

Teacher mobility and attrition is problematic and costly (Vagi, Pivovarova, & Miedel Barnard, 2019), due to factors like recruitment and replacement expenditures, unstable learning environments because of temporary staff and new teachers. In turn this may influence the availability and quality of human capital and pedagogical training in the educational system.

Concerning teacher attrition in Norway, Figure 7.3 reveals several interesting findings. The positive and significant coefficient of 0.07 for the between-school variation disappears once I add school-FEs and control variable models with and without school-FEs. I concluded that there is likely no *causal* association between the share of minority students and teacher attrition, and *H3a* is soundly rejected. On the other hand, between-school variation suggests that, when making comparisons between schools and their average outcomes, there is a small positive and significant association between the share of minority students and teacher attrition from the profession in Norway. This might suggest that schools with high proportion of minority students to some degree differ from schools with low proportions of minority students, and this is related to teacher attrition. Moreover, descriptive statistics in Table 6.1, showed that the average teacher attrition rate in Norway, between 2003—2013, is about 12%, meaning that the estimated coefficient is quite substantial.

Furthermore, the findings regarding *non-western descendant* teachers in Norway can potentially have large consequences for the distribution of teachers and the teacher work force

at a macro-level. Even though the association between the share of minority students and teacher mobility and attrition in Norway and Oslo is insignificant with school-FEs and control variables, significant tendencies from the findings should be emphasised. First, there are relatively few teachers with minority background in the Norwegian school system (Spernes, 2016, p. 6), as documented also in the descriptive statistics in this study. Second, if the increased propensities to leave the teaching profession among non-western descendants are influenced by for example immigrant drive values and career ambitions among immigrant families and ethnic networks, the teaching profession in Norway might fail to preserve great teaching resources. Thus, it can lead to less specific human capital in schools and shortage of educational benefits for minority students, such as bilingual vocational training and additional language skills. In addition, it might result in shortage of minority teacher role models. Overall, this is an area that calls for more research.

The number of teachers with non-western immigrant- or non-western descendant backgrounds in Norway is rather small. Between 2003—2013, non-western immigrant teachers constituted about 2% and 4% of the teacher samples for Norway and Oslo, respectively, and non-western descendant teachers made up about 0.1% and 0.8 % of the sample for Norway and Oslo, respectively (see Table 6.4). Few observations lead to some degree of uncertainty about the coefficients, illustrated by the wide confidence intervals in the figures.

8.5 Null Findings – A Problem?

The findings in this study may not provide a “clean” and conclusive narrative (Nature Human Behaviour, 2020). The general results are incompatible with most previous studies, and although some coefficients are in accordance with previous research, I reject all hypotheses. There is an ongoing debate about null results. Researchers may feel disappointed because there are no major effects present. Interestingly, “two-thirds of the social science experiments that produced null results [...] were simply filed away” and abandoned because scientists believe journals are unlikely to publish them (Mervis, 2014, p. 992). According to Mervis (2014), the practice of not publishing null findings, can skew the literature and bring about wasteful duplication, and the bias against null findings can waste time and money if researchers replicate strategies that are already classified as ineffective. Publishing null findings is principally and ethically important, because these results also document findings.

Null findings can also be of great societal and practical importance. An important aim of this study was to gain more information about the association between the share of minority students and teacher mobility and attrition. I wanted to provide knowledge about potentially exposed areas, and to contribute with knowledge that may be useful for policy to improve teacher stability within schools and within the profession. Null findings possibly are less desirable in a research context, yet I argue that the null findings are relatively positive in a societal context. First, since I cannot accept the hypotheses proposed, I can tentatively reject several potentially *causal* associations. If teachers had preferences for schools with certain characteristics, such as native majority students and students from affluent family backgrounds (Falch & Strøm, 2005), disadvantaged schools might end up with less skilled or “effective” teachers. The societal- and individual consequences would potentially be major. On the positive side, the central findings in this study show that the proportion of minority students at school-level does not affect the probability that teachers will exit lower secondary schools and/or the teaching profession in Norway and Oslo. Moreover, the present null findings in this study may also suggest that, since there is no systematic link between ethnic school segregation and teacher mobility and attrition, there is possibly less demand to invest significant resources to counteract this. Resources related to the educational system in Norway and Oslo may turn to other important features of the school system. In Norway, teachers have experienced “low status and negative media attention as stressful” (Skaalvik & Skaalvik, 2010, referred in, With, 2017). Raising the status of the teaching profession in the society at large, diversifying the teaching population by recruiting teachers of different (socio-economic and ethnic) backgrounds, and recruiting and retaining teachers in the profession, is equally important.

Compared to an international context where the highest rates of teacher turnover can be found in disadvantaged schools with large concentrations of low-income families, students with minority backgrounds and/or low-achieving students (Barbieri et al., 2011; Boyd et al., 2011; Feng, 2009; Greenberg & McCall, 1974; Gritz & Theobald, 1996; Hanushek et al., 2004; Scafidi et al., 2007), the situation in Norway and Oslo seems less severe. With no strong indications that teacher turnover rates are higher in certain schools with particular student body compositions, the implicit assumption that ethnic (and socio-economic) school segregation influence teacher turnover does not hold. Still individual and psychological, cultural and social processes can offer central mechanisms behind teacher mobility and attrition. None of the analyses in this study can completely account for the variety of factors that can influence teachers' career decisions (Vagi & Pivovarova, 2017). Generally, all studies

need replications. And, in particular, since the findings in this study are diverging from previous research, further research on this topic is needed.

8.6 Limitations and Further Suggestions

Throughout the thesis, I have considered and discussed some limitations. Yet, the research design influences the findings and conclusions in this study, and this needs to be addressed further, as well as suggestions for future research. First, a crucial methodological issue with the design is a form of selection bias (see e.g., M. Hernán, A., Hernández-Díaz, & Robins, 2004; M. A. Hernán, 2010), called *survivorship bias/survival bias* or *frailty*.

Methodologically, there is a selection on the outcome in my analyses. The outcome variables in the analyses are coded as binary variables, where 0 denotes *stayers* and 1 refers to *movers* or *leavers*. In the teacher attrition analyses, teachers who exit the teaching profession are dropped from the samples in Norway and Oslo, due to being endogenous variables and the methodological design. If it is the case that “*sensitive*” teachers leave, and “*tolerant*” teachers stay at a school with a high or increasing share of minority students or in the teaching profession, during 2003—2013, this influences the sample in the analyses.

Survival bias is less methodically challenging in terms of teacher mobility *movers* in the first analysis. Some of the so-called “sensitive” teachers who leave a school with a high or increasing share of minority students, may start at another school with lower minority students share. If so, these teachers contribute to *teacher sorting* between different schools. For teacher attrition *leavers* in the second analysis, the methodological challenges are more present due to the methodological design and downward selection bias. It is likely that the share of “tolerant” teachers in schools with high or increasing shares of minority students stay constant over the time period, whereas the share of “sensitive” teachers decreases throughout the time period, since the models are conditioned on *teachers* in teaching. Thus, the estimation of the model lead to a selected subsample of “tolerant”, non-quitting teachers, in schools with high and increasing shares of minority students. Thus, analytically, the model can be said to produce values that “tell something about *you* as a teacher”, in this case the “tolerant” teachers who stay and keep staying in schools with high shares of minority students during the time period. On a positive note, despite that teachers are dropped from the sample, since I am interested in teachers in teaching, the sample is continuously “refilled” with teachers who start working as teachers during 2003—2013. These teachers also contribute to

the average turnover rates. Furthermore, there are ways of addressing issues of survivor bias, yet it is beyond the format of this master's thesis to explore this. However, this is certainly a topic that is recommended for future research.

Second, in this thesis, I have defined teachers by occupational codes and classifications, and not by education or educational level. An inevitable disadvantage of the sample, as before-mentioned, is that I have included assistants and temporal positions. Realistically, they also teach in the school system, however this sample influences the estimation of the “true voluntary quits” in this study (see e.g., Falch & Strøm, 2005, p. 619). Substitutes/on-call substitutes in teaching can, partly, be an important reason why several individuals rapidly change between organisations and work locations (Sundt & Næsheim, 2020). Hence, including temporary job positions and assistants can lead to specification error in the analyses (Lyngstad, 2010a; Skog, 2004), which might challenge the internal validity and the external validity of the study. When including employees who probably are more likely to exit, independent of the share of minority students, it complicates the interpretations of an associations between the share of minority students and teacher mobility and attrition. Possibly more important, the sample of teachers might challenge the generalisability of the study. Temporary positions and assistants are not dropped from the analyses, and treated as equal to other teachers in the analyses due to lack of information to differentiate these positions. However, I strongly recommend future research to address this limitation.

Third, there are several age groups in this study. An alternative operationalisation of the age variable is to use more detailed age categories for teachers (see e.g., Falch & Strøm, 2005), to capture for example wider life stages.

Fourth, a suggestion for future research is to specifically look at teachers in their first teaching assignment and/or to use the time since graduation as a proxy for teaching experience (With, 2017). Beginner teachers have less labour market experience and *human capital* (Becker, 1993) and potentially other desires and opportunities than more experienced teachers. Several international studies have only included beginner teachers in their first assignment, with no prior teaching experience (see e.g., Feng, 2009; Gritz & Theobald, 1996), whereas I have only used age groups as a proxy for seniority.

Fifth, I do not differentiate between teachers' grades, qualifications or specialisations. A recommendation for future research is to investigate the distribution of teachers' skill levels, include teachers' grades from their teacher education as a proxy for “more or less skilled” teachers. Hence, investigate whether skilled teachers systematically leave disadvantaged schools in Norway, since it can have implications for the equality of opportunity in the

educational system.

Sixth, I operate with a large minority student group, however a suggestion for future research is to use a more fine-grained measure of the share of minority students at the school-level. The main explanatory variable, the share of minority students, does not distinguish between non-western immigrants and non-western descendants, nor does the main explanatory variable distinguish between students from different country backgrounds. Recommendations for future research are to investigate the student composition of first-generation and second-generation immigrants separately, as well as to address the country background heterogeneity by using more fine-grained measures of students' country background. It is reasonable to think that there are differences between first- and second-generation students, for example concerning issues related to language, integration and academic achievements. Moreover, previous research has found considerable differences between individuals from different country backgrounds (Birkelund & Mastekaasa, 2009a, p. 227; N. S. Fekjær, 2006; Høydahl, 2008).

8.7 Conclusion

Teachers are crucial to students' learning outcomes in school. Consequently, schools, and especially schools with a socially or economically disadvantaged student body need to recruit and retain teachers. However, the majority of research on teacher mobility and attrition that derives from the US, has stated that the highest rates of teacher turnover can be found in disadvantaged schools with large concentrations of low-income families, low-achieving students and/or students with minority backgrounds. Rather than contributing to equal opportunities for all students, such patterns may contribute to maintaining and increasing social inequalities in the society at large. Hence, it was and still is important to gain an understanding of whether teachers systematically exit disadvantaged lower secondary schools in Norway and/or the teaching profession completely, as well as exploring mechanisms behind these patterns.

In this study, I have mapped and investigated the association between the student composition in lower secondary school, measured by the share of minority students, and teacher mobility from lower secondary school and teacher attrition from the profession in Norway and Oslo. I have explored Norway at large, and focused separately on Oslo, due to the large differences in student composition between schools in this city. To address the

potential mechanisms behind the patterns and interpret the results, I have used a customised macro-micro-macro model as an analytical framework, addressed push- and pull-factors, and applied a theory of action, called the DBO model. I have utilised these analytical tools to investigate how macro-/meso-level conditions can influence individual actions, like teacher turnover. Overall, the results show that once school-fixed effects and control variables are included in the models, I find no support for the hypotheses that minority student shares affect the probability that teachers will leave lower secondary school or the teaching profession in Norway and Oslo, respectively.

Despite the results are not corresponding with my expectations nor with the majority of previous research, the findings indicate dissimilarities in the association between the minority student share and teacher mobility and attrition according to teacher characteristics, like immigrant group and age group. First, teachers who are themselves non-western immigrants are more likely to stay in schools with high or increasing shares of minority students in Norway, compared to native majority teachers. Second, teachers with a non-western descendant background are more likely to leave the teaching profession if working in schools with high or increasing shares of minority students in Norway, compared to native majority teachers. This gives support for the expectation that minority teachers might have different desires, beliefs and/or opportunities in the labour market, relative to native majority teachers. Third, in Oslo, teacher who are themselves in the in the oldest age group 65—70, are more likely to leave the teaching profession if working in schools with high or increasing shares of minority students, compared to the youngest teachers in age group 18—24. This is in accordance with previous research and theoretical expectations about different desires, beliefs and/or opportunities among teachers coming close to retirement age. Teachers' sex is of no importance for any of the associations in the study. In general, teachers leaving the profession is challenging and costly. Arguably, this thesis' topic should be researched further, however, for the future it is equally important to rise the status of the teaching profession in the society at large, recruit and retain teachers in the profession, as well as to diversify the teaching workforce.

In general, the thesis has contributed with more information about whether and how the student composition, measured by the share of minority students at school-level, is associated with teacher mobility and/or teacher attrition, both in Norway and Oslo. Higher minority concentrations in schools do not make teachers more likely to quit their jobs.

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All references in this thesis are reported.

Word count: 34,244

Appendices

Appendix A: Within-variation in the Minority Student Share at School-level in Norway and Oslo

Table A. 1: Within-variation in the share of minority students at school-level in Norway and Oslo, 2003—2013.

Variable	Sample: Norway		Sample: Oslo	
	Mean	Std. Dev.	Mean	Std. Dev.
The share of minority students				
Overall	0.1711225	0.2801264	0.3555186	0.2827928
Between		0.2779029		0.2820071
Within		0.0124948		0.0201172
Total observations (N)	429 199		32 809	
Total unique observations (n)	1374		70	

Appendix B: Sensitivity Tests of the Association Between Minority Student Share and Teacher Mobility and Teacher Attrition

Table B. 1: Sensitivity test: The association between the proportion of minority students and teacher mobility in Norway. Average marginal effects of the proportion of minority students on teacher mobility

	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group
Proportion of minority students	0.00719 (0.00772)	0.0337 (0.0373)	-0.000252 (0.0176)	0.0193 (0.0452)			
Male					0.0184 (0.0455)		
Female					0.0198 (0.0453)		
Native						0.0240 (0.0449)	
Non-western immigrant						-0.162** (0.0501)	
Non-western descendant						0.0977 (0.0853)	
Western immigrant						-0.00761 (0.0497)	
Western descendant						0.0531 (0.164)	
Other						0.00350 (0.0479)	
Age: 18—24							0.0415 (0.0524)
Age: 25—34							0.0333 (0.0460)
Age: 35—44							0.0338 (0.0459)
Age: 45—54							0.0132 (0.0460)
Age: 55—64							-0.00679 (0.0456)
Age: 65—70							-0.0304 (0.0656)

Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes
Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
Teachers' marital status	No	No	Yes	Yes	Yes	Yes	Yes
Average number of students with special Norwegian language training	No	No	Yes	Yes	Yes	Yes	Yes
Average primary school credits	No	No	Yes	Yes	Yes	Yes	Yes
Average parental income	No	No	Yes	Yes	Yes	Yes	Yes
Proportion of parents with higher education	No	No	Yes	Yes	Yes	Yes	Yes
Average man-years without approved teacher education	No	No	Yes	Yes	Yes	Yes	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	429199	429199	381813	381813	381813	381813	381813

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure B. 1: Sensitivity test: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group

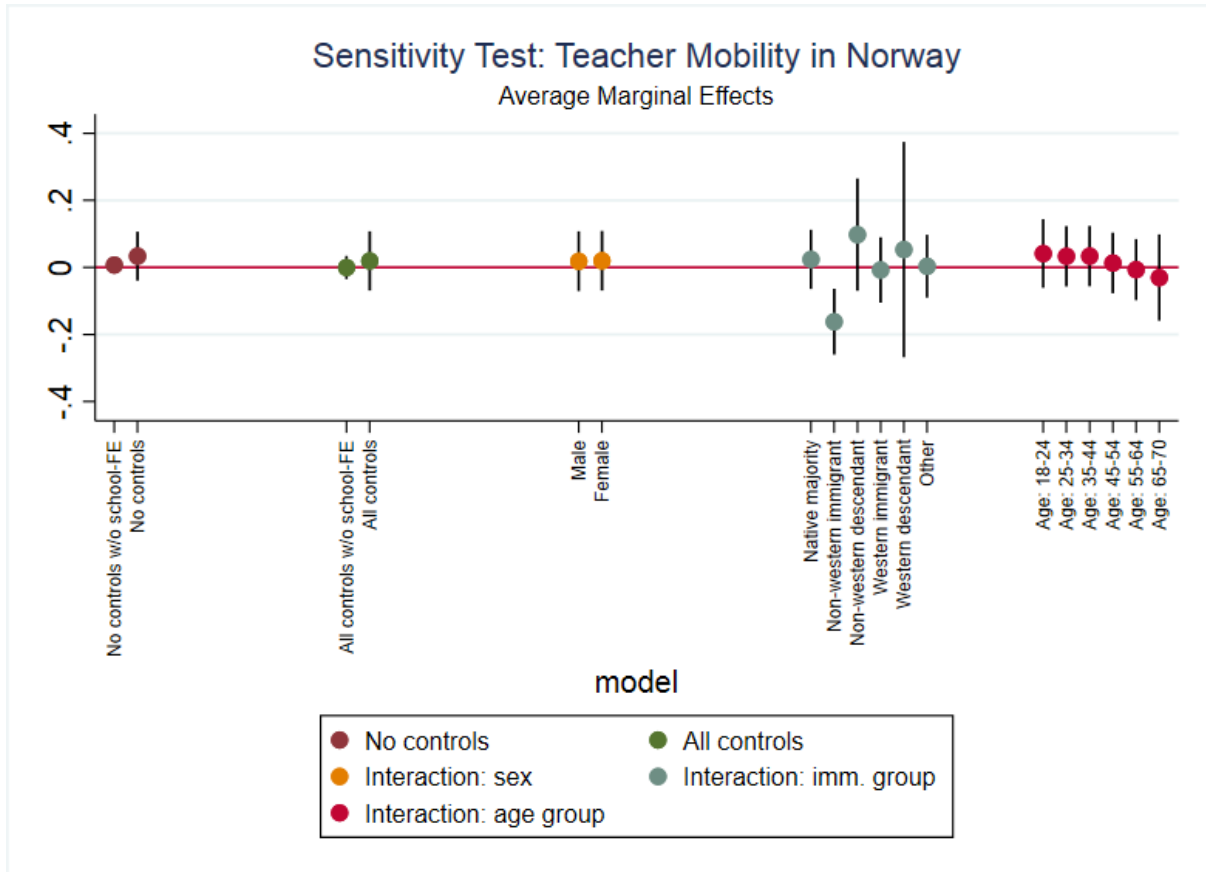


Table B. 2: Sensitivity test: The association between the proportion of minority students and teacher mobility in Oslo. Average marginal effects of the proportion of minority students on teacher mobility

	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group group
Proportion of minority students	0.0473** (0.0165)	0.105 (0.0541)	-0.00121 (0.0268)	-0.0316 (0.110)			
Male					0.00453 (0.109)		
Female					-0.0472 (0.112)		
Native						-0.0309 (0.111)	
Non-western immigrant						-0.177 (0.121)	
Non-western descendant						-0.0360 (0.150)	
Western immigrant						0.0168 (0.116)	
Western descendant						0.0889 (0.258)	
Other						-0.0480 (0.122)	
Age: 18—24							-0.0209 (0.123)
Age: 25—34							-0.0341 (0.112)
Age: 35—44							-0.0267 (0.112)
Age: 45—54							-0.0390 (0.113)
Age: 55—64							-0.0465 (0.110)
Age: 65—70							0.0878 (0.135)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes

Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
Teachers' marital status	No	No	Yes	Yes	Yes	Yes	Yes
Average number of students with special Norwegian language training	No	No	Yes	Yes	Yes	Yes	Yes
Average primary school credits	No	No	Yes	Yes	Yes	Yes	Yes
Average parental income	No	No	Yes	Yes	Yes	Yes	Yes
Proportion of parents with higher education	No	No	Yes	Yes	Yes	Yes	Yes
Average man-years without approved teacher education	No	No	Yes	Yes	Yes	Yes	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	32809	32809	31657	31657	31657	31657	31657

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure B. 2: Sensitivity test: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group

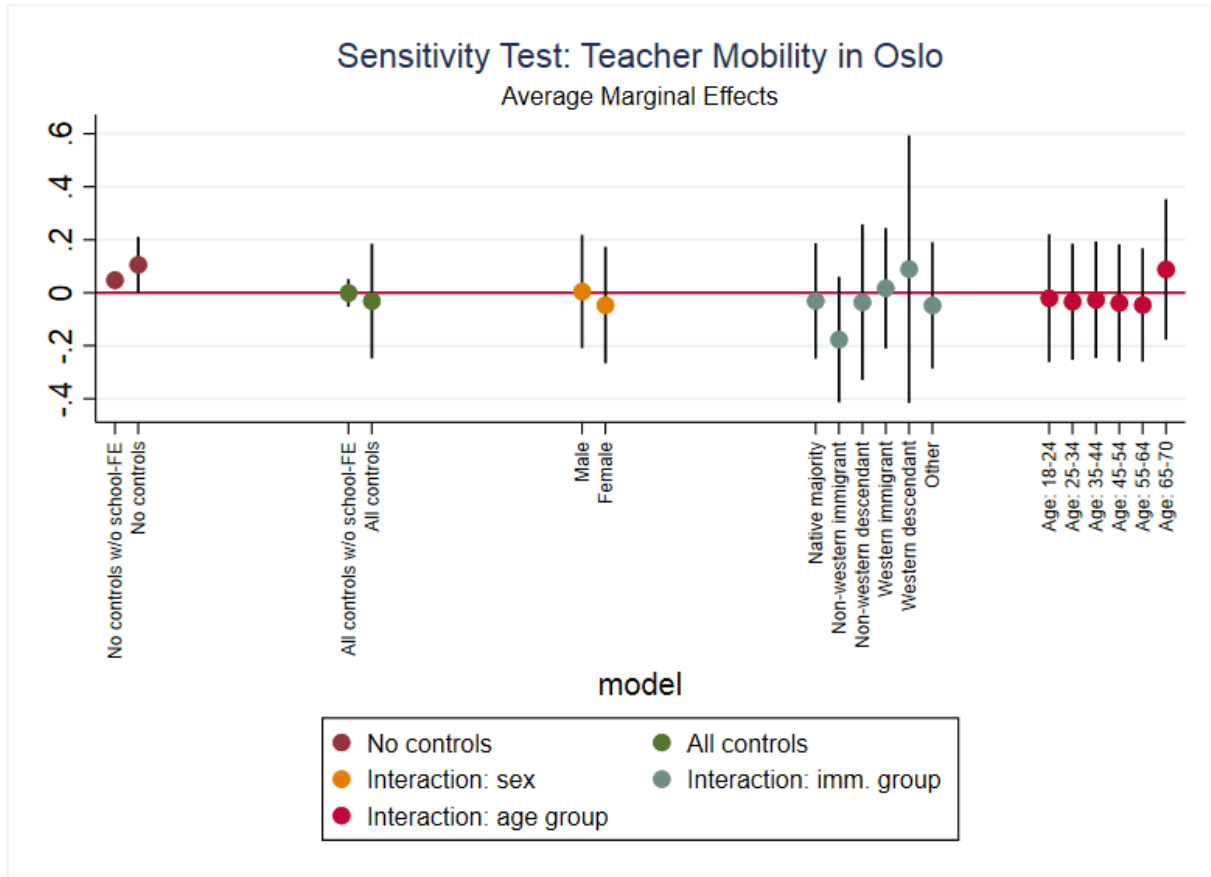


Table B. 3: Sensitivity test: The association between the proportion of minority students and teacher attrition in Norway. Average marginal effects of the proportion of minority students on teacher attrition

	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group group
Proportion of minority students	0.0697*** (0.0125)	0.0262 (0.0382)	-0.00689 (0.00932)	0.0174 (0.0448)			
Male					0.0226 (0.0448)		
Female					0.0147 (0.0450)		
Native						0.0202 (0.0448)	
Non-western immigrant						-0.115* (0.0472)	
Non-western descendant						0.184* (0.0743)	
Western immigrant						-0.00517 (0.0500)	
Western descendant						0.0851 (0.152)	
Other						0.0165 (0.0476)	
Age: 18—24							0.0987 (0.0537)
Age: 25—34							0.0294 (0.0455)
Age: 35—44							0.0176 (0.0452)
Age: 45—54							0.00646 (0.0457)
Age: 55—64							0.00504 (0.0450)
Age: 65—70							-0.00752 (0.0629)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes

Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
Teachers' marital status	No	No	Yes	Yes	Yes	Yes	Yes
Average number of students with special Norwegian language training	No	No	Yes	Yes	Yes	Yes	Yes
Average primary school credits	No	No	Yes	Yes	Yes	Yes	Yes
Average parental income	No	No	Yes	Yes	Yes	Yes	Yes
Proportion of parents with higher education	No	No	Yes	Yes	Yes	Yes	Yes
Average man-years without approved teacher education	No	No	Yes	Yes	Yes	Yes	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	429199	429199	381813	381813	381813	381813	381813

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure B. 3: Sensitivity test: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group

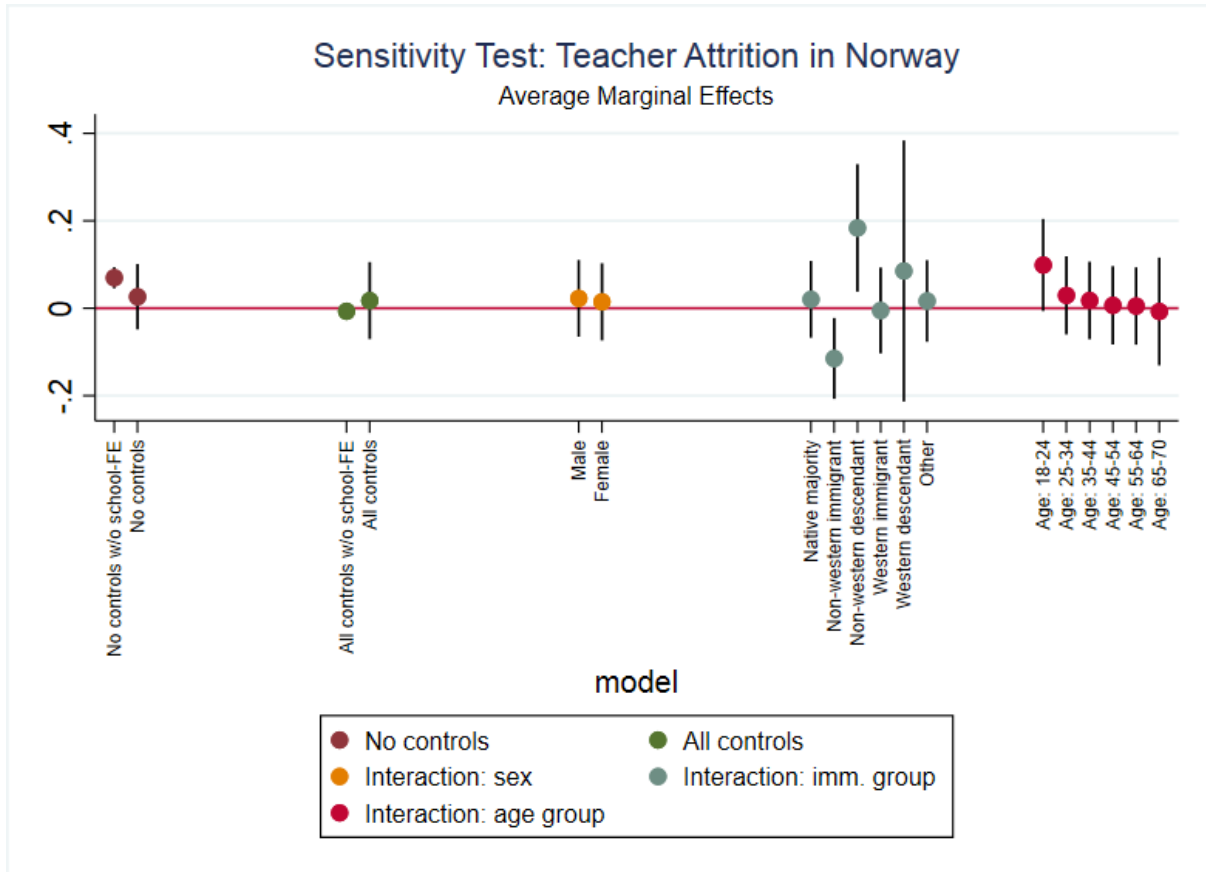


Table B. 4: Sensitivity test: The association between the proportion of minority students and teacher attrition in Oslo. Average marginal effects of the proportion of minority students on teacher mobility

	Model 1.0	Model 1.1	Model 2.0	Model 2.1	Model 3	Model 4	Model 5
	No controls w/o school- FEs	No controls	All controls w/o school- FEs	All controls	Interaction: sex	Interaction: immigrant group	Interaction: age group group
Proportion of minority students	0.0253 (0.0139)	0.119* (0.0547)	0.0273 (0.0194)	-0.00143 (0.113)			
Male					0.0262 (0.111)		
Female					-0.0133 (0.114)		
Native						-0.00818 (0.113)	
Non-western immigrant						-0.0611 (0.120)	
Non-western descendant						0.0660 (0.150)	
Western immigrant						0.0603 (0.118)	
Western descendant						0.178 (0.240)	
Other						0.0252 (0.122)	
Age: 18—24							0.0233 (0.127)
Age: 25—34							-0.0154 (0.115)
Age: 35—44							-0.0151 (0.113)
Age: 45—54							-0.00460 (0.114)
Age: 55—64							-0.000783 (0.110)
Age: 65—70							0.116 (0.139)
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Average number of students	No	No	Yes	Yes	Yes	Yes	Yes
Teacher density	No	No	Yes	Yes	Yes	Yes	Yes
Sex	No	No	Yes	Yes	No	Yes	Yes

Children	No	No	Yes	Yes	Yes	Yes	Yes
Immigrant group	No	No	Yes	Yes	Yes	No	Yes
Age group	No	No	Yes	Yes	Yes	Yes	No
Interaction: sex	No	No	No	No	Yes	No	No
Interaction: immigrant group	No	No	No	No	No	Yes	No
Interaction: age group	No	No	No	No	No	No	Yes
Teachers' marital status	No	No	Yes	Yes	Yes	Yes	Yes
Average number of students with special Norwegian language training	No	No	Yes	Yes	Yes	Yes	Yes
Average primary school credits	No	No	Yes	Yes	Yes	Yes	Yes
Average parental income	No	No	Yes	Yes	Yes	Yes	Yes
Proportion of parents with higher education	No	No	Yes	Yes	Yes	Yes	Yes
Average man-years without approved teacher education	No	No	Yes	Yes	Yes	Yes	Yes
School-FEs	No	Yes	No	Yes	Yes	Yes	Yes
N	32809	32809	31657	31657	31657	31657	31657

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure B. 4: Sensitivity test: The average marginal effects of (1.0) the baseline model w/o school-FEs, (1.1) the baseline model, (2.0) all controls w/o school-FEs, (2.1) all controls, (3) interaction with teachers' sex, (4) interaction with teachers' immigrant group, and (5) interaction with teachers' age group

