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# THE DETERMINANTS OF TEACHER MOBILITY. EVIDENCE FROM A PANEL OF ITALIAN TEACHERS

Gianna Barbieri[*], Claudio Rossetti[†] and Paolo Sestito[‡]

## Abstract

In the Italian system teachers are allocated to schools according to a seniority-based centralized system with no role of individual schools in attracting, selecting and retaining teachers. Largely because of the rather limited pay scale, seniority-based rights to move to a particular school and geographical location represent one of the main career opportunities for tenured teachers. This paper examines the main drivers of the resulting (voluntary) mobility of Italian teachers. We find that the teachers' place of birth (after securing a tenured position, teachers try find work near their place of birth) and several features related to the student mix and the social context of the school are very important. Teachers systematically try to move away from schools where teaching is likely to be more difficult, for example where the students come from a lower socio-economic background and have poorer educational abilities even though teachers could have a more important role in boosting students' human capital accumulation. The centralized allocation system does not appear to equalize opportunities among different school environments. Furthermore, the absence of any criteria other than seniority in regulating teachers' locational preferences produces high staff turnover and a widespread lack of motivation among teachers who, all too often, are simply waiting in one school until they can move on to another.

**JEL Classification**: I20, I21, I28, J45, J61.
**Keywords**: the labour market for teachers, teacher mobility, geographical mobility, school characteristics.

## Contents



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# 1 Main purpose and outline of the paper

Italian[1] teachers are allocated to schools through a centralized system on the basis of seniority. Although the importance of teachers for student achievement is well documented (see for example Hanushek 1992, Ehrenberg and Brewer, 1994), individual schools have no role to play in attracting (through the offer of better pay and working conditions), selecting and retaining the best teachers.[2] Such a system should pursue equality among schools – as schools may not compete in order to have the best teachers – and among teachers – who should be fully protected against the risks of arbitrary decisions taken by school managers. Furthermore, in a career with a very limited pay scale, seniority rights as such might also provide a useful work incentive. Seniority provides an opportunity for the tenured teachers who want to change their location to do so according to their preferences. Seniority (on the lists for access to the profession) also identifies the non-tenured teachers who are awarded a yearly contract (those higher up the list also have some possibility of choosing between various alternatives).

On the other hand such a system has its own costs. As only seniority matters, a teacher's conduct has no impact whatsoever upon their career, including their chances to move where they wish. Even access to a tenured position is governed by seniority, not by the teacher's actual record or formal qualifications. Matching teachers to schools according to idiosyncratic factors (i.e. a seaside or mountain location) is not possible because teachers may only choose the school most suited to them after a series of moves made according to increasing seniority. Consequently, only few of the teachers currently enrolled in a given school may be truly motivated to work there. Many of them may just be waiting to acquire the seniority level that will provide them with a better chance to move elsewhere. More broadly, the lack of any involvement on the part of individual schools in their staff recruitment process means that schools have no interest in cutting costs or enhancing the quality of their personnel policy (at present they have no personnel policy at all).

Barbieri, Cipollone, and Sestito (2008) produced some initial quantitative evidence about the staffing procedures at the individual school level. More specifically they constructed three sets of measures. The first is a measure of total turnover for each school, including both turnover due to the annual renewal of the positions filled by non-tenured teachers hired with yearly contracts[3] and the relocations of tenured teachers moving around according to a vacancy chain triggered by retirement and their own transfer applications. The second is a mismatch indicator, counting the percentage of the tenured teachers in each individual school who, being unsatisfied by their current

[1] We would like to thank Piero Cipollone, Alfonso Rosolia, two anonymous referees and seminar participants at the Bank of Italy, INVALSI and VII "BRUCCHI LUCHINO" Labour Economics Workshop for their helpful comments.

[2] Possibly there is some room for manoeuvre in retaining better people, at least in the case of tenured teachers who may be informally guaranteed some advantages (in terms of timetabling for instance) to discourage them from requesting a transfer.

[3] In the next section we will describe in detail teachers' careers, emphasizing that they begin with a long phase of short-term contracts ("supplenze brevi"), then yearly contracts and finally tenured positions are secured. For a picture of these different stages see also Barbieri, Esposito and Sestito (2010).

work environment, filled in a transfer application. The third is a revealed preference indicator, balancing the applications to move into a given school, as expressed by the whole population of tenured teachers, with the applications to move away from that school, as expressed by the tenured teachers currently working there. Barbieri, Cipollone and Sestito (2008) show that these measures are correlated with actual school performance, hinting at the possible impact of turnover (as a proxy for organizational turmoil) and teachers' motivation on school effectiveness. Cipollone, Montanaro and Sestito (2010) further show that teacher turnover is related to some measures of students' learning over time.

In this paper we put forward this analysis by better documenting the drivers of teacher mobility in the centralized system depicted above. To a large extent such an analysis is preliminary to any identification of the causal links between teacher mobility and school effectiveness. Indeed, in order to identify those links one needs to understand the determinants of teacher mobility so as to exploit its features which are exogenous with respect to the relationship between teacher mobility and school effectiveness.

Most of the previous research on teacher mobility and turnover has focused on the factors determining the decision to leave the public school system (Murnane and Olsen 1990, Dolton 1990, Dolton and van der Klaauw 1995, Stinebrickner 2002, Bonesronning et al. 2003, Hanushek et al. 2004; for Italy see Barbieri, Esposito and Sestito 2010). By contrast, there is still little research on the important issue of mobility within the public school system (see or example Falch and Strom 2005, and Bradley et al. 2006), which, at least in the Italian case, is empirically much more important. Furthermore, unlike previous research focusing on actual worker mobility, we focus on desired mobility, and specifically on transfer applications by tenured teachers. These applications by definition reflect teachers' preferences in favour of another school, regardless of the presence of vacancies in that school, which then determines if the transfer will actually take place. We interpret the fact of filing an application to move to another school as a sign of dissatisfaction with the current school and we analyse the drivers of this dissatisfaction.

Looking at desired mobility provides an interesting test case as, differently from other labour market segments where only the complex interplay of employers' and employees' decisions are observed, we can focus upon workers' mobility choices. In order to do this, we restrict our attention to tenured teachers, who only move if they so desire. Notice however that transfers of tenured teachers is only part of the overall turnover, as non-tenured teachers, including those with yearly contracts, on the contrary move from one school to another depending upon the availability of vacant positions. While most of our analysis will be concerned with the mobility aspirations of tenured teachers only – as we will look at the determinants of the probability of a tenured teaching submitting a transfer application when he/she is entitled but not obliged to do so – we start by looking at the overall mobility patterns of both tenured and non-tenured teachers with yearly contracts.

More specifically, we will identify the two main drivers of teacher mobility, namely broad geographical context and factors related to school characteristics. The former is a very important, although little-explored, aspect of teacher mobility (for some exceptions see Boyd et al. 2005a, and Boyd et al. 2005b). Geographical preferences are in general quite idiosyncratic, being related to unobserved individual preferences. Empirically we proxy them by the individuals' birth-place. Because of the very long entry queues to join the teaching profession in Italy, teachers have to accept whichever location is offered to them and very often start their careers far from their desired geographical location. As a result, we can identify the role of such a magnet by looking at teachers' actual and desired moves towards their birth place as they acquire more seniority. However, the driver we are more interested in refers to those school characteristics – within a broad geographical location – which may signal that a school is an easier place to work. Thanks to the data available to us, we focus here on characteristics of individual schools and their social context rather than on those of the wider local school districts (explored by some previous US research focusing on working conditions, see for example Hanushek et al. 2004). In the context of education, a school that is easier to work in may mean a school where teaching is less demanding but possibly less important, as students do not need any extra support. Our findings about this mobility driver show that teachers are driven away from the most difficult schools, which so end up being populated by inexperienced and un-motivated teachers. This obviously affects the efficacy of the education system as a whole. Dissatisfied teachers may be poor performers not only because of general motivational factors (Rockoff 2004, Rivkin, Hanushek and Kain 2005), but also because they are simply waiting to move on to a different location, putting low effort into their current work duties and disregarding any longer term plans for their students. This is possible in Italy where career advancement (and future mobility opportunities) are not subject to any scrutiny or monitoring.

It should be noted that our work, while motivated by the importance of mobility and workers' motivation in the education sector, has some broader relevance for the analysis of internal labour markets in the public sector. Indeed, many other public sector activities and agencies share a similar central allocation mechanism in which workers are allowed to move between different locations according to seniority, while increases in salary and monitoring of employees are rather limited.

The paper is organized as follows. Section 2 provides a brief description of the rules governing teachers' careers and mobility in Italy. Section 3 presents the data and the broad mobility and turnover patterns. As we will focus on the geographical drivers of mobility, in Section 4 we present the picture of the evolution of the geographical distance between the current work-place and the birth-place (as a proxy of the desired geographical location) for both tenured and non-tenured teachers in the course of their working careers. Then, Section 5 presents an analysis of tenured teachers' transfer applications. Finally, Section 6 draws some conclusions.

## 2 The employment system for teachers in Italy

In Italy there are three broad categories of teachers: tenured teachers, who may be fired only under very special circumstances;[4] temporary teachers with yearly contracts and who may or may nor find a new assignment the subsequent year (such an assignment generally being in a different school);[5] and short-term replacement teachers, with contracts covering a short period or periods during the year. The archives we are going to exploit are restricted to the former two groups, as the short contracts for the latter group are arranged directly at the school level.[6]

In principle (see the law introduced in 1999), access to tenured positions ought to take place through competitive examinations. In practice, these competitions are rarely held as there are special provincial lists of "qualified" individuals in order of seniority and differentiated by subject, waiting to be assigned a position. Being "qualified" has meant different things at different times: for most of the period covered by this paper, it has meant having a suitable degree and either having done a relevant postgraduate course or having accumulated some teaching experience through short teaching assignments. In reality, following some legislative or administrative decisions that widened access to the lists, some teachers who had qualified in the past were able to participate in a seniority mechanism which allocates both newly-established tenured positions and yearly contracts. In this way, teachers who had been put on the list in the distant past were now included in the new lists, which was an advantage because even being bottom of the list was considered an achievement. Since 2007, the existing provincial lists have been frozen, so that no new additions to the lists (and into the profession) are possible anymore, unless a list (in a given province and for a given subject) becomes vacant.

For our purposes here, it is worth noticing that both the chance of a tenured position and that of a yearly assignment depend on seniority alone as no other competitive selection takes place. A teacher who performs poorly in the school where she has been allocated is not punished at all (unless in extreme cases of misconduct, as previously mentioned). Teachers obtain a tenured position after several years of yearly assignments, which may have been discontinuous and often unrelated to each other. On average teachers are 40 years old when they obtain a tenured position, having accumulated a sufficient number of years of seniority.

Seniority still dominates after obtaining a tenured position. The salary depends almost exclu-

[4] These very special circumstances refer to disciplinary infringements, but it should be noted that even extreme misconduct is rarely sanctioned. Tenured teachers whose positions are going to be discontinued have in any case the right to a similar position elsewhere. In fact, we exclude them from most of our analysis because they are obliged to submit an application to move to another school and so it would not make sense to look at the probability of such an event.

[5] More precisely there are two different types of yearly contracts (for further details see Barbieri, Cipollone and Sestito 2008) and we consider them both.

[6] Some more information about people with short ("infrayearly") assignments is in Barbieri, Esposito and Sestito (2010), who show that this kind of job assignment often constitutes the first step in a teacher's career. Since it is therefore an entry port to a teaching career, this phase is also characterized by many exits from the profession.

sively on length of service, not on work performance. Pay rises are automatically awarded after 2, 8, 14, 20, 27 and 34 years of service, cumulating the years before and after obtaining tenure. Albeit automatic, these pay rises are rather limited. The overall increases for primary, lower and upper secondary school teachers are respectively 47, 50 and 57 percent of the starting salary against average figures of 71, 71 and 72 percent according to OECD tables.

However, there is a second and possibly more important aspect that is affected by seniority: the chance to move to the most desired school and location. As a general rule, tenured teachers may apply for their most desired school and are top of the list whenever a vacancy arises. Among tenured teachers, the teacher with the highest seniority is selected. The vacancy chain mechanism works as follows. New vacancies are created, mostly following the retirement of the most senior teachers. They are then filled by already tenured teachers who indicated their interest in those vacancies the previous Spring. Then it is the turn of newly tenured teachers to be allocated (with no possibility to formally express any preference). Finally, the slots left out and, more importantly, those vacated by tenured teachers moving to other schools[7] are then filled by temporary yearly assignments around the start of the school year. Overall, the mechanism never stops because, overall, there are more job positions than tenured teachers, the tenured positions being rationed due to budgetary considerations.

Our focus is on the transfer applications filed by tenured teachers, interpreting them as a sign of dissatisfaction with the school where they are currently working. Tenured teachers have the right to try to transfer to a school they prefer in terms of its broad geographical location, a particular area within a province, a particular town or particular school. However, we need to consider that not all applications are spontaneous because newly tenured teachers need to apply even if they are simply requesting to stay in the school where they have just been assigned. In principle, we could group together those teachers requesting to remain in their current school with those who are not applying to transfer, but we prefer to exclude the just tenured people from most of the analysis, as the process of filing a transfer application is clearly different in the two cases. For similar reasons we also exclude those few teachers made redundant from their current school ("extra" teachers) and who are obliged to apply as they cannot stay on. Another particular group comprises teachers in their second year of tenure. Although they may choose whether to apply for a transfer or not, their choice set is more limited as they can only apply for schools within the same province. Therefore transfer applications made by these teachers may also be interpreted as a signal of dissatisfaction with their current school, but differ from the general case. For these reasons most of our analysis will be limited to voluntary transfer requests only, on the part of teachers with at least two years of tenure and who have not been made redundant from their current school.

[7] On top of this, there are also some positions vacant if a tenured teacher is going to be on leave for the whole school year.

# 3 Data and variables

## 3.1 The data

The data used in this paper comes from the combination of different administrative registries of Italian schools and teachers maintained by the Italian Ministry of Education, and data from the 2001 Italian population and housing census. The first registry is the teacher database, which contains records of teachers with information on gender and date of birth, municipality of birth, type of contract (yearly temporary assignments or full tenure), seniority if a tenured position is held, a unique anonymized teacher identifier, and a unique anonymized identifier of the school where the teacher works. Unfortunately, there is no information about the family situation of the teachers or their educational background nor is there any data available on teachers with infrayearly assignments (for this category, see Barbieri, Esposito and Sestito, 2010).

Through the anonymized teacher identifier we were able to link the teacher database to the registry for teachers' transfer applications. For each tenured teacher who files a transfer application, this registry records the preferences given to new destinations. Specifically, transfer applications can be submitted during the school year (in February) and tenured teachers in primary and secondary schools can indicate up to 15 and 20 new preferred destinations respectively. These registries completely cover the school years 2005/2006, 2006/2007, and 2007/2008.

Through the anonymized school identifier we were able to link the teacher registries to school registries. These school registries contain records of school type, municipality and postal address, the number of enrolled students, the number of foreign-born students, the number of disabled students, the number of students who drop out of the school system during the school year,[8] the number of students who, at the end of the school year, have been tested for the access to the next grade, and the number of students who have actually moved up to the next grade.

These administrative data allows us to obtain very detailed information about Italian teachers and schools. Furthermore, administrative data does not present problems which are typical of survey data, such as unit and item non-response, measurement errors and bias effects due to interaction with interviewers. Relative to normal survey data however, they contain very little information on socio-economic characteristics of the teachers and on their family situation. Furthermore, complete data on all registries are only available for the school years 2005/2006 and 2006/2007.

Using the detailed school address, we were able to link the school registries to data from the 2001 Italian population and housing census, which gave us the possibility to gain some information about the socio-economic context where the school is located. Census data contains information about the gender and age composition of the resident population, educational qualifications, the labour market (such as occupational status and type of occupation), and housing (such as household composition, characteristics of buildings and dwellings). Census data collection is organized by

[8] This excludes students who have moved to another school during the year.

dividing Italy into territorial units called census divisions. We construct a hypothetical market for each individual school by associating to it the closest census divisions. It should be noted that any one individual census section may be associated to more than one school (even at the same grade) since we consider all the closest divisions whose relevant population, in terms of age, sum up to a multiple of the students actually enrolled in a given school. The method, better described in Appendix A, thus provides a complete picture of the potential enrollment competition between schools and allows us to identify whether a given census section is potentially served by competing schools.

We focus our analysis on all registered native teachers[9] born between 1940 and 1980 (aged 25 to 65 in 2005), teaching in primary, lower-secondary ("Secondaria di I grado") and upper-secondary ("Secondaria di II grado") schools during the school years 2005/2006 and 2006/2007. For simplicity, from now on we will refer to school year 2005/2006 as year 2005, to school year 2006/2007 as year 2006, and so on. Our final sample consists of 719,692 teachers working in 17,815 schools.

Figure 1 shows the distribution of teachers by year of birth, gender and type of school. It is important to note that almost all primary school teachers are female, female teachers also predominate in lower-secondary schools, and female teachers are younger than their male colleagues in all types of school.

### 3.2 Teacher-level variables

Our main measure is an indicator for a teacher submitting a transfer application. As pointed out in Section 2, only tenured teachers can submit transfer applications. This measure will be our response variable in Section 5. Distance from the birth place is our main measure related to geographical mobility. Note that considering residential location at birth avoids problems of endogeneity we would instead face if we used teachers' current residential location. Distance is computed as the geodetic distance[10] between the municipality where the teachers were born and the municipality where they currently work.[11] In addition to distance, we include an indicator for teachers who were born in the same province where they now work.

We control for a set of teacher characteristics. This set includes age, an indicator for female teachers, the seniority of tenured teachers (number of years of tenure), indicators for the geographic area of birth, and indicators for the size of the municipality where teachers were born. Appendix B

[9] There are very few foreign-born teachers. They are not included because considering the proximity of their birth place to their work place would not be very meaningful. In any case, we do not observe any systematic differences in the distribution of native and foreign-born teachers by geographical area of work.

[10] Geodetic distance is the length of the shortest curve between two points along the surface of the earth. Geodetic distance behaves well for wide areas of coverage, and takes the earth's curvature into account.

[11] We were able to identify the municipality where teachers were born and where the schools are located, but not the exact location within the municipality. Assigning exactly the same geographic localization (latitude and longitude) to different places within the same municipality is a source of approximation error. Nevertheless, we are confident that the consequences of such an approximation on our results are negligible.

provides a description of these teacher-level variables.

### 3.3 School-level variables

We also control for a set of school characteristics and features and a set of socio-economic variables of the catchment area of a particular school. The former set includes both characteristics obtained directly from the school registries and other characteristics computed (using the school identifier) through a summary of the characteristics of teachers working in each school. From the schools registries regarding teachers, we compute the total number of teachers in each school (as a proxy for school size), the share of non-tenured teachers, and the relative share of tenured teachers aged under 40, from 41 to 50, and over 60 years. Potentially these variables may impact the decision to stay on in the current school as they may lead to job changes within the current school. As for the school registries, we construct indicators for type of school, geographic area where the school is located, size of the municipality where the school is located,[12] schools located in a municipality more than 600 metres above sea level, schools expanding the number of enrolled students year on year, and the types of students in the school. All these variables may proxy for the prestige and accessibility of a school (particularly in the case of a commuting teacher). On top of this, we include the school's share of disabled students, foreign-born students,[13] students who drop out of the school system, and students failing to gain access to the next grade.[14] These variables are used as proxies for the students' socio-economic background and educational ability, which are not directly observable from the data. Hence, such variables should allow us to identify the most difficult schools in terms of teaching. Because most of the foreign-born students are immigrants from poor countries, a high proportion of foreign-born students can be taken as an indicator of low economic background and teaching difficulties. We are aware that a high share of students failing to gain access to the next grade cannot be unambiguously related to low average ability of students in a particular school. Besides the fact that students' ability is not the sole factor impinging upon exams' results (actually teachers' quality and motivation matter and this is why one is interested into them), exams' results are not much comparable across schools in Italy because of the lack of a centralized score system. This may impart some biases to the expected positive relation between the two as we expect teachers to leave schools with least able and most difficult to teach students. For the same reason a positive coefficient, but for possible statistical biases, is also expected for the share of students who drop out of the school system.

We attributed a similar role to the socio-economic census variables associated to the school's

[12] Because we found the exact location of schools from their addresses, we were also able to distinguish between schools located in the centre or in the suburbs of a large municipality.

[13] Foreign-born students include either students born outside Italy or students whose parents were born outside Italy.

[14] This is obtained as the number of failing students over tested students. The latter do not coincide with total enrolled students because of drop-out students and net transfers from/to other schools.

catchment area. We include the share of illiterate residents, the occupation rate, the share of people occupied in agriculture, the average number of rooms per household (standardized by household composition and municipality size), and the average number of household members. These indicators provide a description of the socio-economic context of the school. They may reflect both the potential living conditions for teachers working in a particular school and living close to it, and the socio-economic background of the students enrolled in that school. On the basis of the robustness of our results to the inclusion of detailed geographical controls for each travel-to-area, we strongly favour the second interpretation. Hence, both these indicators and the students' composition indicators will be employed in order to identify the schools where teaching is most difficult (but possibly more important!). Appendix C provides a description of all the school-level variables.

### 3.4 Descriptive statistics

About 16% of teachers included in our starting sample[15] are non-tenured. Teachers who have been tenured for no more than two years account for about 4%, while 1% are teachers made redundant from their current school. Table 1 shows descriptive statistics on teachers. The first two numerical columns show descriptive statistics for all the teachers included in our dataset.[16] The average distance from their place of birth is 120 kilometres, and only about 33% of teachers do not work in their province of birth. The average age is about 47 and slightly less than 80% of teachers are female. The majority of teachers are born in the South of Italy.

The last two numerical columns show descriptive statistics for our final sample made of teachers tenured for at least two years and who have not been made redundant. About 12% of these teachers apply for a transfer. On average, teachers have been tenured for about 18 years, they work closer to their birth place and are older than the overall population of teachers (including the non-tenured teachers with yearly assignments, the newly-tenured teachers and the redundant teachers).

Table 2 shows descriptive statistics on schools. Primary schools account for about 33% of all schools. The average number of teachers working in a school is 40. The (unweighted) average share of non-tenured teachers is 20%. The average proportion of tenured teachers aged 40 or less is 15%. Table 3 shows the sample proportions of "difficult" schools by geographical area and school type. Most of the schools with a high share of foreign-born students are located in the North or Centre of Italy. On the other hand, schools with a higher share of students dropping-out are mainly located in the South.

Finally, Table 4 is a correlation matrix showing links between students' composition variables and social context variables, based on census information. Unsurprisingly, there is a positive correlation between the share of students who drop out of the school system and that of students

[15] The starting sample excludes only foreign-born teachers and those observations with missing information.

[16] The proportion of teachers submitting a transfer application and average tenure are not reported for the full sample, which includes also non-tenured teachers.

failing to gain access to the next. Furthermore, there is a high positive correlation between the share of illiterate residents, that of people employed in agriculture, and the average number of household members. These variables are instead negatively correlated with the employment rate.

# 4 The geographical driver

The distance between teachers' place of birth and place of work is one of the main driving forces for teacher mobility. Boyd et al. (2005a and 2005b) show that US teachers express preferences to teach close to where they grew up and, controlling for proximity, they prefer areas with characteristics similar to their hometown. In this section we look at the overall mobility patterns (of both tenured and non-tenured teachers, i.e. our starting sample as depicted in the left most columns of Table 1) and its relationship with the geographical driver of mobility, an aspect upon which even non-tenured teachers have some room for manoeuvre.

Figure 2 shows the average distance of all teachers in our dataset by age. 25-year-old teachers work on average 300 kilometres away from their place of birth. Average distance decreases until the age of 40. Then, for teachers aged 40 to 65 distance is around 100 km. This picture is consistent with the hypothesis that distance from the birth-place is an important driver for teacher mobility. In fact, although possibly starting their career far away from the municipality where they are born, teachers seem to gradually get closer to their place of birth as age increases.

Specifically, in Italy this pattern is almost entirely explained by the choices made by teachers born in the South, who constitute the majority of all Italian teachers. Figure 3 shows the average distance by age and teachers' area of birth. Teachers born in the North or Centre of Italy work on average about 50 kilometres away from their home town. Differences by age are negligible. The profile of teachers born in the South is completely different. In fact, for the latter the distance is on average higher than 400 kilometres until the age of 30. The average distance sharply decreases between the ages of 30 and 40. Then, after the age of 40 the distance is around 150 kilometres. Hence, teachers born in the North or Centre of Italy work on average close to their birth-places. On the other hand, many teachers born in the South of Italy start their career in a school located in the Centre or North. Among the reasons for this there is a higher probability of finding a job further north. Then, over the years as their seniority increases they get closer to their home towns. Nevertheless, some remain far from their place of birth until the very end of their career. Beyond an age threshold no many further geographically related moves take place.

This is confirmed by Figure 4, which shows the percentage composition of teachers by age and area of birth distinguished by the geographical location of the school. In the schools of the country as a whole, we observe a high prevalence of teachers born in the South. In the Southern schools we find only a few teachers from the other two areas at any age. In the schools located in the North of Italy about 50% of the teachers aged 25 come from the South. Such a percentage gradually reduces

down to 20% for 40-year-old teachers. A similar, although less strong, pattern is observed in the schools located in the Centre of Italy. This evidently confirms the fact that many teachers born in the South of Italy start their career in a school located in the Centre or the North. Then, many – but not all – of them move closer to their place of birth.

One of the reasons why teachers born in the South starts their careers in the North is in order to shorten the time needed to obtain tenure. Table 5 shows the average age of teachers who obtained tenure in 2006 by school area and teachers' area of birth. On average,teachers working in a school located in the North become tenured teachers when they are about 39 years old. For teachers working in a school in the South the average age is slightly more than 40. Nonetheless, teachers born in the South who work in a school located in the North become full tenured teachers before they are 39. Hence, for teachers born in the South there seems to be a trade-off between distance and the time needed to obtain full tenure.

Important differences in average distance are also observed by gender and type of contract. Figure 5 shows the average distance by age and gender. From the age of 30, male teachers work on average farther from their home towns than female teachers. Figure 6 shows the average distance by age and type of contract. We distinguish teachers with a temporary contract, newly-tenured teachers and teachers who have been tenured for at least two years. Not surprisingly, tenured teachers work closer to their birth-place at any age. Furthermore, teachers with temporary contracts work on average much farther from their birth-place than newly-tenured teachers until the age of 45. We also exploited the longitudinal nature of our data with an econometric exercise[17] in which we analysed the change in distance faced by teachers between any two consecutive years. Specifically, we observe important differences related to the change in teachers' status. Newly-tenured teachers (i.e. teachers non-tenured the first year we observe and tenured the second year under observation) show on average an increase in distance, indicating that in order to get full tenure they are ready to pay the price of working farthest from their place of birth. On the other hand, teachers who had been tenured for at least two years show on average a strongly negative change in distance.

## 5 Schools' characteristics and teachers' transfer applications

Our aim is to identify the role of schools' characteristics – in triggering the decision to move away by teachers, namely those directly related to student composition and those that possibly stem from the socio-economic context of the area where the school is located. We expect teachers to try to leave difficult schools. For our research, we need to control for the proximity to the birth-place as a mobility driver as well as other possible drivers related to the school itself and the individual teacher. So we undertake an econometric exercise.

Our exercise is not the first in the international literature. Although salaries play a role in

[17] Results are available from the authors upon request.

location decisions (Murnane and Olsen 1990, Dolton and van der Klaauw 1999, Figlio 2002, and Hanushek, Kain and Rivkin 2004), several empirical studies have shown that teachers' preferences are highly influenced by non-pecuniary factors such as student characteristics. For example, using data about Queensland state school teachers, Bradley et al. (2006) find that (after controlling for pecuniary factors such as remuneration) non-pecuniary factors, such as class size and location, affect movement decisions. Investigating the factors that affect the probabilities that teachers switch or exit state schools, Hanushek, Kain and Rivkin (2004) show that teacher mobility is much more strongly related to the characteristics of the students, particularly race and achievement, than to salary. Using data for the San Diego school system, Greenberg and McCall (1974) show that internal mobility of teachers is governed by non-pecuniary differences as student socio-economic status. Prost (2006) shows that teachers of French tend to switch when they work in schools with a high share of less able students, of students from minorities and of students from an economically disadvantaged background.

To our knowledge our exercise is the first for Italy and is quite unique in the international panorama for its widespread coverage (we consider all schools and teachers) and for its very detailed nature. Moreover, it is quite unique in that we analyse teachers' transfer applications. Because we are interested here in voluntary transfer applications, we focus only on teachers for whom submitting an application is a free and unconstrained choice, i.e. teachers who have been tenured for at least two years and have not been made redundant from the school.

Figure 7 shows the share of teachers submitting a transfer application by age and area of birth. This proportion decreases for the age group 30-55 years, and is close to zero for the group aged 55 years and over. Furthermore, we observe a clear ordering of the share by teachers' area of birth. At any age, teachers born in the South are more likely to apply for a transfer than teachers born in the Centre, and the latter are more likely to want to move than teachers born in the North. However, the chances of applying for a transfer is far from negligible even for the latter.

We model here teachers' preferences about staying in their current school versus applying for a transfer to another school. Specifically, we employ a probit model for the probability that the $i$-th teacher submits a transfer application ($A_i = 1$) as a function of a set of individual characteristics $Z_i$ and a set of characteristics of the school $j$ where teacher $i$ works $Q_{j_i}$[18]

$$\Pr(A_i = 1 | Z_i, Q_{j_i}) = \Phi(\alpha + \beta Z_i + \gamma Q_{j_i}),$$

where $\alpha$, $\beta$ and $\gamma$ are unknown parameters and $\Phi$ is the standard normal distribution function.

Individual characteristics $Z_i$ include a third-degree polynomial in the distance between teachers' birth-place and work-place, an indicator for teachers born in the same province where they work,

[18] We also estimated a zero-truncated negative binomial model for the number of preferences given by teachers who apply for a transfer as a function of the characteristics of teachers' and of the actual school. Results substantially confirm the main findings of the model for the probability of making an application.

a second-degree polynomial in years of tenure, a second-degree polynomial in age,[19] an indicator for female teachers, indicators for the geographic area of birth, and for the size of the municipality where teachers were born. The set of characteristics of the school where teachers work $Q_{j_i}$ includes indicators for type of school, the geographic area where the school is located, the size of the municipality where the school is located, location of the school in a municipality 600 meters or more above sea level, the total number of teachers in the school, the share of non-tenured teachers, the share of tenured teachers aged under 40, from 41 to 50, and over 60, and schools expanding the number of enrolled students. Furthermore, $Q_{j_i}$ also includes the school's share of disabled students, foreign-born students, drop-out students, students failing to gain access to the next grade, and, in the socio-economic context of the school catchment area, the share of illiterate residents, the employment rate, the share of people employed in agriculture, the number of rooms per household, and the average number of household members. Finally, we include year fixed-effects.

Table 6 shows the maximum likelihood estimation of the probit model for the probability of submitting a transfer application. Standard errors are corrected for within-school clustering. Different specifications of the model are presented. The first specification (Model 1) includes teachers' characteristics only, the second specification (Model 2) extends Model 1 by including schools' characteristics, the third specification (Model 3) extends Model 2 by including student composition variables, and finally the last specification (Model 4) extends Model 3 by including social context variables. From now on our comments refer to the last specification (Model 4) which includes all sets of covariates.[20] Most of the coefficients have the expected sign. Both age and years of tenure are negatively related to the probability of applying. Confirming the description provided in the previous section, the coefficients of the polynomial in distance are statistically highly significant. Not working in the province of birth increases the probability of applying to move. Female teachers are less likely to apply for a transfer than male ones. Teachers born in larger municipalities are more prone to move. Figure 8 shows the predicted probability of submitting a transfer application for the baseline teacher as a function of distance (Panel 1), tenure (Panel 2) and age (Panel 3). The first panel of the figure indicates a positive relation between distance from the birth-place and the probability of submitting a transfer application.[21] The second panel indicates a decreasing relation between years of tenure and the probability of making an application. Finally, the third panel of Figure 8 shows that, after controlling for distance and tenure, there is a flat relation between age and the probability of applying for a transfer between the ages of 30 and 40 years. Nonetheless, there are a few tenured teachers aged under 40 applying to transfer. From the age of 40 this probability starts to decrease until the age of 65.

The mismatch vis-a-vis birth place is not the only mobility driver as school characteristics and features are also strongly related to teachers' transfer applications. First of all, there is a clear

[19] Coefficients on higher degree polynomials are not statistically significant.
[20] From likelihood-ratio tests – the four models are nested – Model 4 is preferred over all other specifications.
[21] There are few tenured teachers working more than 300 kilometres away from home.

difference by type of school. Other things being equal, relative to lower-secondary schools (the reference category of this model) teachers working in primary schools or upper-secondary schools are less likely to apply. In particular, among upper-secondary schools, teachers working in classical-stream or scientific-stream upper-secondary are less prone to mobility. Teachers working in large schools have a lower probability of applying to transfer.

Furthermore, we observe a strong positive relation between the probability of submitting a transfer application and the share of disabled students and foreign-born students. On the other hand, after controlling for other school characteristics, a high share of students who drop out of the school system or failing to gain access to the next grade are not significantly related to the probability of a transfer application.

Finally, there is also a clear relation between the probability of making a transfer application and the socio-economic context of the school where teachers actually work. Specifically, there is a significant positive relation between the probability of submitting a transfer application and illiteracy rate, the fraction of employed in agriculture and the average number of household members. Such a probability is also negatively related to the employment rate in the school catchment area. All in all, both these variables (student composition and socio-economic status of the surrounding catchment area) confirm that teachers are more likely to try to leave the most difficult schools.

These results are essentially confirmed when the model is estimated separately for primary, lower-secondary and upper-secondary schools. Table 7 shows the maximum likelihood estimation of the probit model for the probability of submitting a transfer application by school type. Only coefficients of student variables and socio-economic context variables are reported. A high share of foreign-born students in the school is a strong deterrent to remaining in all types of schools. Teachers in lower-secondary and upper-secondary schools with a high share of disabled students have a higher probability of submitting a transfer application. This does not seem to be true for teachers working in primary schools, where the effect of the share of disabled students is statistically not significant.

A first source of concern in relation to our results may be the presence of measurement error, particularly in some of the student composition variables. As everyone knows, students tests and exams are not centralized in Italy and the pass rate (and more generally the marks) may be not very comparable across schools as a measure of students' ability. As a general rule, measurement error should lead to an attenuation bias. Such a bias might be the reason behind the lack of the expected positive link between the share of drop-outs and of students failing to gain access to the next grade and the probability of submitting a transfer application. On the other hand, given that we are using current outcomes concerning students of a given school and not measures of their ability when they first enrolled at that school, our measures might suffer from a potential endogeneity bias pushing in the other direction. The source of this endogeneity bias is actually behind our interest in the determinants of teachers' desired mobility, i.e. the possibility that dissatisfied and ready-to-move

teachers have a negative impact upon their students' performance (see also Cipollone, Montanaro and Sestito 2010).

As a robustness check we considered an alternative specification in which the quality of the student pool is captured by the share of students enrolled in the first year in a school having had to repeat one or more years' of study in their previous school career, instead of the share of drop-out and failing students. The added variable is strongly correlated with the share of drop-outs and failing students – the correlation of the added variable with the regressors used so far is, respectively, 0.272 and 0.467 in lower-secondary schools, and 0.385 and 0.319 in upper-secondary schools, while no such variable can be defined for primary schools, which we therefore excluded from the robustness exercise. Therefore, by definition, the added variable is unaffected by current teachers' behaviour and the precise actual implementation of exams standards at the individual school level and does not suffer from either the endogeneity or the measurement error problems discussed earlier. Given that we have only one single variable we cannot implement a proper IV strategy, and we experimented with a specification which may be considered as a reduced form, in which the new variable replaces the share of failing students and drop-outs. Table 8 shows the maximum likelihood estimation of such a specification. The model is estimated separately for teachers working in different types of schools. The probability of submitting a transfer application is positively related to the share of newly enrolled students who have previously repeated a year. This positive relation is not significant for lower-secondary schools because not many students have accumulated many repeated years, but it is highly significant for upper-secondary schools.

A second source of concern relates to the fact that we have so far interpreted the role of socio-economic context variables as a proxy for schools' teaching conditions more than as a proxy for the living conditions of a locally-housed teacher. One could however easily argue that living conditions are what matter and that what these variables are capturing is the unwillingness of teachers to live in less pleasant locations. In order to shed further light upon this issue, we therefore estimated a model with a full set of fixed effects for the local living area where a teacher working in a given school is supposed to reside. Such an area is wider that the area immediately in reach of the school, as we take into account the possibility of commuting within a broader travel-to-work area. So we may still identify the effect of the schools' socio-economic context variables within any local travel-to-work area, an effect now unambiguously interpretable in terms of the teaching conditions of the school. More specifically, we identified the residential area where the teacher has to live by focusing upon the 600 Local Labour Systems (LLSs) constructed by ISTAT on the basis of the 2001 census.[22] So the LLS fixed effects (here unreported) should capture the impact of the living conditions, while the remaining impact of the socio-economic context variables of each school (now identified within each travel-to-work area) should only be related to the teaching conditions in the individual school.

[22] An LLS is the array of local municipalities within which most of the daily home-to-work commuting takes place. By definition people living in an LLS usually also work within its bounds.

For computational ease we conduct this experiment using a linear probability model (LPM) and Table 9 shows the estimated coefficients of an LPM with and without the SLL fixed effects. The model is estimated for teachers working in all types of schools and separately for teachers working in primary, lower-secondary and upper-secondary schools. The intra-class correlation coefficient, i.e. the percentage of error variance due to unobserved heterogeneity,ranges from about 2.6% for primary schools to about 6.3% for lower-secondary schools, and the hypothesis that these fixed effects are equal to zero is rejected in all cases. Including fixed effects at the LLS level however substantially confirms our previous findings. Specifically, the probability of submitting a transfer application is higher for teachers working in schools with a high proportion of disabled students, foreign students, drop-out students, and students failing to gain access to the next grade, as well as in schools located in a context with high illiteracy and low occupation rates.

Finally, in Appendix D we present additional robustness checks estimating a model which allows for school-specific unobserved heterogeneity[23] and separately by gender, teachers' area of birth and school area. Again, estimation of these models substantially confirms our previous findings.

# 6 Conclusions

In the Italian system teachers are allocated according to a seniority based centralized system with no active role played by the individual schools in attracting, selecting and retaining teachers. Also because of the rather limited pay scales, the fact that the more senior teachers can select their most preferred school and geographical location represents one of the main opportunities Italian teachers have. Our paper has examined the main drivers of the resulting voluntary mobility of Italian teachers.

Specifically, we focused upon two drivers of teacher mobility. Firstly geographical distance from the birth-place since teachers may start their careers far from their desired location (usually the place they were born) and then work towards returning there. Secondly, the characteristics of the schools involved, which relate to a vast array of structural characteristics within a school, possibly signalling that it is a difficult place to work. In the educational context this means a school where teaching is more demanding but possibly more important, as students would need extra support from their school and their teachers. This is a problem for the education system as teachers will be driven away from the most difficult schools, which will be filled by less experienced and less motivated teachers. Even tenured and therefore more experienced teachers working there may just be waiting to move on to a different location, putting only a small amount of effort into their current work duties.

We find a sizable impact of both the teachers' birth-place and several school features related

[23] We included school random effects to capture general time-invariant retention in each school, which is not due to observable characteristics.

to the student mix. Specifically, teachers seem to try to avoid schools located in a context with a high illiteracy rate, a high proportion of people employed in agriculture, and a low occupation rate. Furthermore, a high share of disabled students, foreign-born students, drop-out students, and students failing to gain access to the next grade make a school less attractive to teachers. The centralized allocation system seems unable to equalize opportunities among the different school environments.

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Table 1: Descriptive statistics on teachers.

| | All teachers | | Tenured teachers from at least two years not made redundant from the school | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| applic | | | 0.121 | 0.326 |
| tenure | | | 18.26 | 8.02 |
| dist | 119.5 | 246.4 | 98.8 | 221.0 |
| diffprov | 0.325 | 0.469 | 0.298 | 0.457 |
| age | 47.30 | 8.57 | 49.64 | 7.24 |
| female | 0.784 | 0.411 | 0.784 | 0.412 |
| t:N | 0.301 | 0.459 | 0.308 | 0.462 |
| t:C | 0.155 | 0.362 | 0.158 | 0.365 |
| t:city25 | 0.137 | 0.344 | 0.130 | 0.337 |
| t:city50 | 0.311 | 0.463 | 0.297 | 0.457 |
| t:city500 | 0.132 | 0.339 | 0.130 | 0.336 |
| Obs. | 1,349,889 | | 1,065,792 | |
| Teachers | 719,692 | | 560,158 | |

Table 2: Descriptive statistics on schools.

| | Mean | SD |
|---|---|---|
| prim | 0.333 | 0.471 |
| classic | 0.025 | 0.157 |
| scient | 0.045 | 0.208 |
| socscie | 0.015 | 0.123 |
| tech | 0.102 | 0.303 |
| prof | 0.076 | 0.264 |
| art | 0.015 | 0.120 |
| s:N | 0.369 | 0.483 |
| s:C | 0.179 | 0.384 |
| s:city25 | 0.125 | 0.330 |
| s:city50 | 0.189 | 0.391 |
| s:city500per | 0.019 | 0.137 |
| s:city500centre | 0.059 | 0.235 |
| s:highmunic | 0.082 | 0.275 |
| totteachers | 40.40 | 27.08 |
| fracnonten | 0.195 | 0.155 |
| fracage:(.,40) | 0.148 | 0.128 |
| fracage:(41,50) | 0.371 | 0.146 |
| fracage:(61,.) | 0.036 | 0.053 |
| expansion | 0.438 | 0.496 |
| fracdisab | 0.027 | 0.029 |
| fracforeign | 0.056 | 0.065 |
| fracleaving | 0.007 | 0.031 |
| fracfail | 0.055 | 0.089 |
| fracillit | 0.025 | 0.025 |
| emplrate | 0.411 | 0.081 |
| fracagric | 0.087 | 0.081 |
| rooms | 2.447 | 41.520 |
| avHHmembers | 2.618 | 0.284 |
| Obs. | 35,038 | |
| Schools | 17,815 | |

Table 3: Sample proportion of difficult schools by geographical area and school type.

| | disabled students | | | foreign students | | | drop-out students | | | failing students | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | North | Centre | South | North | Centre | South | North | Centre | South | North | Centre | South |
| Prim. | 0.025 | 0.028 | 0.026 | 0.104 | 0.087 | 0.018 | 0.000 | 0.001 | 0.001 | 0.005 | 0.006 | 0.007 |
| Low-sec. | 0.034 | 0.033 | 0.033 | 0.100 | 0.090 | 0.017 | 0.001 | 0.001 | 0.002 | 0.031 | 0.028 | 0.030 |
| Up-sec. | 0.019 | 0.024 | 0.021 | 0.071 | 0.058 | 0.009 | 0.015 | 0.014 | 0.029 | 0.148 | 0.143 | 0.153 |

Table 4: Correlation matrix between student composition variables and social context variables.

| | fracdisab | fracforeign | fracleaving | fracfail | fracillit | emplrate | fracagric | rooms | avHHmembers |
|---|---|---|---|---|---|---|---|---|---|
| fracdisab | 1.000 | | | | | | | | |
| fracforeign | 0.091 | 1.000 | | | | | | | |
| fracleaving | 0.010 | 0.022 | 1.000 | | | | | | |
| fracfail | 0.041 | -0.007 | 0.277 | 1.000 | | | | | |
| fracillit | 0.014 | -0.409 | 0.036 | -0.045 | 1.000 | | | | |
| emplrate | -0.025 | 0.542 | -0.081 | -0.036 | -0.695 | 1.000 | | | |
| fracagric | 0.003 | -0.181 | -0.020 | -0.110 | 0.566 | -0.298 | 1.000 | | |
| rooms | -0.038 | 0.046 | -0.006 | -0.020 | -0.129 | 0.117 | 0.056 | 1.000 | |
| avHHmembers | 0.038 | -0.344 | -0.003 | -0.060 | 0.412 | -0.416 | 0.211 | -0.100 | 1.000 |

Table 5: Average age of newly-tenured teachers in 2006 by school area and teachers' area of birth. For each cell we report, in order, average age and the cell sample size.

| | Teachers' area of birth | | | |
|---|---|---|---|---|
| School area | North | Centre | South | Italy |
| North | 39.0 | 40.4 | 38.6 | 39.0 |
| | 3,752 | 174 | 1,333 | 5,259 |
| Centre | 41.5 | 40.6 | 40.5 | 40.6 |
| | 87 | 1,505 | 572 | 2,164 |
| South | 39.6 | 39.6 | 40.5 | 40.4 |
| | 92 | 40 | 3,129 | 3,261 |
| Italy | 39.1 | 40.6 | 40.0 | 39.7 |
| | 3,931 | 1,719 | 5,034 | 10,684 |

Table 6: Estimated coefficients of the probit model for the probability of applying for a transfer (* significant at 5%; ** significant at 1%).

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| (dist - 100)/100 | 0.117 ** | 0.119 ** | 0.120 ** | 0.126 ** |
| ((dist - 100)/100)$^2$ | -0.056 ** | -0.045 ** | -0.045 ** | -0.047 ** |
| ((dist - 100)/100)$^3$ | 0.004 ** | 0.003 ** | 0.003 ** | 0.004 ** |
| diffprov | 0.024 ** | 0.033 ** | 0.032 ** | 0.031 ** |
| tenure - 20 | -0.034 ** | -0.028 ** | -0.028 ** | -0.027 ** |
| (tenure - 20)$^2$/10 | 0.004 ** | 0.006 ** | 0.006 ** | 0.006 ** |
| age - 50 | -0.031 ** | -0.041 ** | -0.041 ** | -0.041 ** |
| (age - 50)$^2$/10 | -0.015 ** | -0.013 ** | -0.013 ** | -0.013 ** |
| female | -0.141 ** | -0.038 ** | -0.039 ** | -0.036 ** |
| t:N | -0.327 ** | -0.067 ** | -0.067 ** | -0.065 ** |
| t:C | -0.182 ** | 0.022 * | 0.022 * | 0.023 * |
| t:city25 | 0.023 ** | 0.022 ** | 0.022 ** | 0.023 ** |
| t:city50 | 0.128 ** | 0.118 ** | 0.118 ** | 0.125 ** |
| t:city500 | 0.016 | 0.020 ** | 0.021 ** | 0.028 ** |
| prim | | -0.483 ** | -0.483 ** | -0.489 ** |
| classic | | -0.438 ** | -0.437 ** | -0.437 ** |
| scient | | -0.406 ** | -0.406 ** | -0.407 ** |
| socscie | | -0.107 ** | -0.104 ** | -0.105 ** |
| tech | | -0.125 ** | -0.123 ** | -0.122 ** |
| prof | | 0.103 ** | 0.111 ** | 0.113 ** |
| art | | -0.136 ** | -0.135 ** | -0.129 ** |
| s:N | | -0.302 ** | -0.299 ** | -0.309 ** |
| s:C | | -0.229 ** | -0.226 ** | -0.233 ** |
| s:city25 | | -0.016 | -0.017 | -0.011 |
| s:city50 | | -0.007 | -0.013 | 0.012 |
| s:city500per | | -0.002 | -0.011 | 0.006 |
| s:city500centre | | -0.001 | -0.013 | 0.012 |
| s:highmunic | | -0.003 | -0.001 | 0.000 |
| (totteachers - 50)/10 | | -0.031 ** | -0.031 ** | -0.030 ** |
| fracnonten | | 0.000 | -0.047 | -0.083 ** |
| fracage:(.,40) | | -0.064 | -0.076 * | -0.067 |
| fracage:(41,50) | | 0.066 * | 0.059 | 0.063 * |
| fracage:(61,.) | | 0.141 | 0.139 | 0.121 |
| expansion | | -0.014 ** | -0.013 * | -0.010 * |
| fracdisab | | | 0.915 ** | 0.805 ** |
| fracforeign | | | 0.209 ** | 0.334 ** |
| fracleaving | | | -0.106 | -0.177 |
| fracfail | | | -0.006 | -0.011 |
| fracillit | | | | 2.022 ** |
| emplrate | | | | -0.821 ** |
| fracagric | | | | 0.143 * |
| rooms / 10 | | | | 0.005 ** |
| avHHmembers | | | | 0.037 * |
| Constant | -1.011 ** | -0.875 ** | -0.861 ** | -0.858 ** |
| Obs. | 1,065,792 | 1,065,792 | 1,065,792 | 1,065,792 |
| Pseudo $R^2$ | 0.097 | 0.125 | 0.125 | 0.126 |
| Log-like. | -354,943 | -344,123 | -344,046 | -343,491 |

Table 7: Estimated coefficients of the probit model for the probability of applying for a transfer by school type (* significant at 5%; ** significant at 1%).

| | Primary | Lower-Secondary | Upper-Secondary |
|---|---|---|---|
| fracdisab | 0.330 | 1.248 ** | 0.797 * |
| fracforeign | 0.270 ** | 0.677 ** | 0.626 ** |
| fracleaving | 0.008 | 0.514 | 0.102 |
| fracfail | 0.074 | 0.147 | -0.025 |
| fracillit | 1.432 ** | 1.951 ** | 2.021 ** |
| emplrate | -0.627 ** | -1.010 ** | -0.653 ** |
| fracagric | -0.244 * | 0.345 ** | 0.237 |
| rooms / 10 | 0.006 ** | 0.003 * | 0.005 ** |
| avHHmembers | -0.034 | 0.145 ** | 0.066 * |
| Obs. | 409,825 | 277,183 | 378,784 |
| Pseudo $R^2$ | 0.148 | 0.115 | 0.110 |
| Log-like. | -103,782 | -106,441 | -130,693 |

Table 8: Estimated coefficients of the probit model for the probability of applying for a transfer with the inclusion of the share of students who have previously repeated one or more years (* significant at 5%; ** significant at 1%).

| | Lower-secondary | Upper-secondary |
|---|---|---|
| fracdisab | 1.264 ** | 0.765 * |
| fracforeign | 0.666 ** | 0.464 ** |
| fracdelay | 0.067 | 0.162 ** |
| fracillit | 1.940 ** | 2.103 ** |
| emplrate | -1.020 ** | -0.635 ** |
| fracagric | 0.344 ** | 0.269 * |
| rooms / 10 | 0.003 * | 0.005 ** |
| avHHmembers | 0.146 ** | 0.071 * |
| Constant | -0.739 ** | -1.049 ** |
| Obs. | 277,183 | 378,784 |
| Pseudo $R^2$ | 0.115 | 0.111 |
| Log-like. | -106,442 | -130,669 |

Table 9: Estimated coefficients of the LLS fixed-effects linear probability model for the probability of applying for a transfer (* significant at 5%; ** significant at 1%).

| | All schools | | Primary | | Lower-Secondary | | Upper-Secondary | |
|---|---|---|---|---|---|---|---|---|
| | LPM | FE LPM | LPM | FE LPM | LPM | FE LPM | LPM | FE LPM |
| fracdisab | 0.193 ** | 0.156 ** | 0.071 | 0.050 | 0.317 ** | 0.205 ** | 0.198 * | 0.046 |
| fracforeign | 0.050 ** | 0.013 | 0.038 ** | 0.032 ** | 0.132 ** | 0.042 * | 0.098 ** | 0.046 ** |
| fracleaving | 0.009 | 0.072 ** | -0.015 | 0.057 | 0.188 | 0.507 ** | 0.046 | 0.107 ** |
| fracfail | 0.001 | 0.037 ** | 0.013 | 0.009 | 0.021 | 0.175 ** | -0.008 | 0.032 ** |
| fracillit | 0.475 ** | 0.218 ** | 0.253 ** | 0.028 | 0.573 ** | 0.458 ** | 0.505 ** | 0.111 |
| emplrate | -0.150 ** | -0.169 ** | -0.097 ** | -0.100 ** | -0.225 ** | -0.180 ** | -0.112 | -0.163 ** |
| fracagric | 0.035 | 0.084 ** | -0.036 | 0.005 | 0.094 * | 0.170 ** | 0.066 | 0.039 |
| rooms / 10 | 0.001 ** | 0.000 ** | 0.001 ** | 0.001 ** | 0.001 | 0.001 * | 0.001 * | 0.001 |
| avHHmembers | 0.001 | -0.023 ** | -0.006 | -0.025 ** | 0.024 * | -0.017 ** | 0.006 | 0.009 |
| Constant | 0.182 ** | 0.153 ** | 0.118 ** | 0.092 ** | 0.219 ** | 0.165 ** | 0.146 ** | 0.089 ** |
| Obs. | 1,065,792 | 1,065,792 | 409,825 | 409,825 | 277,183 | 277,183 | 378,784 | 378,784 |
| Adj. $R^2$ | 0.092 | 0.086 | 0.092 | 0.081 | 0.096 | 0.086 | 0.085 | 0.080 |
| $\rho$ | | 0.027 | | 0.026 | | 0.063 | | 0.058 |
| F test $u_i = 0$ | | 13.7 | | 6.8 | | 8.0 | | 8.1 |

Figure 1: Distribution of teachers by year of birth, gender and school type.

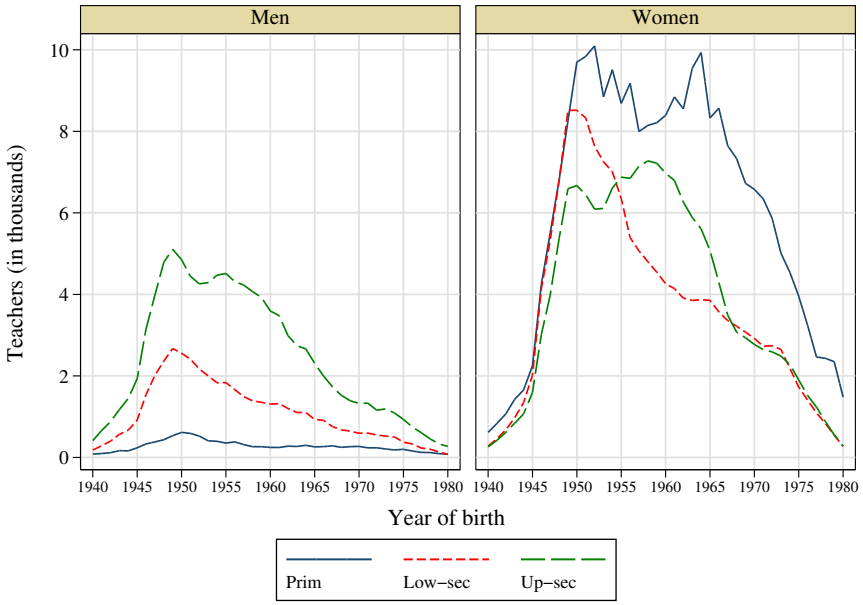



Figure 2: Average distance (km) by age.

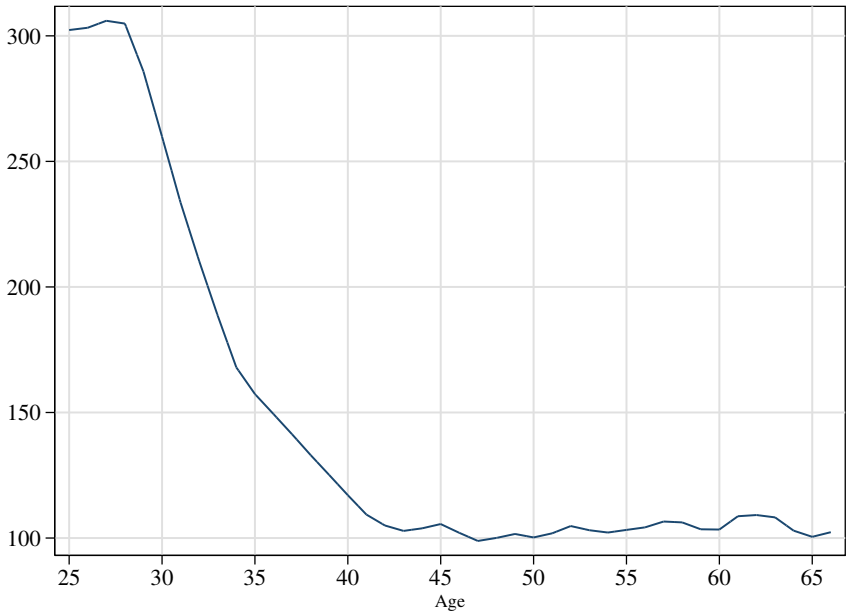


Figure 3: Average distance (km) by age and teachers' area of birth.

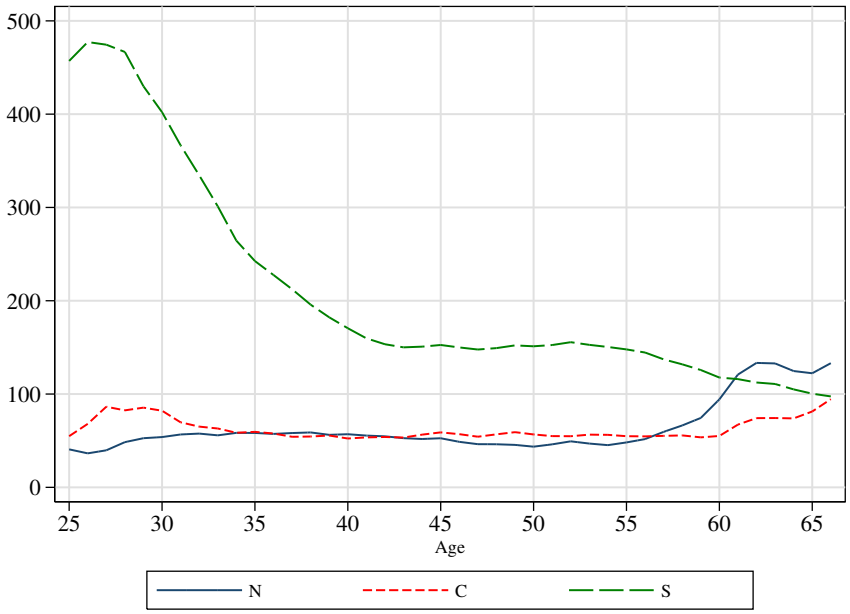



Figure 4: Percentage composition of teachers by age and area of birth according to schools' geographical area.

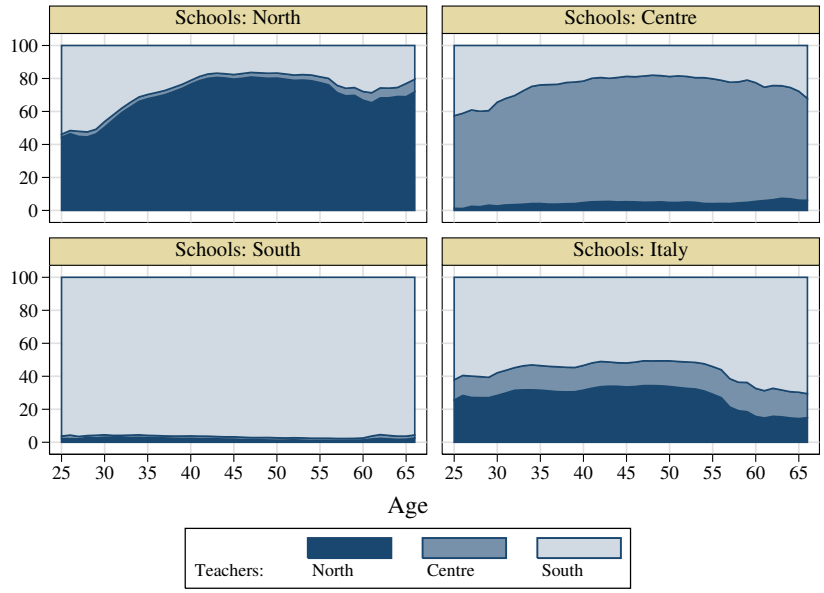


Figure 5: Average distance (km) by age and gender.

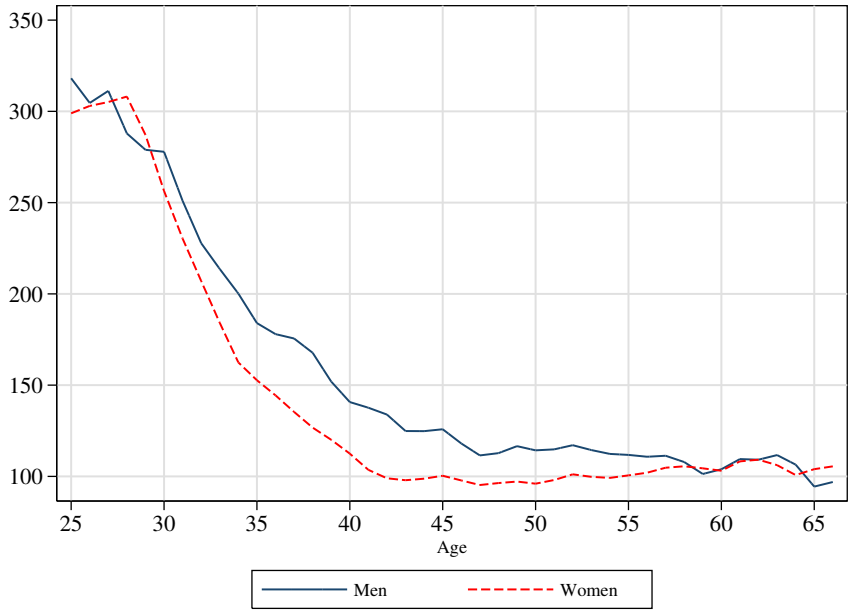



Figure 6: Average distance (km) by age and type of contract.

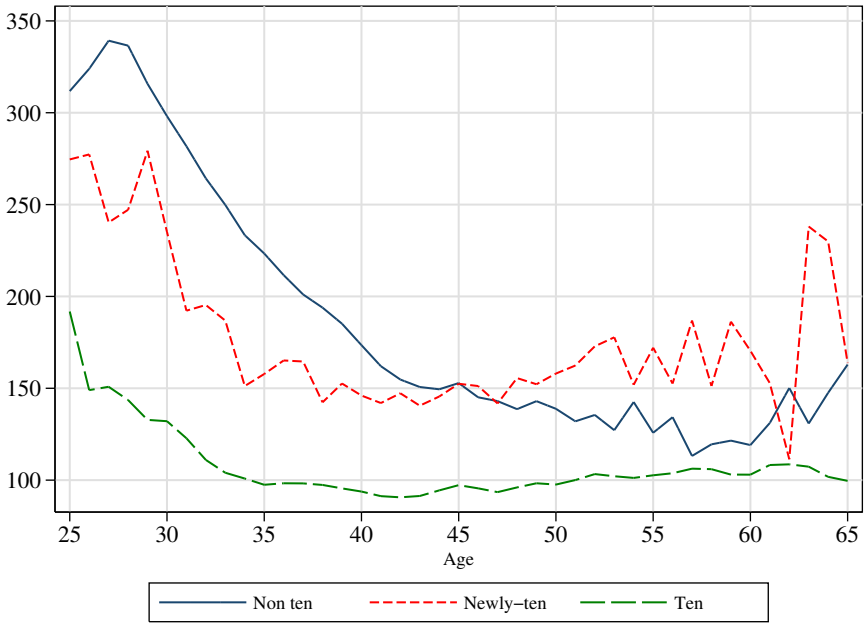


Figure 7: Share of teachers applying for a transfer by age and area of birth.

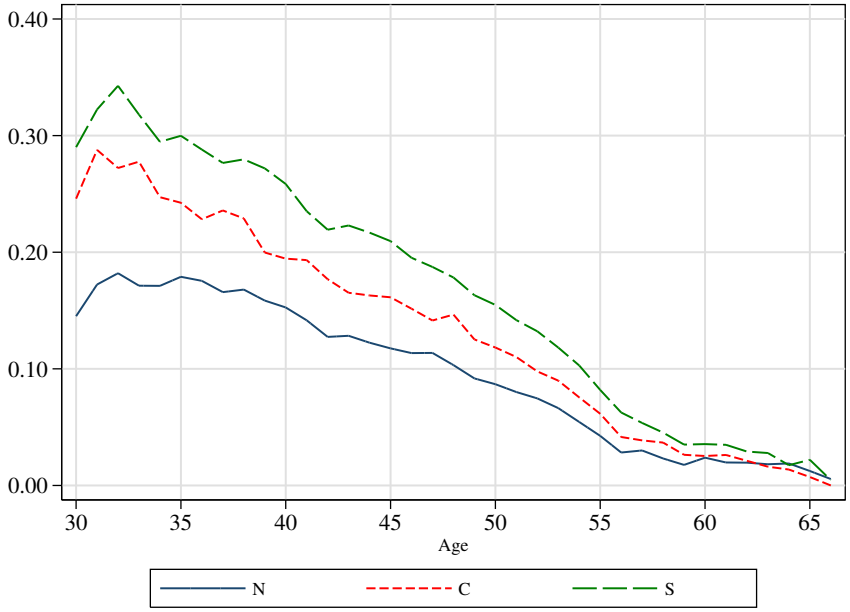
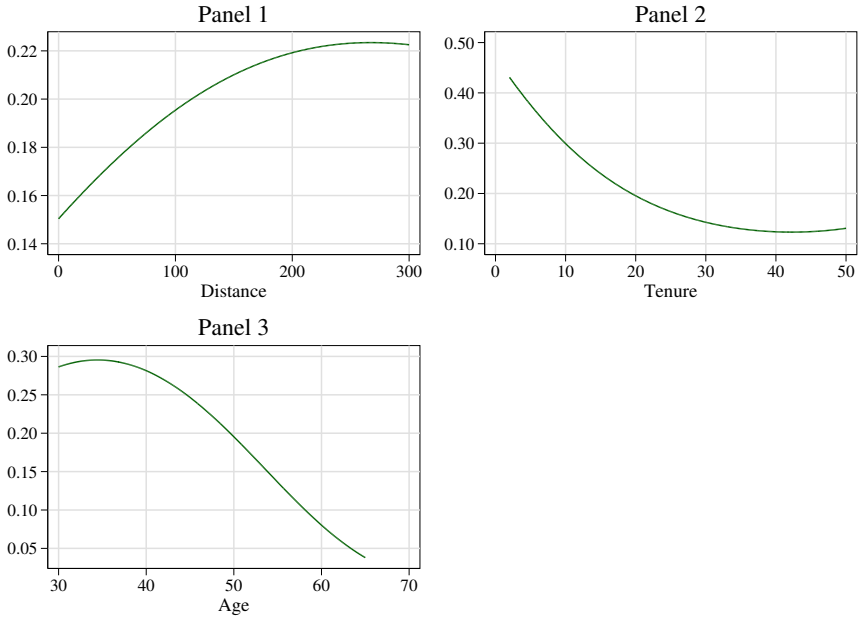



Figure 8: Probability of applying for a transfer as a function of distance, tenure and age.



# APPENDICES

## A Matching between schools and census divisions

This appendix provides a description of the method used to match schools and census divisions in order to construct schools' social context variables. The method is essentially based on the identification of the potential "clients" of each school. For this reason, it is necessary to distinguish different school types, considering separately primary, lower-secondary and upper-secondary schools. The procedure for the association between schools and census divisions consists of assigning to each school the closest divisions (in terms of geographic distance) so that the relevant resident population living in those divisions contains at least $k > 1$ times the number of students enrolled at that particular school. The relevant population is defined accordingly by school type. Specifically, we refer to the resident population observed in the census age-classes of 5-9 years, 10-14 years, and 15-19 years, for primary, lower-secondary and upper-secondary schools respectively. Because lower-secondary schools have a 3-year programme, we correct the relevant population by multiplying the resident population aged 10-14 years by 3/5. Factor $k$ is a multiplicative factor (greater than one) which guarantees overlapping of divisions among different schools, thus allowing for some sort of competition among schools which are close to each other. This method allows us to take into account different factors such as geographical distance, the potentially different population density of each census division, the peculiarity of each school type, and also the attractiveness of each single school.

Specifically, the association procedure consists of the following steps. For each school $j$

1. identify the type of school (primary, lower-secondary and upper-secondary) and, consequently, the relevant population in the divisions (population aged 5-9 years, 10-14 years, and 15-19 years respectively)
2. compute the distance between school $j$ and all census divisions
3. census divisions are then sorted by distance (in ascending order)
4. compute the divisions' cumulative relevant population
5. select the first (closest) $N_j$ divisions so that the cumulative relevant population contains $k$ times the number of students ($S_j$) enrolled in school $j$.

After $N_j$ divisions are associated to each school $j$ according to the procedure described above, socio-economic variables for each school are obtained as a weighted average of these variables for the $N_j$ associated divisions, with weights inversely proportional to the distance between the school and the divisions. The socio-economic context variables used in this paper are obtained by setting

the multiplicative factor $k = 10$. Nevertheless, our results are robust to the use of different values of $k$ in the association procedure.

We will now give a brief description of the matching between schools and divisions. First of all, we do not observe substantial differences in the distribution of the resident population in the census age-classes of 5-9 years, 10-14 years, and 15-19 years (which is relevant for primary, lower-secondary and upper-secondary schools respectively). The average number of in the three age classes is about 8.

On the other hand, we observe substantial differences in the number of primary, lower-secondary and upper-secondary schools, as well as in the number of their enrolled students. Specifically, we observe a high number of primary schools (about 17,000) with an average of about 165 enrolled students. There are about 7,000 lower-secondary schools with an average of about 235 enrolled students. There are also about 7,000 upper-secondary schools with an average of 379 enrolled students.

The average distance between matched schools and divisions is lower for primary schools than for lower-secondary and upper-secondary schools. As we would expect from the higher number, primary schools are on average closer to census divisions than the lower and upper secondary schools. Furthermore, as shown by the table below, the number of schools associated to census divisions is on average close to the multiplicative factor $K = 10$. No relevant differences are observed between geographical areas.

We note that by looking at the number of schools, for each grade, associated to a given census division we may state whether that census division is better served than others and whether households living there have more alternatives to choose from. By focusing on broad aggregates, the following table shows little differences across the North, the Centre and the South of the country, while, as expected, primary schools offer a wider set of alternatives than schools at higher levels.

Average number of schools associated to census divisions by area and distance and area

| | North | | | Centre | | | South | | | Italy | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prim | Low-Sec | Up-Sec | Prim | Low-Sec | Up-Sec | Prim | Low-Sec | Up-Sec | Prim | Low-Sec | Up-Sec |
| (0,1] km | 1.8 | 0.9 | 1.6 | 2.5 | 1.1 | 1.7 | 3.5 | 1.5 | 2.6 | 2.5 | 1.1 | 1.9 |
| (1,5] km | 6.1 | 4.4 | 4.4 | 6.0 | 4.0 | 4.7 | 4.0 | 3.6 | 3.6 | 5.5 | 4.0 | 4.2 |
| (5,10] km | 2.6 | 3.3 | 2.0 | 2.4 | 3.0 | 2.0 | 2.0 | 2.5 | 1.9 | 2.4 | 3.0 | 1.9 |
| >10 km | 1.0 | 2.7 | 2.1 | 1.4 | 3.6 | 2.7 | 1.2 | 2.9 | 2.1 | 1.1 | 3.0 | 2.2 |
| Tot | 11.5 | 11.2 | 10.0 | 12.3 | 11.7 | 11.0 | 10.7 | 10.5 | 10.2 | 11.5 | 11.1 | 10.3 |

The range of alternatives offered to households may be also examined, as in the following table, by looking at the share of census divisions associated to 1, 2 or more competing schools by area and school type. If we consider that schools of the same type compete with each other for a share of pupils, this table offers a simple picture of the Italian school market. The precise figures to

some extent derive from some arbitrary choices due to the multiplicative factor described above. However, by comparing different areas one can see where the competition among schools is more or less accentuated.

Fraction of divisions associated to 1, 2 or more competing schools by area and school type

| | North | | | Centre | | | South | | | Italy | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3+ | 1 | 2 | 3+ | 1 | 2 | 3+ | 1 | 2 | 3+ |
| prim | 0.006 | 0.003 | 0.992 | 0.001 | 0.004 | 0.995 | 0.003 | 0.006 | 0.991 | 0.004 | 0.004 | 0.992 |
| lowsec | 0.003 | 0.005 | 0.992 | 0.000 | 0.000 | 1.000 | 0.001 | 0.003 | 0.996 | 0.002 | 0.003 | 0.995 |
| classic | 0.683 | 0.245 | 0.072 | 0.644 | 0.221 | 0.134 | 0.687 | 0.238 | 0.075 | 0.667 | 0.245 | 0.088 |
| scient | 0.371 | 0.314 | 0.315 | 0.216 | 0.340 | 0.444 | 0.287 | 0.394 | 0.319 | 0.307 | 0.349 | 0.344 |
| socscie | 0.774 | 0.183 | 0.043 | 0.755 | 0.190 | 0.055 | 0.686 | 0.270 | 0.044 | 0.743 | 0.212 | 0.045 |
| tech | 0.113 | 0.180 | 0.707 | 0.092 | 0.196 | 0.712 | 0.116 | 0.201 | 0.683 | 0.108 | 0.189 | 0.703 |
| prof | 0.266 | 0.289 | 0.445 | 0.262 | 0.344 | 0.394 | 0.276 | 0.324 | 0.401 | 0.267 | 0.309 | 0.424 |
| art | 0.784 | 0.184 | 0.031 | 0.768 | 0.194 | 0.037 | 0.868 | 0.126 | 0.006 | 0.812 | 0.164 | 0.023 |

# B Description of teacher-level variables

| Variable | Description |
|---|---|
| applic | Indicator for a teacher applying for a transfer |
| tenure | Number of years of tenure |
| dist | Distance (km) between the municipality where the teacher was born and the municipality where she actually works |
| diffprov | Indicator for working in a different province from that of birth |
| age | Age |
| female | Indicator for female teachers |
| t:N | Indicator for a teacher born in the North of Italy |
| t:C | Indicator for a teacher born in the Centre of Italy |
| t:city25 | Indicator for a teacher born in a municipality with between 25,000 and 50,000 inhabitants |
| t:city50 | Indicator for a teacher born in a municipality with between 50,000 and 500,000 inhabitants |
| t:city500 | Indicator for a teacher born in a municipality with more than 500,000 inhabitants |

# C Description of school-level variables

| Variable | Description |
|---|---|
| prim | Indicator for primary school |
| classic | Indicator for upper secondary school: classical studies stream |
| scient | Indicator for for upper secondary school: scientific studies stream |
| socscie | Indicator for for upper secondary school: social science studies |
| tech | Indicator for upper secondary school: technical studies |
| prof | Indicator for upper secondary school: professional studies |
| art | Indicator for upper secondary school: artistic stream |
| s:N | Indicator for a school being located in the North of Italy |
| s:C | Indicator for a school being located in the Centre of Italy |
| s:city25 | Indicator for a school located in a municipality between 25,000 and 50,000 inhabitants |
| s:city50 | Indicator for a school located in a municipality between 50,000 and 500,000 inhabitants |
| s:city500per | Indicator for a school located in the suburb of a municipality with more than 500,000 inhabitants |
| s:city500centre | Indicator for a school located in the centre of a municipality with more than 500,000 inhabitants |
| s:highmunic | Indicator for a school located in a municipality over 600 metres above sea level |
| totteachers | Total number of teachers working in a school |
| fracnonten | Share of non-tenured teachers working in a school |
| fracage | Share of tenured teachers in different age groups |
| expansion | Indicator for a school increasing the number of enrolled students (the number of students in the past year not greater than the number of students in the current year) |
| fracdisab | Share of students with a disability within the school |
| fracforeign | Share of foreign students within the school |
| fracleaving | Share of students in the school who drop out of the school system |
| fracfail | Share of students in the school failing to move up to the next grade |
| fracdelay | Share of students in the first year at the school having previously repeated one or more years |
| fracillit | School context's fraction Share of agricultural workers in the school catchment area |
| emplrate | Occupation rate in the school catchment area |
| fracagric | School context's fraction of occupied with agriculture |
| rooms | Number of rooms per household (standardized by household composition and municipality size) in the school catchment area |
| avHHmembers | Average number of household members in the school catchment area |

# D Robustness checks for the model for the probability of applying for a transfer

Estimated coefficients of the school-specific random effect probit model for the probability of applying for a transfer (* significant at 5%; ** significant at 1%). This model allows for school-specific unobserved heterogeneity by including school random effects in order to capture general time-invariant retention in each school, which is not due to observable characteristics.

| | All schools | Primary | Lower-Secondary | Upper-Secondary |
|---|---|---|---|---|
| fracdisab | 0.826 ** | 0.488 * | 1.261 ** | 0.737 ** |
| fracforeign | 0.299 ** | 0.359 ** | 0.432 ** | 0.491 ** |
| fracleaving | 0.009 | -1.305 | 0.950 | 0.183 |
| fracfail | 0.054 | 0.103 | 0.020 | 0.111 * |
| fracillit | 2.195 ** | 1.738 ** | 1.824 ** | 2.247 ** |
| emplrate | -0.853 ** | -0.605 ** | -1.095 ** | -0.720 ** |
| fracagric | 0.195 ** | -0.227 * | 0.502 ** | 0.201 |
| rooms / 10 | 0.005 ** | 0.005 ** | 0.003 | 0.005 ** |
| avHHmembers | 0.016 | -0.032 | 0.112 ** | 0.044 |
| Obs. | 1,065,792 | 409,825 | 277,183 | 378,784 |
| Log-like. | -336,579 | -102,112 | -104,102 | -128,677 |
| $\rho$ | 0.090 | 0.077 | 0.102 | 0.072 |
| LR test $\rho = 0$ | 13,822.7 | 3,340.0 | 4,674.7 | 4,033.7 |

Estimated coefficients of the probit model for the probability of applying for a transfer by gender, teachers' area of birth and schools' area (* significant at 5%; ** significant at 1%).

| | Gender | | Teachers' area of birth | | | School area | | |
|---|---|---|---|---|---|---|---|---|
| | Men | Women | North | Centre | South | North | Centre | South |
| fracdisab | 0.697 ** | 0.773 ** | 0.427 | 0.458 | 1.043 ** | 0.436 | 0.221 | 1.367 ** |
| fracforeign | 0.454 ** | 0.304 ** | 0.511 ** | 0.065 | 0.415 ** | 0.486 ** | 0.156 | 0.759 ** |
| fracleaving | -0.118 | -0.024 | -0.150 | 0.152 | 0.047 | -0.341 | 0.238 | 0.173 |
| fracfail | -0.174 * | 0.081 | -0.002 | 0.238 * | -0.005 | -0.041 | 0.272 * | -0.023 |
| fracillit | 2.060 ** | 1.982 ** | 4.221 ** | 2.516 * | 2.276 ** | 2.321 | 4.167 ** | 2.588 ** |
| emplrate | -0.741 ** | -0.819 ** | -1.136 ** | -1.249 ** | -0.268 * | -0.966 ** | -1.193 ** | -0.014 |
| fracagric | 0.117 | 0.132 | 0.315 ** | 0.606 ** | -0.040 | 0.421 ** | 0.643 ** | -0.129 |
| rooms / 10 | 0.005 ** | 0.006 ** | 0.012 ** | 0.004 | 0.003 ** | 0.013 ** | 0.004 | 0.001 |
| avHHmembers | 0.055 * | 0.026 | 0.001 | -0.087 * | 0.092 ** | -0.038 | -0.149 ** | 0.123 ** |
| Obs. | 230,386 | 835,406 | 328,478 | 168,234 | 569,080 | 390,415 | 196,656 | 478,721 |
| Pseudo $R^2$ | 0.103 | 0.136 | 0.113 | 0.121 | 0.127 | 0.109 | 0.113 | 0.133 |
| Log-like. | -79,584 | -263,015 | -88,488 | -51,306 | -202,753 | -106,546 | -60,424 | -175,007 |

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