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TRACKING IN THE TRACKS IN THE ITALIAN PUBLIC SCHOOLING: INEQUALITY PATTERNS IN AN URBAN CONTEXT

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INEQUALITY PATTERNS IN AN URBAN CONTEXT

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Abstract

We study whether, alongside with an explicit tracking system separating students in general versus vocational curricula typically observed in European countries, the Italian highly centralized public schooling is also characterised by an implicit tracking system—typical of the US—which separates students by ability and income within the same track. We pursue this aim by considering the municipality of Turin, a post-industrialized urban context in Northern Italy. We proxy students' ability with the score obtained at the standardised admission test at the School of Economics and Business of the local university, and we first check whether students are stratified by ability not only between tracks but also across schools within the same track. A stark heterogeneity across tracks and schools emerges, thereby strongly suggesting that the inequality patterns common in the Italian schooling system are affected by both types of tracking. We then discuss some potential sources of this US-style tracking, namely self-selection and observed and unobserved school characteristics, all of which can be relevant factors in explaining within-track school heterogeneity. We also investigate whether stratification is linked with income and residential segregation, and we find limited evidence of segregation. Finally, the low mobility of students suggests the need for disclosing more information on each school quality.

Keywords: public schools, educational inequalities, schools stratification, tracking, house prices, income segregation.

JEL Codes: I24, I28, R23

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1. Introduction

As formalised in the Republican Constitution, the Italian public schooling is strongly oriented towards guaranteeing all students equal educational opportunities in order to improve equality via social mobility. This idea is endorsed both by the centralised management system of funds and school resources and by the limited autonomy for each school in terms of choice of curricula and organization of work. However, despite the characterisation in favour of equality, there is ample evidence that the goal is far from being reached: Italian schooling is plagued by differences in terms of outcomes as well as opportunities (e.g., Checchi *et al.*, 1999; Checchi and Peragine, 2010).

Geographical differences (Invalsi, 2012) and the presence of an early tracking system (separating general from vocational education) are commonly identified as the main factors sparking inequities. Striking differences in performance can be found when different school tracks—general education high schools versus technical and professional schools—are considered. The performance in PISA 2012 show that students in general education high schools perform better, the mathematics (reading) average score being 521 (537) points versus 486 (476) and 414 (415) for technical and professional schools, respectively (Invalsi, 2012). This important divide across tracks motivates measures that consider postponing or removing the choice as the key strategy to improve intergenerational mobility in educational attainments (e.g., Brunello and Checchi, 2007). Several reforms have been introduced during the Nineties aiming at wiping out the impact of tracking by raising the age of the first selection, despite these attempts were followed by a number of counter-reforms fostering a clear distinction of curricula.

The implicit premise beyond this debate is that tracking based on the separation between general and vocational education (which is typically observed in Europe, henceforth *EU-style*) is traced as the *only* responsible for the intergenerational transmission of inequalities. The debate completely disregards a different—and more subtle—tracking system (which is instead explicit in the US experience, henceforth *US-style*), which groups students according to their ability and income. The aim of the paper is to understand whether—*within the EU-style tracking*—the Italian schooling is also plagued by an implicit US-style tracking system further reinforcing inequality patterns. According to this potential tracking mechanism, better and wealthier students are likely to consider a specific subset of schools within each track as potential options for their enrolment. These schools are likely to provide a better in quality educational service, eventually reinforcing the relative advantage of their students.

To identify the existence of this double source of potential stratification we need to focus our attention on the urban dimension. In fact, within a given municipality area students can freely enrol in one among several schools within the same track, transportation costs for students (both in monetary and in time terms) are substantially low, and public schools do not normally charge any fee for enrolment, besides a very small tax defined by the central government and equal for all the schools within the same track. Under these circumstances, we might expect to observe only differences in students' performance *between* tracks but not *within* tracks.

Here we consider as a case study the municipality of Turin, a post-industrialised urban context in Northern Italy. Our analysis is based on administrative data on a standardised admission test at the School of Economics and Business of the University of Turin. The test is designed to verify students' general knowledge and basic literacy (for instance, reading ability and very basic mathematics). Students' ability is approximated with the test score. Results obtained through stochastic dominance tests on score distributions and an econometric analysis confirm the available evidence of stratification by track but also show a marked heterogeneity across schools within each track, even in this small urban area. We then try to investigate the sources of this heterogeneity and whether it can be linked with income segregation. Our findings suggest the important role played by several factors, notably, school observed and unobserved characteristics in affecting students' performance. Furthermore, the low mobility of students does not exacerbate the inequality of the system, as income segregation does not seem to be a major concern. Overall, these results call for policies that go beyond the mere abolition of an early tracking system as to remove the intergenerational transmission of inequalities and ask for a better understanding of the heterogeneity in quality of schools in urban contexts like the municipality of Turin.

The remainder of the paper is structured as follows. A brief summary of the related literature is presented in section 2. Section 3 provides a description of the Italian educational system with a particular focus on the upper secondary cycle, which is the one of interest in the study. Section 4 presents the data and the main results of our paper, firstly obtained by stochastic dominance tests and then by more formal econometric analyses. Section 5 discusses potential mechanisms behind our results. Section 6 concludes.

2. Related literature

School tracking, namely the division of students between an academic and a vocational track at the secondary school level, characterises the majority of the European educational systems. We label this typology of tracking as *EU-style tracking*. Several authors investigated its possible effects (e.g., Brunello and Checchi, 2007; Brunello *et al*., 2007; Hanushek and Wößmann, 2006) emphasising the traditional dichotomy between equity and efficiency. From an equity viewpoint, track design is a potential factor of risk due to the possible misallocation of students between tracks. Such misallocation is often driven by the young age at which the choice has to be taken (Breen *et al.*, 2009). Low intergenerational mobility caused by a very early choice is analysed in Dustmann (2004), while Schütz *et al.* (2008) show that the earlier the tracking system operates, the larger the family background effect is. From an efficiency viewpoint, several authors highlight how an early school tracking enables students to exploit peer effects (Sacerdote, 2011; for the Italian case De Giorgi *et al.*, 2010; De Paola and Scoppa, 2010) and to foster the specialisation process.

The separation of students between general and vocational curricula is considered as the main responsible for inequalities in education in the European countries (European Commission, 2010; Hanushek and Wößmann, 2006). This paper looks for some evidence of another potential type of tracking which is likely to operate in the Italian educational system in a more subtle and implicit way. This mechanism is similar to the one at work in the North American educational system (hence, *US-style*) where high ability (and high income) students tend to concentrate in selected—mostly private—schools, while low ability (and low income students) are "segregated" in other institutions, usually public schools. Several researchers, starting from the seminal contributions of Summers and Wolfe (1977) and Oakes (1985), focused their attention on this different tracking scheme to understand whether it reduces or perpetrates social inequalities. A strict hierarchy of schools by quality emerges as an equilibrium in the model of Epple and Romano (1998) in which students are diversified according to ability and income. Epple *et al.* (2003, 2004) test this model reinforcing the idea of an US "educational market" as a sort of "ladder" in which the bottom ground is occupied by public schools and by low-income-low-ability type of students, whereas the upper grounds are taken by private schools. Furthermore, the higher the tuition fees are, the higher the level of students' ability and income (and consequently the school quality) will be.

By comparing the Italian and the US systems, Checchi *et al*. (1999) find that the more equity oriented Italian system results in less intergenerational mobility than the US one. One of the drivers of this result could be the presence of some embedded mechanisms implicitly operating in the Italian educational system, *de facto* reducing its ability to generate social upward mobility. The implicit US-style tracking which we aim at identifying in this paper may be part of these mechanisms.

3. Setting the stage: The institutional background

The structure of the Italian educational system is similar to the one of most European countries. The level 0 in the ISCED-Classification is a three year pre-primary stage followed by a level 1 five year cycle that children begin at the age of six. Level 2 is a three-year lower secondary cycle while level 3—the one we focus on—consists of a five-year upper secondary cycle, the *Scuola Media Superiore*. The successful completion of the upper secondary stage opens the door to university degrees (or to post-secondary non-tertiary courses). With the exception of the level 0 cycle, the system is mostly public, with the vast majority of students enrolling in a public school. This is hardly surprising in a country where public schooling is the paramount tool to guarantee equality and social mobility, as even stated in the article 34 of the Republican Constitution. In turn, the system of funding and management of resources is highly centralised.

At present, the (level 3) upper secondary cycle—which usually involves 14 years old up to 19 years old students—is organised in two different tracks, one based on "general education" and an alternative one based on more "vocational" (i.e., professional and technical) studies. The first track includes the so-called *Licei,* schools more oriented to prepare students for future university careers. The second track provides technical or professional specialisations and includes technical and professional schools.[1] The main role of technical schools is to prepare students for a particular kind of technical or administrative job in fields such as agriculture, industry, or trade. Professional schools provide an even more direct link between education and specialised jobs. In the academic year (a.y.) 2011/2012, 49.2% of students enrolled in a *Liceo*, while 32.1% enrolled in a technical school, with just a minor share (18.7%) of students enrolled in a professional school (MIUR, 2011).

Entering in one of the two tracks has profound consequences on later outcomes. Firstly, dropout rates are remarkably higher in technical and professional schools (2.1% and 3.6%, a.y. 2006/7) than in the more academic oriented schools (0.2%). Secondly, as shown in the Introduction, the PISA data suggest that students enrolled in a general education high school perform better than students enrolled in a technical school, and these—in turn—perform better than students enrolled in a professional school. The main concern is that the choice of track is deeply affected by family background, with children coming from better educated families showing a higher probability to be enrolled in the academic oriented high-school track (e.g., Brunello and Checchi, 2007; Checchi and Flabbi, 2013; Flabbi, 2001). Results provided by Isfol (an Italian research centre on labour market issues) with reference to 1999 show how the choice of track between *Licei* and technical schools is heavily affected by parents' occupational status. Around 67% of students with parents covering a managerial position are enrolled in the general education track, whereas this proportion dramatically drops to 24.3% when considering students whose parents are employed in agriculture. This is the main reason why—in order to increase equality—many advocate for introducing different (*EU-style*) tracks in public schooling as late as possible. However, this tracking might represent only one of several factors explaining the inequality patterns in the Italian (mostly) public schooling system. Our main claim here is that the Italian schooling system is characterised not only by an *EU-style* (early) tracking system but also by a (more subtle) *US-style* tracking *within* each track. To understand whether—besides the stratification deriving from the definition of different curricula between general and vocational education—a stratification process is at play also *within the same track*, we need to restrict our attention to a sub-sample of students facing the same set of schools as

[1] Because of some remarkable differences between technical and professional schools, in the remainder

potential options of choice *within the track*. Since tuition fees are fixed at the national level and identical across different schools, we restrict the geographical area to a urban centre, thereby ensuring that travel costs do not affect school choice within the area. We consider the municipality of Turin as a case study. Turin is the third economic and productive pole of the country and the fourth Italian city in terms of population, accounting around 900,000 inhabitants and extending for about 130 km^2. Each of the approximately 6,400 students aged 13 years old of the Level 2 secondary cycle enrolled in 2002 faced a very ample set of choices in terms of upper secondary school to attend.[2] There are indeed 82 different schools within the municipality area: 42 belong to the general education track (25 public, 17 private) while 24 are technical schools (20 public, 4 private) and 16 are professional schools (15 public and 1 private). A very limited number of them are mixed school, i.e., schools that—for organisational reasons—offer more than one tracks.

Each student (either resident in Turin or not) is free to enrol in the school she prefers. Given the size of the city, transport costs—in terms of time and money—are very unlikely to play a significant role in affecting individual choices. Due to an efficient transportation system, travel times are acceptable (more on this in Section 5) and the cost for public transport is low, especially when it comes to tariff schemes applicable to students. Under these circumstances, we might expect to observe only differences in students' performance *between* tracks but not *within* tracks. Our empirical analysis, presented in the next sections, aims at assessing whether there is evidence supporting this hypothesis or not.

of the paper we will consider them separately.

[2] The typical student taking university admission test in 2007 started his/her upper secondary cycle of education in September 2002. Reported population size refers only to residents in the municipality of Turin.

4. The empirical analysis

4.1. Data and descriptive analysis

We use administrative data provided by the University of Turin concerning all the students taking the admission test at the School of Economics and Business in the four academic year period 2006-2009.[3] Alongside with the test score, the data provide information about student's age, gender, nationality, residential address, high school attended (track and specific school), high school final grade, and household income. The admission test is a standardised test aiming at verifying students' very basic literacy in a number of fields, including mathematics, reading, and history.[4] The test—introduced in 2006—is composed by 80 questions and the final score—our main proxy for students' cognitive skills and ability—is obtained assigning 1 point for each correct answer, 0 points in case of no answer, and a penalization of 0.5 points for each wrong answer.

The non random nature of our sample raises some concerns about two different types of potential selection bias. Being based on a university admission test, our sample only considers those students who decide—after the upper secondary cycle of education—to carry on with a university career. Furthermore, as we are considering only a specific degree, there might be a self-selection process driven by the interest in the specific field, namely economics and business. Given the administrative nature of our data we cannot address the self-selection issue in a definite way. Nonetheless, the likely impact of self-selection bias on our results is limited. On the one hand, by restricting our attention to the fraction of students enrolling at the University, we reasonably compare the upper part of the whole students' distribution as worse performing students tend to enter the labour market right after the end of the upper secondary cycle. In turn, it should be more difficult to find differences across the observed distributions than across the whole distribution. On the other hand, there is no compelling reasons to believe that—across tracks and schools—students of different ability choose to enrol in the test. The degree awarded by the School of Economics and Business is very broad in terms of subjects

[3] From now on, we will refer to the academic year 2006/7 as year 2006, and so forth for the other academic years.

and it is deemed as an "easy" degree so that it is chosen by a large fraction of students coming from any secondary tracks and schools. Unsurprisingly, the proportion of students coming from different secondary tracks in our sample fairly mimics the proportions in the Italian student population. Furthermore, the local labour market offers the same opportunities to all students within each track, so that it is very unlikely that the fraction of good students enrolling in the test differs across schools within each track.[5] Summing up, there are no reasons to believe that the sample selection bias might be large, especially as far as the *within-tracks* results are concerned.[6]

Our administrative dataset enable us to control also for students individual economic background as it contains an indicator of the household income, the so-called *Isee* (literally, the Indicator of the Equivalent Economic Situation of the household) used to identify students who are eligible to receive benefits (such as reduced fees or scholarships). Two caveats about income data must be introduced. Firstly, unfortunately the data about income are available only for the last two years, 2008 and 2009. Secondly, approximately one half of the students (52.5% in 2008, and 50.3% in 2009) have missing information about income due to several reasons: richest families do not certify their actual income as they are aware of not being eligible for benefits, students make mistakes in the procedure or they do not respect deadlines, they are not informed about the possibility of having benefits or they have other kind of incompatible scholarships.

Among all schools from which the students taking the test come from, we select all public schools in the municipality of Turin with at least 80 students taking the test in the period between 2006 and 2009, with the only exception of professional schools for which the threshold is established at 40 observations due to the limited number of observations for the professional track. We end up with a sample composed by 13 schools: 5 of them are general education high schools (School A to E), 5 are technical schools (School F to J) while 3 are professional schools (School K to M). These schools

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[4] A representative selection of questions included in the test is available upon request to the authors.

[5] In our analyses we use household income as regressor. The Italian labour market is notoriously characterised by personal ties which are related to households' economic background. In turn—by conditioning on income—we reasonably make entry conditions in the labour market similar for students across all schools.

[6] An exception might be due to the fact the curricula from the School of Economics and Business are considered as the natural follow-up of one of the fields in the technical tracks ("Istituti Tecnici Commerciali", whose main focus is accountancy). In turn, a larger fraction of best students coming

are the focus of our analysis. We use observations from the whole 2006-9 period in the stochastic dominance analysis of test scores (section 4.2). Due to the lack of information on family income, we restrict the analysis to the 2008-9 period for the econometric exercise (section 4.3) and the stochastic dominance analysis of income (sections 4.2 and 5). As shown in Figure 1, schools tends to be evenly spread across the city areas.[7]

[Table 1 around here]

Descriptive statistics for each public school (Table 1) confirm a characteristics of the Italian schooling system widely discussed in the literature (e.g., Checchi and Flabbi, 2013; Flabbi, 2001): the existence of a very strong link between family background and children's educational choices. Students coming from one of the more academic oriented high schools are characterised by a higher average household income and they perform better than students from professional and technical schools. The average performance is 47 points for the general education track, 44 for the case of technical schools and only 34 points for professional schools. Very importantly for the purposes of this paper, the school level descriptive analysis also provides support to our claim of an US-style tracking within each track. The range between the maximum and the minimum average score for schools in the same track is around 7 points for general education high schools, 3 points for the case of technical schools and about 10 points in the case of professional schools. These differences in average scores—with the partial exception of technical schools—are quite large, the average score being 44, and they appear to be even more relevant when one considers that the test simply aims at assessing very basic literacy in general fields. Some within-track heterogeneity in income appears as well, especially among professional schools.

4.2 The stochastic dominance analysis

The previous descriptive analysis offers preliminary indications on possible stratification processes operating in the urban setup we observe. A second and more

from this track might enrol in the School of Economics and Business. See footnote 12 below.

[7] Some schools have several buildings, usually located in nearby areas. This is the reason why Figure 1 shows 19 locations instead of 13.

important evidence of differences across schools within the same track is obtained by comparing the distributions of scores and income for each school.[8] We formally test the differences in distributions across schools, by considering the Kolmogorov-Smirnov and the Fligner-Policello tests.[9] Results are shown in Table 2: the three panels around the main diagonal represent the comparison *within* tracks (solid line) while the other three report the *between* tracks comparison (dashed line).

[Table 2 around here]

Results strongly confirm the presence of between tracks stratification. As for the test score distribution, schools in the technical and professional track tend to be stochastically dominated by schools in the general education track and—as expected—technical schools dominate professional schools. Similar conclusions emerge when income distribution is considered, richer students being more likely to be enrolled in a general education high school with respect to a technical or professional school. These findings confirm the importance of the economic background in shaping the individual choice between the three different curricula.

Turning to a possible US-style tracking system, both tests suggest that—within the general education track—schools such as Schools A and D outperform other *Licei*, like Schools C or E. The hypothesis of equality of distributions can be rejected in the majority of these cases, the tests showing very low p-values. Differences are relatively less striking among technical schools, where School F appears to be the top performer. School L stochastically dominates both Schools K and M within the professional schools.[10]

Although the stochastic dominance analysis provides some evidence of possible stratification processes, it fails to consider the role student and school characteristics play as determinant of test score. To overcome this problem we turn to the econometric analysis in the next section.

[8] The exercise is similar to the approach used in Gibbons and Telhaj (2007) for assessing differences in performance across secondary schools in the UK. A graphical representation of test score distribution is available upon request.

[9] We perform both tests as the Fligner-Policello test does not rely on the assumption of equal variances.

[10] Discussion of the results of the within track income comparisons is postponed in Section 5.

4.3 The econometric analysis

This section introduces a more formal econometric analysis to support our claim of an US-style tracking system within the EU-style tracking in the urban context of Turin. Before extending the analysis to the within track stratification, we first assess whether the existence of the EU-style tracking system survives the inclusion of student-level regressors. To this end, we estimate the following equation:

(1) $$\textit{Test Score} = \beta_0 + \sum_j \beta_j \, \textit{track} + \sum_k \beta_k \, \textit{income} + \gamma \, \mathbf{X} + \varepsilon$$

where *track* and *income* are two sets of dummy variables for the different tracks and income classes. Given the nature of the data we decide to split observations for students who certificate their income in three equally sized classes and to include in a residual fourth class the entire set of students with missing information about income.[11] **X** is a vector of characteristics that may affect the performance at the test, such as student's gender and age and the academic year in which the test is taken. Estimates of eq. (1) are reported in the first three columns of Table 3.

[Table 3 around here]

The importance of the EU-style tracking system in determining individuals' performances at the test stands out clearly. Professional schools clearly underperform with respect to both general education and technical schools, the difference being around 10.5 and 8.5 points, respectively, and the difference between general education and technical schools is statistically significant in the first two columns.[12] As expected, when income is added as regressor the magnitude of the track effect slightly decreases, due to the relevance of household income in influencing the choice among alternative tracks. The income effect is positive and significant: moving from the first to the third income class (median values are approximately 7,400 and 30,800 euro) increases test

[11] Hence, the 1st income class contains the 33% of students with lower level of income, etc.

[12] This effect is due to the interaction of two different factors: better—in terms of unobservable ability—students tend to self-select themselves into the general education track but also the quality of the educational service offered is likely to be different between the tracks. Our data do not allow us to discriminate between the two factors. We will discuss this issue in Section 5. Notice also that the good performance of technical schools could be partially due to a sample selection effect. See the discussion

scores by 3.6 points, approximately 8% of average scores.[13] Individual controls (gender, age, year in which the test is performed) do not affect our main results.

In order to confirm the existence of an implicit US-style tracking process operating within each track, we estimate an augmented version of equation (1) which—in order to capture specific school effects—contains a full set of 13 dummies (*school*)[14]

$$(2) \quad Test\ Score = \beta_0 + \sum_j \beta_j\ track + \sum_k \beta_k\ income + \sum_h \beta_h\ school + \gamma\ \mathbf{X} + \delta\ \mathbf{S} + u$$

Columns 4 to 6 of Table 3 present the main estimates of eq. (2), without (columns 4 and 5) and with (column 6) individual controls. As expected, previous results in terms of stochastic dominance tests are upheld by the econometric analysis. Notice the absolute stability of school coefficients across different econometric specifications. The inclusion of additional regressors (income and other individual controls) only marginally affects the magnitude and the statistical significance of school coefficients. In particular, within the general education track, School A performs better than the other schools, some of them perform comparably (e.g., Schools B and D) while others perform remarkably worse (e.g., School C, whose disadvantage is not negligible as it reaches a value of 9 points in the more general specification). A similar pattern emerges in the vocational track where the performance of School F is indeed significantly better (4-5 points) than the performance of Schools I or H. A very relevant stratification process within the professional track emerges: School L shows a much better performance (between 13 and 15 points) when compared with School K.

The F-statistics reported at the bottom of the table jointly test the hypothesis of equality to zero of school coefficients within the same track. Unsurprisingly, the test always shows significant within-tracks differences: in almost all the specifications schools in the three different tracks perform differently, despite the small area in which they operate.

in footnote 6.

[13] Income might also have indirect effects on the test score via the choice of either the track and/or the specific school within each track. The first indirect effect has been documented in the previous section whereas the next section shows limited support for the second one.

[14] Equation (2) also contains the vector **S**, containing proxies for school quality, which will be discussed in the next section.

The coefficients of the other regressors do not appreciably change across model specifications. The direct effect of income on test score is confirmed; students in the upper income class perform better than others. Females perform slightly worst with respect to males and age has a negative impact on test score.[15]

We performed several robustness checks of our findings. We firstly split the income categories according to the four quartiles (plus a category for individuals with missing information) and then we consider the separation in income classes made by the School of Economics and Business of Turin in order to impute individual fees. Finally, we augmented eq.(2) with a measure for standardised individual ability based on high school final grade. Our findings of stratification within tracks remains in these alternative specifications.[16]

Overall, our findings confirm the presence of two different stratification processes: the first one operates between the different tracks whereas a second one, more subtle, operates across schools within each track. Next section suggests some mechanisms that can explain the latter kind of tracking.

5. Why an US-style tracking system? Ability, school quality and residential income segregation

Our results strongly suggest the existence of an US-style stratification process. This finding leads to the relevant issue, especially for policy purposes, of understanding which are the sources of this kind of stratification. Admittedly, the limitation of our dataset only allows us to suggest some tentative explanations.

The first likely mechanism behind stratification is self-selection. Best students could enrol in the same schools, so that the observed heterogeneity in performance is due to the quality of students when they started their upper secondary cycle of study. These peer effects can eventually reinforce the impact of the stratification processes we uncovered here. Alongside with individual student ability, also (observed and/or unobserved) heterogeneity in school quality can drive the differences in test

[15] Gender differences emerge also considering PISA data on Italy, with women performing better than men in reading, and men performing better than women in mathematic. See INVALSI (2012) for details.

[16] Detailed results are not included here for sake of brevity and are available upon request to the authors.

performances across schools. Table 4 presents descriptive statistics for some (observed) structural indicators of quality for our sample of 13 schools.[17]

[Table 4 around here]

The evidence of similarity of these 8 school quality indicators across schools *within the same track* is mixed. By considering general education schools, there are no stark differences in terms of average class size and number of students per computer.[18] Similar considerations apply also to vocational schools, although the range between the top and the bottom ranked organization is slightly wider with respect to the general education track. This conclusion is hardly surprising in a centralised school system, where the Central government ultimately assigns resources to public schools. Teacher quality and motivation might also play a significant role in shaping differences among schools (Aaronson *et al.*, 2007). We proxy these teachers' characteristics (admittedly, very difficult to observe) with the percentage of teachers with a permanent contract, the share of teachers who apply for relocation, as well as teachers' involvement (average yearly number of day of absenteeism per teacher) and experience (age composition). Also in this case the differences are not striking. Nonetheless, at a deeper scrutiny some patterns in observable characteristics in line with the previous econometric analysis emerge. Top performing schools in each track (Schools A, F/G, and L) appear to display a higher percentage of teachers with permanent contract than worse performers (Schools C, H, I, and K) whereas less clear results emerge for class size and the percentage of teachers applying for relocation. If we substitute school fixed effects with these three variables in our econometric model, they come up with the expected sign and two of them are statistically significant (see col. 7, Table 3), thereby confirming that differences in class size and teacher quality and motivation do play a role in explaining school performance. However, the increase in fit with respect to the model in col. 3 is

[17] Due to data availability, we measure school characteristics only in 2011. However, given their persistency, they can be reasonably considered very similar to the (unknown) values in our sample years.

[18] The importance of class size in affecting students' performance is emphasised, *inter alia*, by Akerhielm (1995), Angrist and Lavy (1999), Krueger and Whitmore (2001), and—for the Italian case—by De Paola *et al.* (2013).

small, so that other unobserved factors, notably school and teachers practices, are clearly important determinant of school performance.[19]

Another variable displaying an interesting pattern is the percentage of funding from families, with best performing schools relying more on students' parents than worse performers. In turn, this evidence suggests the role of households' income in within-track heterogeneity of school performances. To investigate this issue, we replicate the stochastic dominance tests carried out in Section 4.2 by comparing students' income distribution. Table 2 shows some evidence of within track heterogeneity, especially in the professional track.[20] We explore this issue further and we draw from the income residential segregation literature the idea that school quality and housing prices (and, in turn, household income) in the area where the school is located might be linked.[21]

Following this literature, we focus on house market values in the school neighbourhood, and the home-school students' mobility. If good schools are chosen by students regardless of their economic conditions (proxied by house prices), then the within track stratification would be a less serious concern. Instead, if good schools are mainly chosen by students living in the area the school is located in and this area is wealthier, then the US-style stratification would really contribute to exacerbate inequalities beyond the EU-style tracking.

A first finding is a limited intra-city mobility (see Table 5). We consider home to school (time) distance by public transport.[22]

[Table 5 around here]

[19] Freeman and Viarengo (2014) perform a cross-country analysis using the 2009 PISA data to show that school effects are quite important and partially explained by schools and teachers practices, which are unfortunately unavailable to us.

[20] Notice that—due to data availability—income comparisons are based on a lower number of observations with respect to test scores (2 vs 4 academic years). The decrease in sample size leads to a lower power of the test, especially for an equality of distribution test.

[21] Several papers analyse the links between housing prices and school performance. Black (1999) for US, Gibbons and Machin (2003, 2006) for the UK and Fack and Grenet (2010) with reference to the French case. On this issue, see also Nechyba (2003), Downes and Zabel (2002), Dhar and Ross (2012), Clapp *et al.* (2008) and Bayer *et al.* (2007). Recently, De Fraja and Martínez-Mora (2014) analyse the relationship between different tracking systems and income residential segregation.

[22] We compute the home to school time distance as the average of the home-school travelling time at 7:30 am and the school-home travelling time at 1 pm. These times have been computed for a randomly chosen schooling day, namely Wednesday, October 7th, 2009.

The percentage of students who opt for the *closest home solution* is extremely high, especially if one considers that time distances are computed *door-to-door* so that they also include the time needed to reach the bus station. For instance, more than 30% of students attending Schools A or E were living in distances bounded between 1 and 10 minutes, and the percentage increases to more than 65% when the 15 minutes threshold is used.[23] Technical and professional schools show higher mobility than general education schools. A likely explanation is that these tracks offer more diversified curricula, which are not offered in all the urban neighbourhoods, so that a relatively higher mobility is justified by the interest in a specific subject.

We also computed average house prices in the schools' districts by inspecting transactions posted on internet.[24] As for general education high schools, stark differences between the geographical contexts in which each school is located emerge. Schools B and D are located in "high income areas", whereas Schools C and E—worse in performance both in the stochastic dominance analysis and in the econometric one—are in "low income areas". However, the best performer, School A, is located in an average income area. Focusing on technical schools, the stratification appears to be more relevant than in the case of general education schools. For instance, house prices in school J neighbourhood are more than double than those in school G area. Nonetheless, the latter is the best performer school and it is located very close to school C, the worst performer among general educational schools. Finally, by far the best school among the professional ones (school L) is located in a semi-central area and it clearly outperforms schools located in wealthier areas. By comparing Tables 1 and 5, it can be noticed that best performers located in suburban or semi-central areas (Schools A, G, and L) display an average students' income higher than expected according to the economic resources of the area. A suggestive tentative explanation is that these schools are able to attract students from other, more affluent, areas.

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[23] The public transportation network is very widespread and allows fast mobility across the municipality area. This is especially true in the North-South direction which is served by a fast tramway line. For instance, the 11.8 km distance between schools E and C (see Figure 1) can be covered in 30 minutes. Travel times along the East-West direction are higher, but still reasonable. In fact, it takes 38(47) minutes to travel from school J to school G1(A2) despite the distance is "only" 6.2(7.0) km. Travel times are computed at 7:30 am of the same schooling day indicated in the previous footnote.

[24] We inspected the www.immobiliare.it website, the best know real estate transactions website in Italy. We computed average price house by retrieving the most recent 15 offers within a 800 meters circle from each school location. The website has been inspected in October 2014.

Summing up, the exact role of the several factors responsible for the stark within-track heterogeneity we uncovered remains an unsolved issue. Observed schools' characteristics seem to only partially account for the difference in performance. Residential segregation does not appear to be a major issue as—although worse performing schools tend to be located in suburban areas—very high quality schools are also located in these areas. In turn, these findings suggest that unobserved schools' characteristics and practices might play an important role in shaping differences in school performance.

6. Concluding remarks

In our paper we assess whether—beyond an EU-style tracking that separates students in different curricula—the Italian highly centralised public schooling is plagued also by an implicit US-style tracking system, which separates students by ability and income within the same track. To this end we analyse public schools in a relatively small urban area, the municipality of Turin, by using admission test data at the School of Economics and Business provided by the University of Turin. The test is designed to verify students' basic knowledge and literacy. We study stochastic dominance of scores distribution across different schools within the same track. Our findings strongly suggest that both types of tracking affect the inequality patterns common in Italian schooling. We then consider a regression model to corroborate these results by controlling for additional regressors. Results confirm the between and within track schools heterogeneity. We then discuss the potential mechanisms behind the US-style tracking, namely the role of students' innate abilities and of school quality, providing also evidence on some determinants of this quality. Finally, we address the issue of income residential segregation, showing that best performing schools do not appear to be located in the most affluent areas. This finding makes the inequality stemming from the US-style stratification a less serious concern, but open the question of why students' mobility is low despite the school quality heterogeneity.

All these results show that the mere abolition of an early tracking system as to remove the intergenerational transmission of inequalities can be a partial solution in presence of a marked heterogeneity of school quality within tracks. Further analyses are called for in order to assess whether this heterogeneity also exists in other municipalities in Italy as elsewhere, and which are the mechanisms behind it. Whichever these mechanisms are, a proper evaluation exercise of schools and a widespread information about the results can be indeed helpful, also in the light of the likely informational advantage (for instance, through informal networks) wealthier families might have.

References

Aaronson, D., Barrow, L., Sander, W. (2007), Teachers and Student Achievement in the Chicago Public High Schools, *Journal of Labor Economics* 25 (1), 95-135.

Akerhielm, K. (1995), Does Class Size Matter?, *Economics of Education Review* 14, 229-241.

Angrist, J.D., Lavy, D. (1999), Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement, *Quarterly Journal of Economics* 114, 533-575.

Bayer P., Ferreira F., McMillan R. (2007), A unified framework for measuring preferences for schools and neighborhoods, *Journal of Political Economy* 115, 588-638.

Black, S. (1999), Do better schools matter? Parental valuation of elementary education, *Quarterly Journal of Economics* 114, 577-599.

Breen, R., Luijkx, R., Müller, W., Pollak, R. (2009), Non-Persistent Inequality in Educational Attainment: Evidence from Eight European Countries, *American Journal of Sociology* 114, 1475-1521.

Brunello, G., Checchi, D. (2007), Does School Tracking Affect Equality of Opportunity? New International Evidence, *Economic Policy*, 781-861.

Brunello, G., Giannini, M., Ariga, K. (2007), The Optimal Time of School Tracking, in: Peterson, P., and Wößmann, L., Schools and the Equal Opportunity Problem, MIT Press, Cambridge, MA.

Checchi, D., Flabbi, L. (2013), Intergenerational Mobility and Schooling Decisions in Germany and Italy: The Impact of Secondary School Tracks, *Rivista di Politica Economica* CII, 7-57.

Checchi, D., Ichino, A., Rustichini, A. (1999), More equal but less mobile? Education financing and intergenerational mobility in Italy and in the US, *Journal of Public Economics* 74, 351-393.

Checchi, D., Peragine, V. (2010), Inequality of opportunity in Italy, *Journal of Economic Inequality* 4, 429-450.

Clapp J.M., Nanda A., Ross S.L. (2008), Which school attributes matter? The influence of school district performance and demographic composition on property values, *Journal of Urban Economics* 63, 451-466.

De Fraja G., Martínez-Mora F. (2014), The desegregating effect of school tracking, *Journal of Urban Economics* 80, 164-177.

De Giorgi, G., Pellizzari, M., Radaelli, S. (2010), Identification of Social Interactions through Partially Overlapping Peer Groups, *American Economic Journal: Applied Economic*s 2, 241-275.

De Paola, M., Ponzo, M., Scoppa V. (2013), Class size effects on student achievement: heterogeneity across abilities and fields, *Education Economics* 21, 135-153.

De Paola, M., Scoppa, V. (2010), Peer group effects on the academic performance of Italian students, *Applied Economics* 42, 2203-2215.

Dhar P., Ross S.L. (2012), School district quality and property values: examining differences along school district boundaries, *Journal of Urban Economics* 71, 18-25.

Downes T.A., Zabel J.E. (2002), the impact of school characteristics on house prices: Chicago 1987-1991, *Journal of Urban Economics* 52, 1-25.

Dustmann, C. (2004), Parental background, secondary school track choice, and wages, *Oxford Economic Papers* 56, 209-230.

Epple, D., Figlio, D., Romano, R. (2004), Competition between private and public schools: testing stratification and pricing predictions, *Journal of Public Economics* 88, 1215-1245.

Epple, D., Romano, R. (1998), Competition between Private and Public Schools, Vouchers, and Peer-Group Effects, *American Economic Review* 88, 33-62.

Epple, D., Romano, R., Sieg, H. (2003), Peer Effects, Financial Aid and Selection of Students into Colleges and Universities: an Empirical Analysis, *Journal of Applied Econometrics* 18, 501-525.

European Commission (2010), Why socio-economic inequalities increase? Facts and policy responses in Europe.

Fack, G., Grenet, J. (2010), When do better schools raise housing prices? Evidence from Paris public and private schools, *Journal of Public Economics* 94, 59-77.

Flabbi, L., (2001), Secondary Schooling Decisions in Italy, *Rivista di Politica Economica* 91, 85-114.

Freeman, R., Viarengo M. (2014), School and family effects on educational outcomes across countries, *Economic Policy*, July, 395–446

Gibbons, S., Machin, S. (2003), Valuing English primary schools, *Journal of Urban Economics* 53, 197-219.

Gibbons, S., Machin, S. (2006), Paying for primary schools: supply constraints, school popularity or conjestion, *Economic Journal* 116, C77-C92.

Gibbons, S., Telhaj, S. (2007), Are Schools Drifting Apart? Intake Stratification in English Secondary Schools, *Urban Studies* 44, 1281-1305.

Hanushek, E., Wößmann, L. (2006), Does educational tracking affect performance and inequality? Differences-indifferences evidence across countries, *Economic Journal* 116, 63-76.

Hastings, J.,Van Weelden, R.,Weinstein, J. (2007), Preferences, information and parental choice behaviour in public school choice, NBER Working Paper 12995.

Invalsi (2012), OCSE PISA 2012 – Rapporto Nazionale.

Krueger, A., Withmore, D. (2001), The effect of attending a small class in the early grades on college-test taking and middle school test results: evidence from project STAR, *Economic Journal* 111, 1-28.

Ministero della Pubblica Istruzione (2008), La dispersione scolastica. Indicatori di base. Anno Scolastico 2006/2007, Direzione Generale per gli Studi e la Programmazione e per i Sistemi informativi – Servizio Statistico.

Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR) (2011), Focus sulle iscrizioni alla scuola secondaria di II grado – a.s. 2011/2012, Direzione Generale per gli Studi, la Statistica e per i Sistemi Informativi – Servizio Statistico.

Nechyba T. (2003), School finance, spatial income segregation, and the nature of communities, *Journal of Urban Economics* 54, 61-88.

Oakes, J., (1985), Keeping Track: How Schools Structure Inequality, Yale University Press, New Haven, CT.

Rivkin, S., Hanushek, E., Kain, J. (2005), Teachers, Schools, and Academic Achievement, *Econometrica* 73, 417-458.

Sacerdote, B. (2011), Peer Effects in Education: How Might They Work, How Big Are They and How Much Do We Know Thus Far?, Handbook of the Economics of Education – Volume 3, 249-277.

Schütz, G., Ursprung, H., Wößmann, L. (2008), Education Policy and Equality of Opportunity, *Kyklos* 61, 279-208.

Summers, A., Wolfe, B. (1977), Do Schools Make a Difference?, *American Economic Review* 67, 639-652.

Tables and Figures

Table 1 - *Descriptive statistics*

School	Female (%)	Year 2006 (%)	Year 2007 (%)	Year 2008 (%)	Year 2009 (%)	Average test score (/80)	# students taking the test	Average income (€)	# students who report income
					General education high schools				
School A	30.63 (23.53)	24.32 (-)	29.73 (-)	19.82 (43.14)	26.13 (56.86)	50.38 (42.79)	111 (51)	25,370 (25,370)	26 (26)
School B	36.25 (37.84)	28.75 (-)	25.00 (-)	15.00 (32.43)	31.25 (67.57)	47.41 (39.27)	80 (37)	20,747 (20,747)	24 (24)
School C	41.58 (37.50)	31.68 (-)	28.71 (-)	15.84 (40.00)	23.76 (60.00)	43.70 (32.38)	101 (40)	20,887 (20,887)	29 (29)
School D	25.99 (31.94)	25.95 (-)	27.85 (-)	26.58 (58.33)	19.62 (41.67)	48.91 (41.71)	158 (72)	27,285 (27,285)	30 (30)
School E	32.80 (38.36)	20.00 (-)	21.60 (-)	32.00 (54.79)	26.40 (45.21)	45.41 (39.94)	125 (73)	(24,153 (24,153)	46 (46)
Total	**32.52** **(33.70)**	**25.74** **(-)**	**26.61** **(-)**	**22.96** **(48.35)**	**24.70** **(51.65)**	**47.31** **(39.74)**	**575** **(273)**	**23,825** **(23,825)**	**155** **(155)**
					Technical schools				
School F	58.45 (56.92)	20.42 (-)	33.38 (-)	26.76 (58.46)	19.01 (41.54)	44.74 (38.70)	142 (65)	16,823 (16,823)	39 (39)
School G	71.30 (71.05)	25.93 (-)	36.11 (-)	15.74 (39.47)	22.22 (60.53)	43.72 (38.29)	108 (38)	18,433 (18,433)	23 (23)
School H	61.90 (60.71)	34.52 (-)	27.38 (-)	17.86 (50.00)	20.24 (50.00)	42.8 (32.97)	84 (28)	16,125 (16,125)	18 (18)
School I	60.24 (60.71)	24.10 (-)	33.73 (-)	20.48 (50.00)	21.69 (50.00)	42.11 (34.45)	83 (28)	18,026 (18,026)	20 (20)
School J	12.35 (12.90)	22.22 (-)	29.63 (-)	25.93 (51.61)	22.22 (48.39)	45.15 (37.29)	81 (31)	15,412 (15,412)	18 (18)
Total	**54.62** **(53.68)**	**24.90** **(-)**	**32.53** **(-)**	**21.69** **(51.05)**	**20.88** **(48.95)**	**43.82** **(36.92)**	**498** **(190)**	**17,019** **(17,019)**	**118** **(118)**
					Professional schools				
School K	81.18 (75.00)	29.41 (-)	25.88 (-)	20.00 (44.44)	24.71 (55.56)	31.87 (22.39)	85 (36)	10,253 (10,253)	20 (20)
School L	45.45 (45.45)	22.73 (-)	22.73 (-)	25.00 (45.45)	29.55 (54.55)	41.65 (37.52)	44 (22)	19,599 (19,599)	20 (20)
School M	82.00 (83.33)	20.00 (-)	24.00 (-)	22.00 (41.67)	34 (58.33)	33.12 (26.68)	50 (24)	11,924 (11,924)	18 (18)
Total	**72.63** **(69.51)**	**25.14** **(-)**	**24.58** **(-)**	**21.79** **(43.90)**	**28.49** **(56.10)**	**34.62** **(27.70)**	**179** **(82)**	**13,994** **(13,994)**	**58** **(58)**
Whole sample	**47.04** **(46.06)**	**25.32** **(-)**	**28.67** **(-)**	**22.28** **(48.62)**	**23.72** **(51.38)**	**44.11** **(36.95)**	**1,252** **(545)**	**19,676** **(19,676)**	**331** **(331)**

In brackets descriptive statistics for the sample used in the econometric analysis
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Table 2 - *Kolmogorov-Smirnov and Fligner-Policello tests on test score and household income distributions by upper secondary public school*

	School A	School B	School C	School D	School E	School F	School G	School H	School I	School J	School K	School L
School B	0.22 0.45 (0.06) 0.19				*General education high schools*							
School C	(0.00) 0.24 (0.00) 0.50	0.62 0.25 0.14 0.68										
School D	0.54 0.24 0.29 0.93	0.47 0.17 0.28 0.37	0.04 0.88 0.04 0.68									
School E	(0.00) 0.20 (0.00) 0.23	0.34 0.91 0.23 0.66	0.44 0.34 0.67 0.88	(0.01) 0.27 (0.01) 0.48								
School F	(0.00) (0.01) (0.00) (0.00)	0.59 0.20 0.29 0.18	0.69 0.13 0.54 (0.09)	(0.02) (0.02) (0.01) (0.05)	0.84 (0.07) 0.78 (0.06)					*Technical schools*		
School G	(0.00) (0.01) (0.00) (0.00)	(0.04) 0.21 (0.02) (0.08)	0.28 (0.05) 0.43 (0.03)	(0.00) (0.02) (0.00) (0.02)	0.12 (0.04) 0.23 (0.01)	0.16 0.89 0.16 0.61						
School H	(0.00) (0.02) (0.00) (0.01)	(0.04) (0.09) (0.03) (0.08)	0.23 0.13 0.38 (0.04)	(0.00) 0.16 (0.00) (0.02)	0.39 (0.07) 0.19 (0.04)	0.23 0.42 0.14 0.50	0.34 0.34 0.57 0.58					
School I	(0.00) (0.02) (0.00) (0.01)	(0.01) 0.32 (0.00) 0.27	(0.09) 0.22 0.16 0.14	(0.00) (0.06) (0.00) (0.07)	(0.09) 0.13 (0.05) (0.08)	(0.02) 0.90 (0.03) 0.97	(0.07) 0.66 0.33 0.69	0.70 0.66 0.70 0.50				
School J	(0.00) (0.00) (0.00) (0.00)	0.29 (0.02) (0.07) (0.03)	0.94 (0.04) 0.78 (0.01)	(0.02) (0.01) (0.00) (0.00)	0.75 (0.01) 0.45 (0.00)	0.78 0.20 0.38 0.13	0.48 0.54 0.73 0.38	0.60 0.70 0.58 0.84	0.13 0.17 0.33 0.26			
School K	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.01) (0.00) (0.00)	(0.00) 0.13 (0.00) 0.17	(0.00) (0.01) (0.00) (0.00)	(0.00) (0.06) (0.00) (0.05)		*Professional schools*
School L	(0.00) (0.01) (0.00) (0.00)	(0.01) (0.09) (0.00) (0.08)	(0.07) 0.16 0.13 (0.04)	(0.00) (0.03) (0.00) (0.02)	(0.02) (0.04) (0.04) (0.02)	(0.06) 0.64 (0.03) 0.48	0.88 0.77 0.40 0.71	0.14 0.66 0.82 0.90	0.35 0.51 0.96 0.47	0.12 0.67 0.26 0.57	0.00 0.02 0.00 0.01	
School M	(0.00) (0.00) (0.00) (0.00)	(0.00) (0.02) (0.00) (0.03)	(0.00) (0.08) (0.00) (0.00)	(0.00) (0.03) (0.00) (0.00)	(0.00) (0.01) (0.00) (0.00)	(0.00) 0.33 (0.00) 0.19	(0.00) 0.63 (0.00) 0.36	(0.01) 0.95 (0.00) 0.90	(0.01) 0.33 (0.00) 0.32	(0.00) 0.94 (0.00) 0.94	0.65 0.17 0.78 0.07	(0.01) 0.79 (0.00) 0.66

The first (second) column in each cell refers to the tests on equality of the test score (income) distribution. Exact two-tailed P-value for the KS test (first line) and asymptotic two-tailed P-value for the FP test (second line). In case of statistical significance at the 10% level, p-value in brackets indicate that column school dominates line school, otherwise line school dominates column school.

Table 3 –*Test score and secondary schools: regression results.*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Reference track: General education high schools							
Technical schools	-2.82***	-2.44**	-1.54	-4.09*	-3.66	-3.23	0.77
	(1.07)	(1.11)	(1.06)	(2.20)	(2.23)	(2.30)	(1.99)
Professional schools	-12.04***	-11.35***	-9.15***	-20.41***	-19.73***	-17.41***	-4.86
	(1.51)	(1.55)	(1.41)	(2.56)	(2.57)	(2.45)	(4.90)
Reference income class: 1st income class							
2nd income class		1.54	1.50		1.32	1.14	1.52*
		(1.59)	(1.43)		(1.48)	(1.34)	(0.73)
3rd income class		2.92*	3.40**		2.13	2.55*	2.90**
		(1.68)	(1.48)		(1.58)	(1.40)	(1.08)
Income missing		2.13	1.78		1.66	1.39	1.16
		(1.35)	(1.20)		(1.27)	(1.13)	(0.93)
School quality indicators							
Class size							-2.41***
							(0.59)
Teacher with permanent contract (%)							0.39**
							(0.13)
Teacher applying for relocation (%)							-0.30
							(0.28)
Reference general education high school: School A							
School B				-3.52	-3.31	-1.80	
				(2.30)	(2.33)	(2.37)	
School C				-10.42***	-10.05***	-9.28***	
				(2.59)	(2.59)	(2.36)	
School D				-1.08	-0.95	-1.95	
				(2.11)	(2.11)	(2.08	
School E				-2.85	-2.64	-3.13	
				(2.08)	(2.08)	(2.07)	
Reference technical school: School F							
School G				-0.41	-0.46	1.30	
				(2.18)	(2.21)	(2.05	
School H				-5.73**	-5.74**	-5.29**	
				(2.85)	(2.81)	(2.37)	
School I				-4.26*	-4.22*	-3.85	
				(2.55)	(2.57)	(2.39)	
School J				-1.42	-1.26	-2.60	
				(2.46)	(2.45)	(2.27)	
Reference professional school: School K							
School L				15.14***	15.13***	13.38***	
				(2.67)	(2.68)	(2.31)	
School M				4.29	4.38	4.49*	
				(2.95)	(2.95)	(2.60)	
Constant	39.74***	37.76***	38.02***	42.79***	41.09***	40.75***	56.45***
	(0.68)	(1.35)	(2.38)	(1.73)	(2.06)	(2.98)	(14.96)
Individual controls	No	No	Yes	No	No	Yes	Yes
F-test (P-value) for school coefficients							
General education high schools				5.11	4.73	5.01	
				(0.00)	(0.00)	(0.00)	
Technical schools				1.53	1.53	2.41	
				(0.19)	(0.19)	(0.05)	
Professional schools				16.86	16.73	17.17	
				(0.00)	(0.00)	(0.00)	
F-test (P-value) for income coefficients							
		1.52	2.64		0.94	1.67	4.86
		(0.22)	(0.07)		(0.39)	(0.19)	(0.03)
R^2	0.11	0.12	0.28	0.20	0.20	0.35	0.30
N	545	545	545	545	545	545	545

Dependent variable: Test score (/80). Individual controls include gender, age and year when the test is taken. Robust standard errors in brackets for col.(1) to (6). Standard errors clustered at school level in brackets in col. (7). Significance levels: *10%, **5%, ***1%.

Table 4 - *Some indicators on school and teacher quality by upper public secondary school in the municipality of Turin, a.y. 2011/2012*

School (Relative ranking)	# of students/ computer	Average class size	# of teachers	Teacher with perm. contract (%)	Teacher applying for relocation (%)	Average number of yearly days of absenteeism per teacher			Teacher by age class (%)				Source of funding	
						Illness	Maternity	Other	<35	35-44	45-54	>54	Central level (%)	Families (%)
						General education high schools								
School A (1)	9.7	21.6	112	90.2	4.8	6	1	2	0	12.1	51.5	36.4	93.8	5.8
School B (2)	8.6	24.2	58	96.6	5.7	11	0	4	3.2	6.3	45.3	45.3	92.9	7
School C (5)	7.5	23.8	59	84.7	7.5	9	3	3	1.5	18.4	44.6	35.4	98.2	1.5
School D (3)	9	23.2	92	96.7	9	3	1	2	2.2	18.7	37.4	41.8	91.8	7.8
School E (4)	9.5	22.7	83	94	10.8	6	3	2	0	9.8	48.1	42	93.2	3.1
						Technical schools								
School F (2)	5.5	22.5	65	81.6	8	9	2	10	2.8	13.9	43	40.3	95	4.2
School G (1)	4.4	22.1	74	81.1	6.8	5	3	3	7.7	16.7	38.5	37.2	98.8	1.1
School H (5)	6.1	22.3	108	76.8	2.8	8	0	4	5	12.1	37.3	45.4	94.7	2.8
School I (4)	5.8	22.5	33	75.8	3.8	8	0	3	0	17.5	42.5	40	98.6	0.8
School J (3)	3.6	24	102	93.1	1.9	1	0	3	5	8.9	38.6	47.5	94.4	3.6
						Professional schools								
School K (3)	3.1	22.3	115	79.1	8.7	8	3	10	4.7	16.9	49.1	29.2	97.7	1.5
School L (1)	7	23.6	142	85.2	2.3	6	2	2	2.8	19.1	44.3	33.8	93.9	6
School M (2)	6.5	21	111	62.2	9.4	6	4	7	6.3	32.4	37.8	23.4	98.6	1

Relative ranking refers to schools within the same track and it computed according to estimates in Table 3 – Col. (6).
Source: Our computations on data provided by the Ministero dell'Istruzione, dell'Università e della Ricerca (MIUR) (2013)

Table 5 - *Students' mobility and typology of houses in districts around public schools*

School (Relative rank)	Students from outside the municipality (%)	Trip by public transport no longer than 10 minutes[a] (%)	Trip by public transport no longer than 15 minutes[a] (%)	Area[b]	Average housing market value[c] (€/m^2)
			General education high schools		
School A (1)	27	30.8	69.7	Suburban Suburban	2,130 1,860
School B (2)	22.5	21.8	39.5	Central	2,620
School C (5)	52.5	5.2	35.4	Suburban	1,410
School D (3)	4.4	17.8	54.9	Central	2,700
School E (4)	33.6	35.5	69.3	Suburban	1,650
			Technical schools		
School F (2)	21.1	15.2	34.8	Central	2,830
School G (1)	40.7	25	55.4	Suburban Suburban	1,660 1,310
School H (5)	28.6	20.8	54.1	Suburban	2,120
School I (4)	26.5	1.6	21.8	Central	2,900
School J (3)	23.5	11.3	25.8	Semi-central	3,390
			Professional schools		
School K (3)	27.1	14.5	30.6	Central Suburban Suburban	2,900 1,780 1,520
School L (1)	43.2	8	12	Semi-central	2,210
School M (2)	26	14.8	35.1	Central Central Semi-central	3,030 2,800 1,900

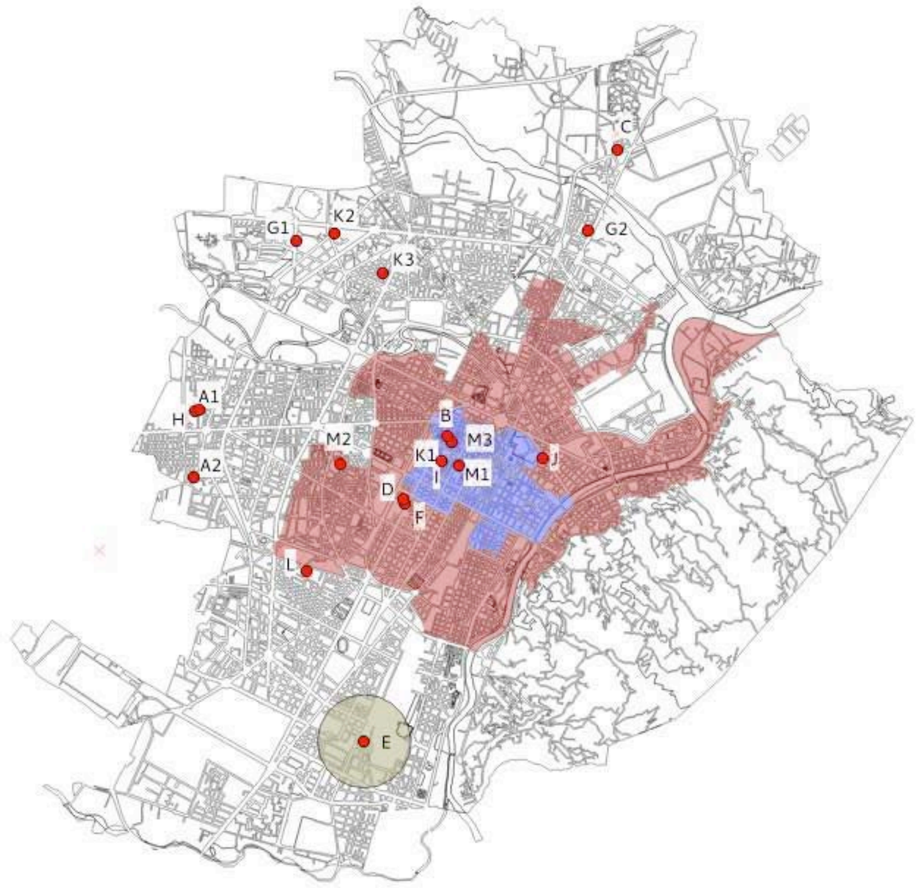
Relative ranking refers to schools within the same track and it computed according to estimates in Table 3 – Col. (6).

[a] The length of trip by public transport are computed using the interpolation of Google Maps and GTT website (Gruppo Torinese Trasporti), the provider of public transport at the municipality level. The length is the average of the Home-School and School-Home trip, computed at 7:30 am and 1:00 pm, respectively, for the same schooling day, namely Wednesday, October 7th, 2009. Distances are *door-to-door*; time required to reach the bus stop is considered.

[b] Schools A, G, K, and M have a central building plus additional secondary buildings.

[c] House prices have been retrieved by inspecting the www.immobiliare.it website. Average price is computed as the trimmed average (excluding the highest and the lowest offer) of the 15 more recently posted prices. The website has been inspected in October 2014.

Figure 1 – *School location in the municipality of Turin*



The figure presents the location of the 13 schools in the Turin area. Central area is in blue whereas semi-central area are in red. The grey area represents a circle of 800 meters radius centred on school E.

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