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Inequalities in Secondary School Attendance in Germany

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Abstract

In Germany, children are sorted into differently prestigious school types according to their ability at the end of primary schooling, normally at age 10. This early decision about children's future schooling cannot be easily corrected. However, secondary school attendance has a huge impact on future career options, so that equality in pupils' distribution to differential school types is important. This paper examines the impact of social and economic background on children's school type if ability is held constant. The analysis is based on national data taken from two surveys of learning achievement, the Third International Mathematics and Science Study (TIMSS) and the Programme of International Student Assessment (PISA). These data reveal that a large share of pupils in less prestigious school types would fit perfectly well in better school types given their measured ability. Children from rural areas, pupils from lower socio-economic backgrounds and boys in general have a significantly lower probability of being selected to the most academic school track even when their ability is similar to that of their urban and better socially placed counterparts.

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1 Introduction

In J. K. Rowling's 'Harry Potter' books the children at the school for wizardry are sorted into different houses by the 'sorting hat'. This is placed on pupils' heads, examines their character and talents and allocates them to the house which fits them best. The sorting hat never fails. In reality, however, we cannot explore a child's head to make a perfect selection. In Germany children are sorted into differently prestigious secondary schools. The assignment of children to school types is based on their ability, generally measured as early as at the end of primary schooling when pupils are about 10 years old. This transition process is in contrast to that of other industrialized countries insofar as children are selected into differentially challenging school environments at a particularly early stage of their intellectual development. Even though, in principle children can correct this early decision during their secondary schooling, actual figures of children doing so show that the permeability of the secondary school system is rather low in terms of school type changes.

However, secondary school choice has a huge impact on pupil's later life time career chances. The more prestigious the school environment, the greater are pupils' opportunities to enter high labour-market positions with subsequently better earning opportunities. Given this importance of the type of secondary school attended, the main task in the paper is to examine whether children around the age of 15 are distributed across school types in

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accordance with their measured ability. Hence, we estimate the impact of social and economic background factors on children's attendance of respective school environments if ability is hold constant.

The analysis is based on data taken from two surveys of learning achievement, the Third International Mathematics and Science Study (TIMSS) and the Programme of International Student Assessment (PISA). Both surveys contain national data with an objective measure of ability and a large set of family background data. Hence, they offer a more comprehensive approach to estimate educational inequalities in Germany than other research studies on that topic that mainly refer to regional data or lack pupils' background characteristics. The application of statistical techniques that show school type attended controlling for ability and other background factors is a further value added of the paper over existing German studies. Finally, the comparison of results given by two different large-scale surveys applying diverse measures of ability opens the opportunity to confirm whether these results are robust and sensitive.

The remainder of this paper is structured as follows: Section 2 introduces the German educational system, describing the institutional factors leading to pupils' school track attendance during secondary schooling and highlights the importance of school type attendance by showing the close linkage between school tracks and later lifetime opportunities. Section 3 examines determinants of secondary school attendance. It contains a review of the literature that illustrates the general patterns of pupils' access to secondary school tracks, and that guides the building of hypotheses underlying the factors that shape differential school type attendance. In order to examine these hypotheses we apply logistic regression models that are estimated with survey microdata from PISA and TIMSS. This research design is discussed in Section 4. Our regression results presented in Section 5 indicate which groups of children face inequalities in attending prestigious secondary school

tracks if we control for children's learning achievements. The last Section 6 concludes by summarising the results.

2 The German Educational System and the Transition from Primary to Secondary School

Primary schooling and the main secondary school tracks

In Germany educational legislation is decentralized into the country's sixteen individual states or Länder. Throughout Germany compulsory schooling starts at children's age of 6 years in the primary school or *Grundschule*. It generally consists of 4 years' schooling in mixed-ability classes after which children are divided into the main different secondary school tracks, *Hauptschule*, *Realschule* and *Gymnasium*.

The *Gymnasium* or grammar school is the preferred school track taken by the most academically-inclined children and prepares pupils with 8 or 9 years' education ending with the *Abitur*. This qualification is the precondition for university entry. About 90 per cent of those who obtained the *Abitur* in 1999 had attended *Gymnasium* (Statistisches Bundesamt, 2000b), making *Gymnasium* the main and most important school track for recruiting university students. The *Realschule* or intermediate school is attended by children with medium levels of assessed ability at primary school and lasts 6 years (5^{th} to 10^{th} grade). It provides general knowledge and preparation for white-collar occupations. Pupils with only low average academic achievement at the primary school generally enrol in the *Hauptschule*. This school track consists of 5, sometimes 6, years of schooling (5^{th}–9^{th}/10^{th} grade) and is designed to provide pupils with more basic instruction combined with practical abilities.

The traditional tripartite structure of the secondary school system has been expanded with the introduction of several new and mainly *Land*-specific kinds of school and the *Gesamtschule* or comprehensive school is now a well-established school-type in most *Länder*.

In 1999, 29 per cent of 8th graders attended the *Gymnasium*, 26 per cent the *Realschule*, 23 per cent the *Hauptschule* and 10 per cent the *Gesamtschule.*

Given this relative small relevance of the *Gesamtschule* and our focus on the tripartite secondary school system we consequently examine neither educational achievements in the *Gesamtschule*, nor whether this type of school offers a valid alternative to inequitable secondary school attendance.

Rules governing pupils' secondary school track attendance

Two institutional rules have impacted upon secondary school track attendances at the end of secondary schooling, when pupils are about as old as students covered by TIMSS and PISA. The basic decision on a child's secondary school track stems from the transition process generally[2] taking place at the end of primary schooling, that is, at the end of the 4th grade at the age of about 10 years. This early selection of children into different types of learning environment in Germany is striking in comparison to other OECD countries where comprehensive schooling over a longer period of time tends to be the norm.

Generally, the decision about school track is taken by the local educational authorities and parents (Avenarius and Jeand'Heur, 1992; KMK, 1999) and is based on children's measured ability. This takes the form of a primary school recommendation for a secondary school track, mainly referring to pupil's marks in the core subjects of German and mathematics.

The impact of the recommendation on the selection process differs across *Länder*. In most *Länder* (Berlin, Bremen, Hamburg, Hessen, Mecklenburg-Vorpommern, Niedersachsen, Nordrhein-Westfalen, Rheinland-Pfalz, and Schleswig-Holstein) parents are entitled to choose a school track other than that recommended by the primary school. In

[2] In some Länder schooling remains partly comprehensive for one or two more years due to the 'orientation stage' or Förderstufe, or a longer duration of primary schooling (KMK, 2000a).

other *Länder* (Baden-Würtemberg, Bayern, Brandenburg, Saarland, Sachsen, Sachsen-Anhalt and Thüringen) parents are not entitled to choose a school track which differs from the one recommended by the primary school.

The second factor that might have impacted on PISA and TIMSS pupils' school type attendance at the end of secondary schooling is the general opportunity to switch school tracks after completion of each successive school grade. This factor is of minor importance due to a low permeability between secondary school tracks. The PISA data show that 11 per cent of 15 year-olds reported having been downgraded, whilst only 5.8 per cent reported being upgraded to a more prestigious school type during the 5 years of secondary schooling (Baumert *et al.,* 2001).

Secondary school track attendance and lifetime career chances

Respective secondary school tracks are designed to prepare children for diverse occupational directions since the different secondary school qualifications imply different entry opportunities for further education. The higher the level of secondary schooling, the greater the opportunities for vocational or academic training, which again leads to a higher labour-market position. Inversely, the lower the secondary school qualification, the higher the risk of unemployment (Riphahn, 1999). It is thus not surprising that there is a high correlation between children's early educational qualifications and their adult occupation as well as the prestige of their first job (Müller et al., 1998).

Consequently, secondary school attendance is associated with subsequent earning opportunities. Table 1 reports the increase in entry wages for those with a Realschule and Gymnasium qualification respectively compared to a benchmark worker with a Hauptschule qualification with further training. Male workers with a Gymnasium qualification who

entered the labour market between 1984 and 1990 earned about 54 per cent more than their cohort counterparts with a Hauptschule qualification when age is controlled for.

Table 1: Percentage addition to an individual's earnings by secondary school qualification compared to those with a Hauptschule qualification

	Male	Female
Realschule	21.7	33.5
Gymnasium	54.2	72.6

Source: Dustmann, 2001.
Note: The percentage addition shown derives from a regression analysis controlling for age at entry into the labour market.

Taken together, the secondary school track attendance shapes decisively an individual's lifetime chances and limits professional opportunities, especially for children tracked at the lower end of the hierarchical tripartite school system. Hence, it is vital that the school track attendance be equitable. The next section examines inequalities in access to more prestigious forms of secondary schooling.

3 Hidden educational inequalities inherent in the secondary school attendance

Tracking after comprehensive primary schooling is based on the assumption that different levels of educational ability need to be differentially promoted in different types of secondary school environments. Hence, educational inequality exists if children from different types of family backgrounds, but with the same level of ability, are selected differently into the secondary school tracks.

In the following we show that ability is not the only factor that influences secondary school attendance and examine the impact of other factors uncontrolled and controlled for ability by reviewing literature and using TIMSS and PISA micro data.

Ability and secondary school track

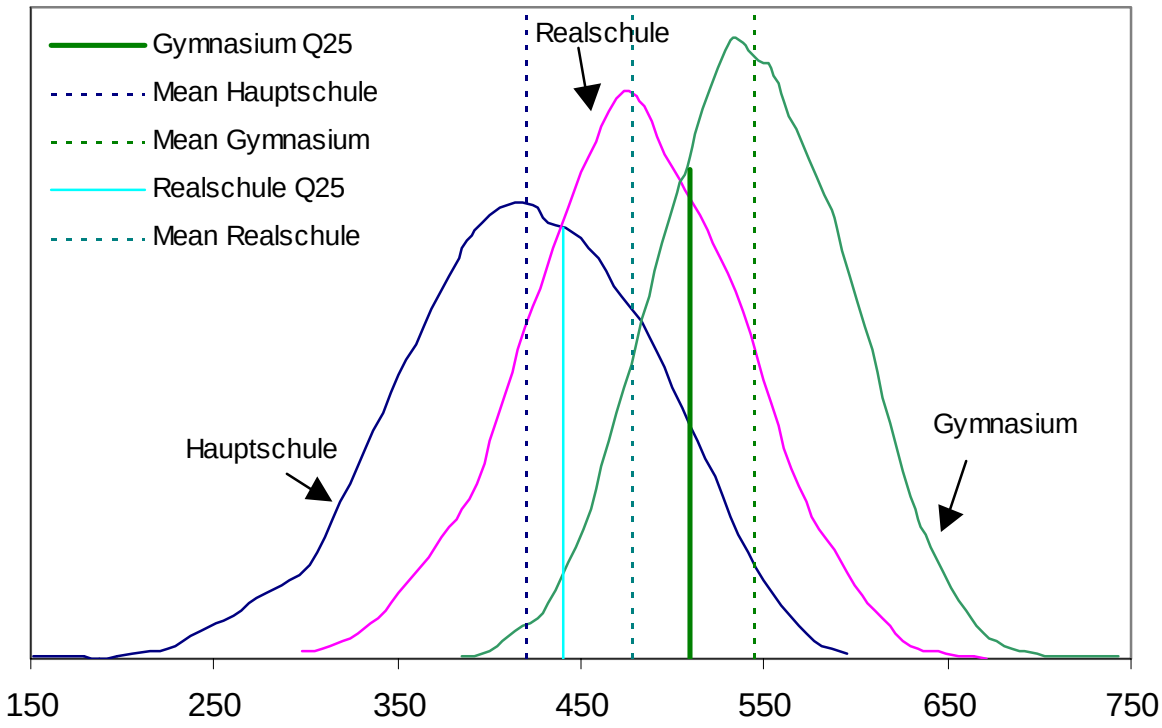
The general notion of 'ability' comprises a wide range of knowledge and skills from pupils' specific knowledge to strategies for problem-solving. However, educational achievement survey or primary school recommendation only reflect a better or worse approximation of what we understand in terms of the broader concept of ability. In this section and the following sub-sections we will refer to diverse approaches of measuring ability.

Figure 1 reports the average mathematics scores of pupils drawn from the Third International Mathematics and Science Study (TIMSS) 1995. The data give the distribution of pupils' educational achievement within school tracks in mathematics at the end of the 7th grade. Indeed, *Gymnasium* pupils report on average higher test scores than children in *Realschule*, and children in *Realschule* again perform better than those in *Hauptschule*. This indicates that ability plays a key role in the secondary school tracking decision. Nonetheless, children's educational achievement within school tracks intersects strikingly as illustrated by the overlapping bell curves giving the distribution of children's ability by school track. For example, Table 2 illustrates that about 8 per cent of *Hauptschule* pupils and 30 per cent of *Realschule* pupils score better than the bottom quartile of *Gymnasium* pupils in mathematics, and that in science 13 per cent of *Hauptschule* pupils and 36 per cent of *Realschule* students report educational levels of achievement above those for the bottom quartile for the *Gymnasium*. In addition, about 40 per cent of *Hauptschule* pupils seem to be well enough equipped to attend *Realschule* given their measured achievement levels in mathematics and science.

Hence, ability seems not to be the only factor impacting upon school track attendance. The following sub-sections examine other factors that might take influence in children's

positioning and therefore explain the huge overlap of ability between respective school types.

Figure 1: Pupils' educational achievement by school track[3]



Source: TIMSS 1995, 7th grade, mathematics scores, author's own calculations.

Table 2: Hauptschule and Realschule pupils with better test scores than the bottom quartile of Gymnasium and Realschule (Q25) by subject

Pupils as % of respective school track	*Gymnasium* Mathematics	*Gymnasium* Science	*Realschule* Mathematics	*Realschule* Science
Hauptschule	8.4	13.3	39.7	39.9
Realschule	29.8	35.8	75.1	74.9

Source: TIMSS, 7th grade, author's own calculations.

[3] The mean score for the respective school tracks are 544 (standard deviation 50.4) for *Gymnasium*, 478 (57.6) for *Realschule*, 419 (66.9) for *Hauptschule* and 443 (59.3) for *Gesamtschule*.

Parental socio-economic background

The explanatory power of parental socio-economic background in secondary school tracking is based on the assumption that also in case that meritocracy is the only guiding principle of the educational system this does not automatically lead to a class-neutral educational attainment (Bourdieu, 1977). Families of different social status differ in terms of their cognitive knowledge and their class-specific 'habits'. In particular, two factors may generate educational disparities in secondary school selection. First, *primary disparities*, where class-dependent differences in cultural resources such as knowledge, are often inherited by the younger generation. Additionally, *secondary disparities* refer to varying parental decisional ability by parental socio-economic background (Breen and Goldthorpe, 1997).

A study on West Germany (Büchel *et al.,* 2000) shows that of pupils living in households where the head of household completed the *Abitur*, 79 per cent attended *Gymnasium* while only 28 per cent of pupils with a lower level of parental education received higher secondary schooling in the period 1986–1996.[4] Inversely, about 9 per cent of pupils with more well educated parents attended *Hauptschule,* while it is four times more for the offspring of lower educated parents.

These strikingly differences in secondary school track attendance might be due to children's lower ability. However, a study on Rheinland-Pfalz (Mahr-Georg, 1999) analysing parental aspirations for children's school track shows that secondary educational disparities are also important in explaining pupils' biased selection by parental background factors.[5] Generally parents want their children to attain at least their own level of educational status,

[4] Kessler (2001) shows identical results for the unified Germany.

[5] Although parents can only make the final decision about children's school track in about half of the German *Länder*, parents generally do have some degree of influencing the decision on their children's school track in the other *Länder*. Furthermore, in the *Länder* where parents have the right to a final decision they need to follow through a communication process with school officials in order to enforce their school track aspirations. Hence, in all *Länder* parents need to have a clear understanding and firm

and of parents who have completed *Abitur* 74 per cent want their children to do the same. This figure is in contrast to the 18 per cent of parents whose educational attainment is *Hauptschule* or below.

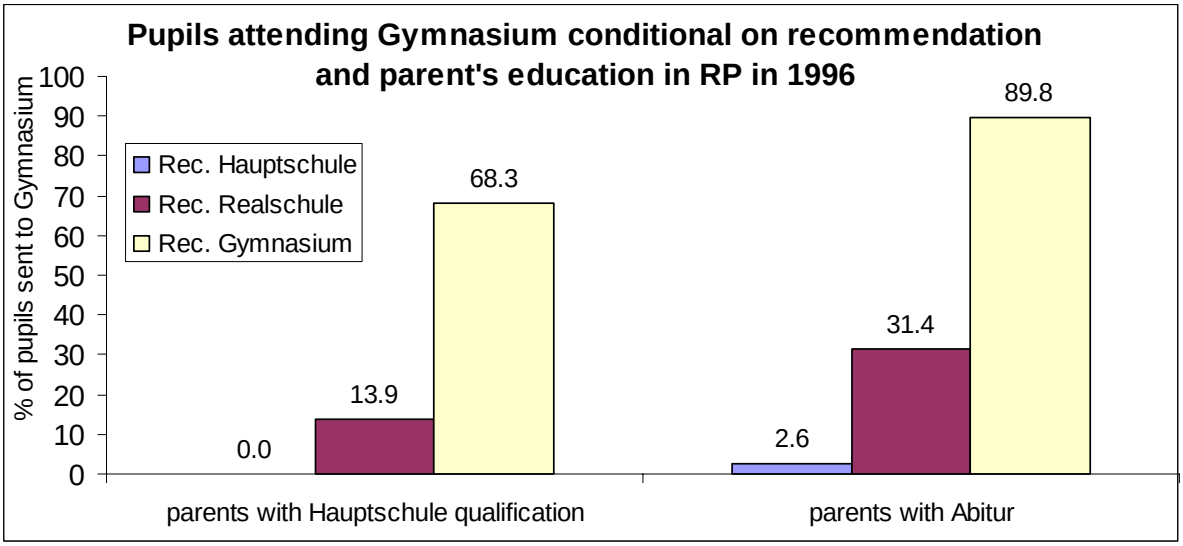
However, the less ambitious aspirations of lower educated parents are not merely derived from their realistic estimation of their offspring's limited ability. Figure 2 reports the percentage of those attending *Gymnasium* in the 5th grade by level of parental education and pupils' primary school recommendation in Rheinland-Pfalz.

Within the group of parents with a *Hauptschule* qualification and with children who were attributed a high ability by a primary school recommendation for the *Gymnasium*, only 68 per cent decided to send their children to the *Gymnasium* while the remaining 32 per cent opted for a lower school track. This is in contrast to only 10 per cent of parents with *Abitur* who channelled their children to lower-than-recommended school tracks. Additionally, parents who completed *Abitur* are more likely to take action in order to channel their children into higher-than-recommended school tracks. Twice as many pupils of these parents than pupils with parents holding a *Hauptschule* qualification attended the *Gymnasium* although they were only recommended for *Realschule*. Hence, parents with a higher level of educational attainment might be more likely to ignore a primary school recommendation than parents from a lower educational background with regard to more prestigious school tracking.[6]

aspiration concerning their children's secondary choice if they want to channel their child into a more academic school track than that recommended.

[6] For similar results see: Schimpl-Neimanns, 2000; for contrasting results see Lehman *et al.*, 1997.

Figure 2: School attendance by level of parental education and primary school recommendation in Rheinland-Pfalz



Source: Mahr-Georg, 1999
Note: 'Rec.' stands for 'recommended to'.

Besides primary and secondary disparities there is also evidence, that the transition process is not based on equal rules. Lehmann *et al.* (1997) demonstrated that teachers expect higher school performance from children with lower parental education for issuing a *Gymnasium* recommendation.

Hence, taken together the literature review, we test Hypothesis 1*: There are no differences by socio-economic background in the probability of attending Gymnasium, controlled for ability.*

Gender

In 2000 about 56 per cent *Gymnasium* pupils were girls while boys were over-represented in the *Hautpschule* at 55 per cent (Baumert *et al.*, 2001).

Is this advantage due to a higher level of academic ability on the part of girls, or do boys face educational inequalities? In general boys display better mathematics scores than girls, while girls perform noticeably better in reading than their male counterparts. (Baumert et al., 2001) However, there is evidence to suggest that girls are more likely to receive a recommendation for *Gymnasium* irrespective of ability. A study of pupils at the end of 4th

grade in Hamburg demonstrated that girls could score lower but still be recommended to the most academic school track than their male counterparts (Lehmann *et al.,* 1997).

We therefore assume that we will be able to reject Hypothesis 2: *There are no differences by gender in the probability of attending Gymnasium, controlled for ability.*

Migrant status

Today, migrant children account for almost 10 per cent of all children in the public education system (Statistisches Bundesamt, 2000a).

Beside the higher proportion of migrants' offspring who leave secondary school without any qualification,[7] their participation in respective school tracks illustrates that non-nationals do not keep up with the schooling attainments of German nationals. In the school year 1999/2000 the share of non-nationals in the *Hauptschule* was almost twice as high as the total share of non-nationals in the school system, whilst non-nationals were underrepresented in the *Realschule* and *Gymnasium* (Statistisches Bundesamt, 2000a).

Educational credentials of migrant parents are generally poorer than those of German nationals (Frick and Wagner, 2001) which might account partly for migrants' lower access to more prestigious secondary schooling. However, more important for explaining migrants' distribution in secondary schools might be their normally lower educational performance. Lehmann et al. (1997) has demonstrated that migrants may display lower capabilities than German nationals and still obtain a recommendation for Gymnasium. Additionally, there is evidence that migrant status is not significant for Gymnasium attendance once ability is controlled for (Frick and Wagner, 2001).

This leads to the expectation that we will be able to reject Hypothesis 3: *There are differences by migrant status in the probability of attending Gymnasium, controlled for ability.*

[7] In 1998, 8.1 per cent of German nationals left school without receiving any educational qualification, but this figure rises to 17.6 per cent for non-nationals (Bellenberg *et al.,* 2001).

Location

Children's chances of attending higher secondary schooling is also shaped by the location where schools are situated. The *Land* variable for PISA and TIMSS is not available to the author, so that the regression analysis cannot take into account differences of educational inequalities between *Länder* that are intensely discussed in Baumert *et al.* (2002).

Turning below the *Land* level, there is evidence to suggest that unconditional on ability, children in metropolitan areas have a slightly higher probability of being enrolled in *Gymnasium* (Frick and Wagner, 2001). This may be due to the fact that different socio-economic and cultural milieus prevail across different geographical areas and mirror the differing social class, education attainment and occupation as well as the income and origin of the inhabitants. Additionally, educational supply in secondary schools differs between urban and rural areas. Since the number of children in rural areas is generally lower, the *Gesamtschule* offering schooling for children of all abilities seems to be more efficient in terms of meeting the general demand for education. Therefore, in rural areas children's ability may exert less influence on the decision on differential secondary school selection.[8]

Hence, we are likely to reject Hypothesis 4: *There are no differences by location in the probability of attending Gymnasium, controlled for ability.*

4 Research Design

The data used to measure educational inequalities in Germany is taken from two cross-national surveys of learning achievement, the Third International Mathematics and Science Study (TIMSS), and the Programme for International Student Assessment (PISA).

TIMSS was conducted by the International Association for the Evaluation of Educational Achievement (IEA) in 1995.[9] The target population we focus on covers data on

[8] This might also be true due to the general pattern that *Länder* with lower shares of pupils completing *Abitur* tend to have a higher share of rural population.
[9] See http://www.timss.org. Germany did not participate in the repeat survey of TIMSS in 1999.

7th and 8th graders' achievement in mathematics and science. PISA is co-ordinated by the OECD[10] and assesses pupils in mathematics, science and reading literacy in 2000. The target population for PISA consists of 15 year-olds attending secondary school irrespective of their school grade. In addition, both surveys provide comprehensive information on pupils' learning environments, family background and school variables. However, the data on mathematics and science results differ in PISA and TIMSS due to the diverse assessment of pupil ability. TIMSS test items rely heavily on the schedule of the school curricula, whereas PISA refers to pupil 'literacy' as the capacity to put knowledge and skills to functional use. The examination of educational inequalities in pupils' school attendance by focusing on both surveys therefore enables us to capture pupils' learning achievements regarding school curricula as well as their ability to apply the knowledge acquired in real-life situations.

On the basis of the hypotheses developed in section 4.2 we assume that the probability of *Gymnasium* attendance is determined according to the following model:

$$P(Gym_i) = F(\beta_0 + \beta_1 A_i + \beta_2 G_i + \beta_3 L_i + \beta_4 N_i + \beta_5 SE_i + \beta_6 FT_i + \beta_7 GR_i)$$

where the different independent x variables are coded as follows: *A* denotes a pupil's level of achievement, *G* is gender, L is the location where the pupil's school is situated, *N* captures pupil's nationality, *SE* is the socio-economic background of parents, *FT* refers to pupil's family type, and *GR* controls for students' diverse levels of achievement in respective grades. Results were obtained from maximum likelihood estimation of the probability[11] of attending *Gymnasium* by using a logistic regression. The focus of our model relies therefore on the probability of attending *Gymnasium* in comparison to the probability of participating in *Realschule, Hauptschule* or *Gesamtschule.*[12] Hence, we limit our examination to factors

[10] See http://www.pisa.oecd.org.

[11] The functional form adopted for *p* is the logit given by: $p = 1/(1 + (\exp(-\beta x))$.

[12] Pupils attending *Gesamtschule* were not omitted since they comprise about 10 per cent of the entire sample. Additionally, only a small percentage of these pupils completed *Gesamtschule* with the final certificate or *Abitur*. However, running the regressions without the population in *Gesamtschule* gives us very similar results.

determining *Gymnasium* attendance. Since the *Gymnasium* is the most prestigious school track leading to university entry and to prestigious vocational apprenticeships, factors impeding *Gymnasium* participation are most important for scrutinising educational inequalities.

Variables

Table 3 presents the variables used and their coding for both surveys. Table A1 in the Appendix gives the summary statistics for the variables for TIMSS, Table A2 for PISA including the respective sample sizes. The Appendix also presents a summary of the relatively small differences in coding between TIMSS and PISA variables.

Ability

In contrast to PISA data, TIMSS only covers levels of achievement in mathematics but not German literacy skills. Hence, we can operationalise ability only by controlling for mathematics knowledge when using these data. Interpretations of the results have to bear in mind that our measurement of 'ability' may be biased.

Grade

The need to control for pupil's grade derives from the special design of the dataset that includes 7th and 8th graders in TIMSS and additionally 9th and 10th graders in PISA.[13] Children in different grades are likely to display varying average abilities due to a different number of years spent in school. Hence, in regressions where we control for ability we also controlled for diverse ability within different grades.

[13] For the purposes of analysis, we omitted 3 pupils in grade 11 and 1 pupil in grade 6 of the original PISA sample.

Table 3: Variables and coding

Term used in formula	Variable	Coding of variable
Dependent variable	*Gymnasium*	1 = *Gymnasium* attendance, 0 = other
Independent variables		
A (ability)	Reading test score (*only PISA*)	Metric science test scores
	Maths test score	Metric maths test scores
G (gender)	Gender	0 = female, 1 = male
L (location)	Location	0 = urban area, 1 = rural area
	Missing location	0 = location available, 1 = missing value
N (nationality)	Language	0 = respondent always speaks German at home, 1= rest
	Missing language (*only TIMSS*)	0 = language available, 1= missing value
	Parents Migrants	0 = at least one parent born in Germany, 1 = both parents migrants
SE (Parents' socio-economic background)	Books in household	0 = 0–100 books, 1 = more than 100 books
	(Parents below upper secondary)	(Control group: neither parent completed secondary education)
	Parents upper secondary	1 = at least one parent completed upper secondary education, credentials of both parents are below tertiary education, 0 = rest
	Parents tertiary	1 = at least one parent holds some tertiary education (university or vocational training), 0 = rest
	Missing education	0 = parental education available, 1 = missing value
GR (grade)	Grade 7, Grade 9, Grade 10 (*only PISA*)	0 = other grade, 1 = respectively grade 7, 9 or 10 (control group: grade 8)
	Grade (*only TIMSS*)	0 = grade 8, 1 = grade 7
FT (Family type)	Single parent	0 = nuclear family, 1 = single parent
	Sibling	0 = child without siblings, 1 = other

5 Results

Table 4 presents results of two regression models that are almost similar for TIMSS and PISA with the exception of the survey-specific measures for ability and a slightly diverse coding for variables on parental education and locations (see Appendix). As an aid to judging the importance of the estimated parameter we used the following equation:

$$\frac{dp}{dx_i} = p(1-p)\beta_i$$

where x_i is the *i*th element of the independent variables in our model. Thus, at $\hat{p} = 0.5$, the estimated effect on the predicted probability of a unit change in a continuous variable, or the turning on of a dummy variable, is approximately equal to $\hat{\beta}_i / 4$.

Parental socio-economic background

Model 1 in Table 4 reports the regression results for parental socio-economic background unconditional on ability for PISA and TIMSS. We measure parental background by the variables 'books in household' and by the distinction between parents without completed upper secondary education (control group), parents with completed upper secondary education and parents with tertiary education. In line with the literature, the regression results confirm that parental socio-economic factors have a significant impact and in the expected direction for *Gymnasium* attendance. Given a predicted probability of *Gymnasium* attendance of one-half, children of parents who completed upper secondary education have about a 15 per cent higher probability (0.660/4) using TIMSS data, and a 25 per cent greater probability (1.031/4) using PISA data of being tracked to *Gymnasium* than children in the control group. The *ceteris paribus* effect of parents with tertiary education increases a child's probability by some 30 percentage points with TIMSS and by about 40 per cent with PISA data. In both surveys children living in households with more than 100 books consistently

report a circa 30 per cent higher probability of attending *Gymnasium* than children in households with fewer books.

However, it is important to certify whether parental socio-economic background factors remain significant for *Gymnasium* attendance even controlling for ability (Hypothesis 1). Model 2 illustrates the regression results conditional on ability. The improvement of the log-likelihood indicates the high explanatory power of the variable 'mathematics test score' for TIMSS and 'reading' and 'mathematics' literacy for PISA data. The higher a child's ability, the greater its probability of attending *Gymnasium*, as one would expect. However, the results consistently show that parental education still has a strongly determining impact on the probability of *Gymnasium* attendance. Children whose parents completed upper secondary schooling display a 12 per cent (TIMSS), and (much greater) 24 per cent (PISA), higher probability of being tracked to *Gymnasium* than the control group (given $p = 0.5$). In both surveys children whose parents hold some tertiary credentials have a 30 per cent greater probability of being tracked to *Gymnasium*. Hence, the influence of parental education on secondary school attendance decreases only slightly and therefore remains relatively high even when children's ability is controlled for. Although the influence of other socio-economic background factors, captured by the variable 'books in household' has decreased by about two-thirds in both surveys once ability is controlled for, they still play an important role for explaining *Gymnasium* attendance besides parental education. Hence, children from lower socio-economic background face inequalities in the access to Gymnasium even if it is controlled for ability.

Table 4: Logistic regression models of probability of Gymnasium attendance, TIMSS 1995, PISA 2000

		TIMSS 1995 N= 5519		PISA 2000 N=2389	
		(1)	**(2)**	**(1)**	**(2)**
Ability	Mathematics test score		0.033 (14.23)***		0.015 (7.73)***
	Reading test score				0.011 (6.72)***
Gender	Gender	0.462 (3.69)***	0.931 (5.54)***	0.384 (2.74)***	0.561 (2.64)***
Parental socio-economic background	Books in household	1.154 (10.10)***	0.472 (3.91)***	1.126 (8.77)***	0.421 (2.77)***
	Parental tertiary	1.210 (7.58)***	1.118 (5.66)***	1.589 (10.71)***	1.166 (6.62)***
	Parental upper secondary	0.660 (5.35)***	0.513 (3.26)***	1.031 (6.13)***	0.976 (4.69)***
	Education missing	-0.151 (1.02)	0.070 (0.41)	-0.150 (0.74)	0.166 (0.65)
Migrant status	Parents migrants	-0.224 (0.86)	0.071 (0.27)	-0.197 (0.74)	0.015 (0.05)
	Language at home	-0.366 (2.10)**	0.248 (1.19)	-0.751 (2.28)**	0.211 (0.49)
	Language missing	0.460 (1.23)	0.748 (1.94)*		
Location	Location	-2.280 (2.22)**	-3.002 (2.75)***	-1.352 (3.45)***	-1.480 (3.40)***
	Location missing	-0.190 (0.45)	0.160 (0.34)	-0.782 (1.44)	-0.638 (1.01)
Family type	Single parents	-0.265 (2.12)**	-0.141 (1.00)	-0.376 (2.14)**	-0.290 (1.40)
	Siblings	-0.134 (1.24)	-0.229 (1.98)**	-0.297 (1.76)*	-0.406 (1.99)**
Grades	Grade 7		0.652 (5.97)***		-0.443 (0.26)
	Grade 9				-0.047 (0.15)
	Grade 10				-0.900 (2.41)**
Statistics	Constant	-1.415 (4.39)***	-18.960 (14.98)***	-1.351 (4.95)***	-14.538 (14.98)***
	Pseudo *R*-squared	0.17	0.47	0.22	0.48
	log-lklhd	-2970.98	-1885.71	-1162.89	-785.89

Source: TIMSS 1995, PISA 2000, author's own calculations.
Note: robust z-statistics in parentheses;* significant at 10 per cent; ** significant at 5 per cent; *** significant at 1 per cent.

Gender

Model 1 indicates as expected that girls have about 10 per cent higher probability of attending *Gymnasium* than boys controlling for background factors (and given $p = 0.5$) and irrespective of ability.

PISA and TIMSS coefficients on girl's probability of being tracked to *Gymnasium* differ once ability is controlled for. Model 2 for TIMSS data displays a strikingly higher probability on the part of girls to be selected to the most academic school track (about 25 per cent given $p = 0.5$) than when using PISA data. This is due to the one-sided operationalisation of the variable 'ability' using TIMSS only taking mathematics achievement into account, where girls perform normally less well than boy. The PISA data results, with the application of a more comprehensive measure of ability, are more reliable for estimating gender equality in *Gymnasium* access and reveal that girls are about 14 per cent more likely to be selected to the *Gymnasium* than boys irrespective of a similar level of ability. This could be due to the gender inequality in pupil's school selection whereby primary school teacher's assessment of a child's learning and working behaviour will impact on the secondary school recommendation insofar as girls may be more likely to conform to teachers' studying expectations than boys. However, educational inequality suffered by girls in the 1960s in terms of the likelihood of being tracked to *Gymnasium* (Dahrendorf, 1968) now seems to have shifted to boys.[14]

Migrant status

Migrant status is measured by two variables: first, whether both parents migrated to Germany, and second whether pupils always speak a language other than German at home.

[14] However, although the positive trend of gender equality is prevalent in secondary education it has not yet percolated up to university attendance and vocational training (Böttcher and Klemm, 2000).

The PISA and TIMSS data reveal that non-nationals face educational disadvantages in terms of Gymnasium attendance (Model 1), as one would expect. The impact that being a non-national pupil has on *Gymnasium* attendance is confirmed by testing the joint impact of both correlated variables showing that the variables language and parental migration taken together are still significant at the 1 per cent level for PISA and 10 per cent level for TIMSS.[15]

However, once we control for ability our two variables measuring migration are no longer significant with either the TIMSS or PISA data (Model 2). This effect does not only appear due to correlation effects of both variables, since the joint impact of both migration variables also decreased to insignificance.[16] Hence, migrants do not face unequal access to the *Gymnasium* tracks once we control for parental background and ability. (Hypothesis 3)

Nevertheless, this positive outcome of the regression analysis does not mean that the high level of educational disparity in secondary school attendance between German nationals and migrants discussed above need not be taken seriously. On the contrary, although migrants may not face inequality in their allocation of school tracks the regression results imply that they are worse off than German nationals for two reasons. Firstly, the high influence of parental background on children's school chances hits migrants harder than nationals because migrant parents generally have rather low levels of educational attainment. Secondly, non-national pupils generally report lower capabilities than their German counterparts. Since migrants account for almost 10 per cent of the school population, the capability of the German educational system to integrate non-nationals is likely to depend on active strategies that promote learning capabilities of foreign pupils long before the selection process takes place.

[15] For PISA the test results is $\chi2=10.17$***; for TIMSS we find $\chi2=5.30$*.
[16] For PISA we find an insignificant $\chi2 = 0.38$; the test of the joint hypothesis for TIMSS also results in an insignificant $\chi2 = 1.94$.

Location

Children's school location is measured by the 'location' variable indicating whether the school attended is in a rural or urban area. Model 1 shows that children in rural areas are about 55 per cent (TIMSS), and 35 per cent (PISA) less likely to be tracked to *Gymnasium* than children in urban areas (given $p = 0.5$),[17] and this probability even decreases when ability is controlled for. Hence, we reject Hypothesis 4, since children in rural areas face educational inequality in access to *Gymnasium*. *Land*-specific school provisions, pupils' generally lower average Gymnasium attendance in the *Länder* with a higher share of rural population, diverse infrastructure and parental decision-making processes regarding children's school attendance may interfere with the strikingly high impact of the location variable.

Other control variables

Generally, children living in single-parent households report lower levels of educational achievement than children living in nuclear families. Moreover, there is also evidence that children in single-parent households are less likely to be tracked to *Gymnasium* (Frick and Wagner, 2001). The TIMSS and PISA results both consistently reveal that children living in single-parent households have a circa 7 per cent lower probability of being tracked to *Gymnasium* than their counterparts (Model 1), but once controlled for ability (Model 2) their chances for *Gymnasium* attendance do no longer differ significantly from that of their counterparts.

On the other hand, pupils with siblings face educational inequalities, since PISA and TIMSS regression results display consistently a lower probability of *Gymnasium* attendance for children with at least one sibling once we control for children's ability. This is in line

[17] These differences between both surveys might derive from the different way in which the variable 'location' has been constructed (see Appendix).

with other research reporting that the higher number of siblings the lower children's educational attainment (Hausner and Kuo, 1998; Bauer and Gang, 2000).

Summary of results

Table 5 summarises the results for Model 2 of Table 4 for PISA and TIMSS using calculations of predicted probabilities for national pupils that display average levels of achievement in *Gymnasium*. For all calculations, 'books in the family' are set above 100 and 8th graders are assumed to live in a two-parent family without siblings.

The first two rows give the probabilities for boys and girls of average *Gymnasium* ability and living in rural areas by level of parental education. For girls with highest parental education the predicted probability of attending *Gymnasium* is about one half, while only about one third for boys using PISA data. Those living in rural areas whose parents have below upper secondary education have only a 5–20 per cent predicted probability of attending *Gymnasium* although they display the average ability of the most prestigious school track. Boys in rural areas have the worst chances of being tracked to *Gymnasium*. Lower predicted probabilities for boys with TIMSS data can be explained by not having controlled for reading ability in the regression analysis. As rows 3 and 4 show, living in an urban area increases the predicted probability of attending *Gymnasium* enormously. PISA data show that girls living in urban areas with parental education below upper secondary have about four times higher a chance of being tracked to *Gymnasium* than boys in rural areas with the same parental background and abilities.

Table 5: Predicted probabilities of attending Gymnasium by given characteristics, controlling for ability

	Parents with below upper secondary education		Parents with upper secondary education		Parents with tertiary education	
	PISA	TIMSS	PISA	TIMSS	PISA	TIMSS
Boys in rural areas	0.13	0.05	0.28	0.08	0.32	0.14
Girls in rural areas	0.21	0.12	0.41	0.18	0.45	0.29
Boys in urban areas	0.40	0.51	0.64	0.64	0.68	0.76
Girls in urban areas	0.54	0.73	0.75	0.82	0.79	0.89

Source: TIMSS 1995, PISA 2000, author's own calculations.
Note: The predicted probabilities are based on Model 2 in Table 4 for TIMSS and PISA. For all predicted probabilities we set the following base characteristics: ability is the average level of achievement for Gymnasium for 8th graders. Hence, for PISA the average Gymnasium score is 529 for mathematics and 524 for reading; for TIMSS the average mathematics achievement is 562. Books in households are set to more than 100. 8th graders are assumed as living in a two-parent family without siblings.

Hence, although children would perfectly fit to *Gymnasium* due to their high-level achievement (average *Gymnasium*), the location they live in, their socio-economic background or gender impact heavily on their chance of attending *Gymnasium*. Based on PISA data, the predicted probabilities for attending *Gymnasium* of equally well performing children differ between the low figure of 13 per cent (boys in rural areas with low parental background), and 79 per cent (girls in urban areas with high parental background).

6 Conclusion

Using PISA and TIMSS data we studied the kind of pupil characteristics that accompany inequality in secondary school attendance. Both surveys indicate that boys from low socio-economic backgrounds and living in rural areas have the lowest chance of being tracked to most prestigious schools even if their school performance is equal to that of their counterparts. A boy has a lower probability of being at a *Gymnasium* of about 15 per cent (PISA) conditional on ability. Parental socio-economic background exerts particular weight: TIMSS and PISA data consistently show that pupils whose parents completed tertiary

education are about one third more likely to attend the most challenging school track than children in the control group with the same abilities but whose parents do not hold upper secondary education. Children whose parents finished upper secondary schooling still have a 15 per cent better chance of being tracked more prestigiously than the control group. Pupils from rural areas encounter the highest educational inequalities insofar as their probability of being tracked to *Gymnasium* is at least 35 per cent lower than that of their urban counterparts. Hence, girls living in an urban area from high-status families have a circa six times greater chance of being selected to *Gymnasium* than boys living in rural areas from low-status families and given pupils' equal abilities.

However, PISA and TIMSS data revealed that migrant pupils do not face educational inequalities *per se*. Although the proportion of migrant children enrolled in *Hauptschule* is almost twice as high as the total share of non-nationals in the secondary school system, they do not have a lower probability of being tracked to prestigious school tracks than German nationals once ability is controlled for. Migrants lower educational achievement and their generally lower socio-economic background explains why migrants face problems to attend more prestigious school tracks.

In Germany tracking is not only organised by one educational authority but also parents have an impact on their children's educational path in the transition process. We have presented evidence that not only the educational system but also parental preferences help generate inequalities in pupils' allocation of secondary school types.

Whatever factors determine mostly the biased secondary school attendance, the outcome in terms of educational inequalities has a persistent impact. Those who attend a lower school track than their assessed ability would imply are likely to end up with lower wages and more limited career options. Hence, it is likely that the educational inequalities inherent in

secondary school attendance continue to have an impact on pupils' lives long after they have left school.

There is a clear need to examine whether, and to what extent, newly implemented educational policies and other mechanisms can overcome or offset the educational inequalities inherent in the selection process and its potential long-term impacts. For example, this paper did not examine whether the *Gesamtschule* constitutes a valid alternative to the tripartite system although TIMSS and PISA data on *Gesamtschule* pupils' mean achievement would suggest that this is not the case. A fruitful direction for further research might be to examine the extent to which a postponed transition process leads to decreasing educational inequalities, whether an improvement of the permeability of the secondary school system is a valid mechanism for correcting unequal tracking, and whether promoting disadvantaged children may increase their chances of equal access to the more prestigious school tracks within the German secondary school system.

APPENDIX

Table A1: Summary statistics TIMSS 1995

Variable	No. obs.	Mean	Std. Dev.	Min	Max
Gymnasium	5763	0.349	0.477	0	1
Mathematics	5763	492.385	75.758	99.13	712
Gender	5685	0.508	0.500	0	1
Books	5647	0.502	0.500	0	1
Parents' tertiary education	3516	0.234	0.423	0	1
Parents' upper secondary	3516	0.336	0.472	0	1
Parents' below upper secondary	3516	0.431	0.495	0	1
Migrant parents	5667	0.121	0.326	0	1
Language	4692	0.116	0.321	0	1
Location	3480	0.201	0.400	0	1
Single parent	5763	0.136	0.344	0	1
Sibling	5678	0.775	0.418	0	1
Grade	5763	0.506	0.500	0	1

Source: TIMSS 1995, author's own calculations.

Table A2: Summary statistics PISA 2000

Variable	No. obs.	Mean	Std. Dev.	Min	Max
Gymnasium	2830	0.285	0.451	0	1
Reading[18]	2830	482.803	110.963	119.916	732.442
Mathematics	2830	489.804	98.628	142.022	749.236
Gender	2791	0.508	0.5	0	1
Books	2772	0.497	0.5	0	1
Parents' tertiary education	2366	0.257	0.437	0	1
Parents' upper secondary	2366	0.127	0.334	0	1
Parents' below upper secondary	2366	0.616	0.486	0	1
Migrant parents	2754	0.155	0.362	0	1
Language	2556	0.074	0.262	0	1
Location	2552	0.349	0.477	0	1
Single parent	2769	0.121	0.326	0	1
Sibling	2830	0.884	0.320	0	1
Grade 7	2785	0.116	0.107	0	1
Grade 8	2785	0.149	0.356	0	1
Grade 9	2785	0.603	0.489	0	1
Grade 10	2785	0.236	0.425	0	1

Source: PISA 2000, author's own calculations.

[18] For the calculation we used student's weights for the smaller sample size of achievements in mathematics and the average of the 5 plausible values.

Regression calculations

Scores for mathematics and reading

Calculations with STATA 7.0 took the mean of the 5 plausible values for the respective subjects and adjusted standard errors for clustering on the primary sampling unit (PSU) 'school' as described below. TIMSS data we used the adjusted new scale scores of the 1995 TIMSS data.[19]

Estimation of standard errors

The TIMSS and PISA sampling design includes varying sampling probabilities for different students and data clusters. Besides the need to apply student's weights, we have taken into account that the TIMSS and PISA sampling procedure is based on a two-stage clustered sample design within each country, with the PSU being the school. Hence, observations in the same PSU are not independent, leading to underestimated standard errors. One way to deal with this problem is the use of the jack knife replied replication method. Since this methodological approach has some disadvantages, we controlled for the cluster design by imputing the PSU 'school'. In order to compare the results of both methods we ran regressions with: a) the jack knife replied replication method by using the programme SPSS; and b) the method controlling for the cluster design by using STATA. The similarity between the respectively estimated standard errors shows that the cluster design with STATA does not lead to an underestimation of the standard errors.

Missing values

Missing values for the variables 'parental education' and 'location' and for TIMSS additionally of the variable 'language', are relatively high for both datasets (see Tables A1 and A2). We assigned these variables the value 0 for missing data and introduced a location, educational and language dummy variable to control for imputed data. The results of the

dummy variables are presented in the regression outcomes. We controlled for our method of dealing with missing values by running regressions with the original variables as well as with imputed values and dummies. The regression results with and without imputed values for the respective variables are almost identical.

TIMSS and PISA — differences in the coding of variables

Variables with slightly diverse coding for PISA and TIMSS are the following:

Achievement variables

These variables display test scores of the respective survey on educational achievement and reflect therefore a diverse approach in measuring pupils' ability.

Parental education

As illustrated in Table 4, we constructed a variable displaying parents with tertiary education and parents with upper secondary education. The percentages of the summary statistics (Tables A1 and A2) reveal the diverse proportion of parents with upper secondary education in PISA and TIMSS. In TIMSS, our variable measures whether parents completed an apprenticeship or the *Gymnasium* (TIMSS 1997). For PISA we selected parents with an ISCED-97 level of 3a (OECD 1999), which reflects upper secondary school credentials (e.g. *Fachhochschulreife, Abitur*). Hence, parents who completed apprenticeships could not be included in the variable 'upper secondary' for PISA, so that the average percentage of this group is lower than in the TIMSS data.

Location

The location variable distinguishes between schools situated in rural and urban areas. For TIMSS we defined 'rural area' as one where the headmaster responded that the school was situated on the 'outskirts of town' or 'village or town'. In PISA we defined 'rural area' as one where the school was located in villages or towns with about or below 15,000 inhabitants.

[19] The 1995 data were rescaled by the International Study Center, Boston College, in order to make them comparable with the 1999 round of TIMSS (Germany did not participate) by using the same calculation

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