

Age at school entry and teacher's recommendations for secondary school track choice in Germany

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Abstract: At the end of primary school, German pupils are typically given a (more or less binding) recommendation which secondary school track they should visit. This recommendation and the actual track choice have major effects on the entire life course, mainly through labour market outcomes. Using data from the German PISA extension study (PISA-E), we analyse the effect of age at school entry on recommendations made by primary school teachers. We find that age at school entry has a significant and sizeable effect on teacher's recommendations. Younger pupils are less often recommended to Gymnasium, the most academic and prestigious – and in terms of later life outcomes most attractive – track. Since for most pupils age at school entry is merely a historical accident, driven by institutional regulations of cut-off birth dates for primary school admittance, our study suggest that the German educational tracking system unintentionally creates inequalities in educational opportunities.

Keywords: Educational tracking, month of birth effects

JEL-Codes: I21, I28

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1. Introduction

One of the most debated features of the German schooling system is the early selection of students into different secondary school tracks. At the end of primary school (usually at age 10), German pupils are typically given a more or less binding (depending on the federal state) recommendation which type of secondary school they should visit. This recommendation and the ensuing decision has major effects on the entire life course, mainly through labour market outcomes (see e.g. Dustmann 2004). Of the three main secondary school tracks (Hauptschule, Realschule, and Gymnasium), Gymnasium is the most academic and prestigious and it is the only track that provides direct entry into tertiary education. Upon finishing Gymnasium successfully, children in Germany are awarded a general university-entrance diploma. While mobility between tracks is desirable and possible in theory, there is only little mobility between tracks in practice. The remaining mobility between tracks is more likely from a higher ranked school to a lower ranked school, i.e. children who do not meet the standards of the school are referred to a lower level school. Incidence of upward mobility is rare. Thus, the decision made at the end of primary school tends to be final and more or less determines the educational opportunities of children.

The common justification for school tracking is efficiency. Homogeneous classrooms provide a learning environment that is better adapted to the abilities of the individual pupil. Ability differences between the high- and low-achieving students in a class are smaller than in comprehensive school systems and allow more focussed instruction without leaving the weakest pupils behind or have better students be underchallenged by the curriculum. Overall, it is believed, tracking will thus benefit weak and strong pupils alike, leading to better aggregate educational outcomes.

However, the publication of the PISA 2000 and 2003 results provided three important insights to the German public: first, Germany's school system was not as successful as many thought. On the contrary, Germany ended up in the bottom half of the "PISA league", whereas many of its neighbouring countries performed far better.¹ Second, among all PISA countries, Germany is the country where the individual background has the largest impact on a child's educational outcome (Artelt et al. 2001). The German school system fails spectacularly in creating "equality of opportunity" for all children. Third, children from disadvantaged backgrounds are particularly vulnerable of being "left behind" by the education system. While

¹ Actually, this was already the result of the TIMSS study five years earlier (see e.g. Jürges & Schneider, 2004), which went largely unnoticed by the broader public.

better performing students in Germany are on a similar level as those in neighbouring countries, weaker students in Germany perform much worse than those in other countries.

Apparently, the three problems are interrelated, and early educational tracking in Germany could be part of the explanation. Opponents of tracking argue that it might not only create inequalities in opportunity and a bias against disadvantaged students but that it might also be inefficient in the sense that slowing down the learning environment for weaker children will harm them more than increasing learning speed will help the better children. The aggregate performance can thus suffer from tracking. In fact, a recent cross-national study sheds light on the efficiency and equity aspects of secondary school tracking. Using several primary and middle school datasets from TIMSS and PISA and comparing countries with and without educational tracking, Hanushek & Wößmann (2005) find that tracking after primary school increases educational inequality *and* reduces aggregate performance.

While this research suggests that tracking might not be a good idea in the first place, the present paper studies potential failures of the German tracking system that would also be harmful if tracking increased aggregate performance. We analyse the determinants of secondary school track recommendations. Since teachers' recommendations are typically based on the academic achievement of the individual pupil in primary school, one expects of course a major impact of family background on the recommendations. Our primary interest, however, is to analyse the effect of age at school entry. Being a year older when the recommendation is made could increase one's chances to be sent to Gymnasium, because around that age, one year could make a difference in terms of maturity and academic achievement.²

If there is an effect of age at school entry on recommended secondary school track, this has two immediate consequences. First, it might pay for parents to hold back their children for another year to provide them with better educational chances and thus better chances in life. Second, age at school entry is largely determined by chance, i.e. by a child's birth day in relation to an arbitrary cut-off date. Thus, if we identify an age effect on track recommendations, the system is unfair in the sense that it creates avoidable inequality of access based on a random event. The second point is of utmost policy relevance. If teacher's recommendations are biased towards older students because at the end of primary school they are on average more mature and show better academic performance, these recommendations must not be made binding. Alternatively, the recommendation should be taken out of the hand

² We generally focus on Gymnasium recommendations versus Haupt-/Realschule recommendations.

of individual teachers and be based on a standardised test that formulates recommendations accounting for differences in age.

A number of recent economic studies has analysed the effect of age at school entry on academic achievement, for instance years of schooling (Angrist & Krueger, 1992), standardised test results (Datar 2006; Strøm 2004; Leuven et al., 2004; Frederiksson & Öckert 2004; Puhani & Weber; 2005), grade retention (Eide & Showalter, 2001), or factual secondary track choice (Fertig & Kluve, 2005; Puhani & Weber; 2005), and on labour market performance (Frederiksson & Öckert 2004). Challenging the conventional view that children gain by starting school at an older age, Angrist & Krueger (1992) find that children who enter primary school at an older age attain slightly less education. However, this finding is largely due to the U.S. schooling laws, which allow pupils to leave school when they turn 16 (i.e. they do not need to finish the class they have started). The Angrist & Krueger paper is one of the first papers to use quarter of birth information as an instrumental variable for age at school entry, an identification strategy that is used in most of the other papers (and in the present paper) as well. Why an IV strategy might be needed, will be explained in more detail below.

Datar (2006) studies the effect of kindergarten entrance age on mathematics and reading achievement levels and test score gains in the first two years of school. She finds that a one year delay in kindergarten entrance leads to significantly higher test scores at kindergarten entry in both subjects and also – which is more interesting – to greater test score gains. The effects are somewhat stronger for children from disadvantaged backgrounds.

Strøm (2004) finds that Norwegian children born in the first months of the year have significantly better test scores in PISA 2000 (i.e. at age 15) than those born in the last months. Norway has very strict enrolments laws that require children born in the same calendar year to start school at the same time (the cut-off date is December 31st). January-born children have on average .2 standard deviations better results in PISA than December-born children. Frederiksson & Öckert (2004) use Swedish register data and find quantitatively very similar effects of age at school entry on academic performance in ninth grade (the cut-off birth date for school entry in Sweden is also December 31st).

The evidence for Germany is somewhat mixed. Fertig & Kluve (2004), using retrospective survey data, do not find any significant effect of age at school entry on educational performance. Their dependent variables are the likelihood of repeating a class and the leaving certificate eventually attained by a child. In contrast, Puhani & Weber (2005) find positive and strong effects of school entry age on standardised test scores at the end of

primary schools (using PIRLS data) and the likelihood of attending a more academic school track (using administrative data for the federal state of Hessen).

Using data from the German PISA 2000 extension study, we find that age at school entry has a significant and sizeable effect on teacher's recommendations to enter Gymnasium. Younger pupils are less often recommended to Gymnasium. Since age at school entry is largely driven by institutional birth date regulations concerning school entry, this type of recommendation bias is arbitrary. Moreover, we believe that it is also avoidable if, for instance, recommendations are made on the basis of standardised tests – accounting or month of birth effects. Standardised test might also help counteracting another bias. As recent analyses of the PIRLS data suggest, teachers' recommendations are also biased towards children from more advantaged backgrounds (Bos et al. 2004).

Our study adds to the literature in several ways. First, it uses an alternative data source for Germany (PISA-E). Second, it looks at track choice recommendations at the end of primary school as the outcome variable and third, it combines the literature on age at school entry effects with the literature on educational tracking in a novel way, leading to important policy conclusions on the practice of educational tracking in Germany.

2. Institutional background

We now give a brief description of the German school system, where we emphasise those aspects that are most relevant for understanding the importance of secondary school track recommendations in the German context.³ Figure 1 gives a stylised overview of primary and secondary education in Germany.

All children in Germany attend primary school, which covers grades 1 to 4, or in some states grades 1 to 6. There is no formal exit examination at the end of primary schooling. Rather, students are generally allocated to one of the three secondary school types on the basis of their ability and performance in primary school. If the primary school (teacher) considers a child suitable for a certain type of secondary school, the child will be admitted without any special admission procedure. If the primary school's recommendations conflict with the parents' wishes, however, the final decision about the future course of education lies either with the parents, the secondary school, or the school supervisory authority, depending on the state laws .

³ A detailed description of the German school system can be found in Jonen and Boele (2001).

-- Figure 1 about here --

The *Hauptschule*, *Realschule* and *Gymnasium* are the three main types of secondary school; each leads to a specific leaving certificate. The *Hauptschule* provides its students with basic general education, and usually comprises grades 5 to 9 (or 10 in some states). The *Realschule* provides a more extensive general education, usually comprising grades 5 to 10. The *Gymnasium* provides an in-depth general education covering both lower and upper secondary level, and usually comprises grades 5 to 13 (or 12 in some former GDR states). Depending on their academic performance, students can switch between school types.⁴

Age at school entry in Germany is defined relative to a specific cut-off date. Until recent years, this date was June 30th (May 31st in the former GDR), and these dates applied to all children we have in our sample.⁵ The rule is that children who turn 6 on or before June 30th are admitted to primary school in that year, which starts in August or early September. Children who turn 6 after June 30th are admitted to primary school one year later. If everyone complied to that rule, the oldest children in first class would be those born in July and they would be 85 months (i.e. 7 years and 1 month) old, assuming that school starts in August. The youngest children in the class would be those born in June and they would be 74 months (or 6 years and two months) old. The obvious question is: do these 11 months of age make a difference for the secondary school track recommendation given by the primary school in fourth grade? If everyone complied with the school entry regulations, age at school entry would be completely exogenous and the causal effect could be easily identified by simple mean comparisons or OLS regressions.

However, there is no rule without exception. The exception makes age at school entry a choice variable that is plausibly correlated with a child's ability. Ability, however, should be the major determinant of secondary school track recommendations. Before children are admitted to primary school, they have to pass some basic maturity tests. Children who are old enough, but do not pass this test, are admitted to primary school one or (in very few cases) two years later (*late enrolment*). It is also possible for parents to defer the school entry of a child even if he or she has passed the maturity test. Further, children who are born after the deadline (but before Dec 31st) can be admitted to school if they pass the maturity test (*early*

⁴ A fourth type of school, the *Gesamtschule* (comprehensive school), does not appear in this graph. This type of secondary school offers all lower secondary level leaving certificates, as well as providing upper secondary education. It only plays a minor role in most federal states, however, with less than 10 percent of all children attending a comprehensive school.

⁵ In recent years, many federal states in Germany have deferred the cut-off date by three, sometimes even six months, admitting more younger children to primary school.

enrolment). In both cases (late and early enrolments), the final decision is made by the primary school principal, who tend to follow the request of the parents.

-- about here Figure 2 --

Overall, the proportion of *late enrolments* is higher than the proportion of early enrolments. For example, Figure 2 shows the proportion of late and early enrolled students between 1971 and 2001 in Baden-Württemberg (one of the larger German federal states). Between the mid-70s and the mid-90s, the proportion of late enrolments was about 10 percent, while the proportion of early enrolments was below two percent. As a result, German children are on average quite almost seven years old, when they enter primary school (6.8 years compared to 6.6 years if everyone was enrolled at the regular age), which is much older than in some other European countries.⁶ Since the mid-90s, the proportion of late enrolments has decreased substantially to about six percent while the proportion of early enrolments has increased. This development partly reflects some steps made by the state government to bring down average age at school entry (for instance, in 1998, the cut-off date in Baden-Württemberg was effectively shifted to September 30th).

3. Data and descriptive results

The data used in this study are drawn from the extension to the German PISA 2000 study (PISA-E).⁷ In particular, we use the sample that contains information on children who visited 9th grade in 2000, independent of their age. The full sample contains data on 31,751 students. The sample frame of the 9th graders differs from the one used in the international PISA study, which sampled 15 year olds, independent of the grade. The key feature of the data is that they contain detailed information on the school career of the child up to the grade in which they are observed, including age at school entry, repeated classes (if any), and track choice recommendation.

Our main outcome variable is the secondary school track recommended by the primary school. This and other important information is drawn from the parent questionnaire which was answered by about 88 percent of the parents. Although a response rate of nearly 90

⁶ For example, the average age at primary school entry in Italy, France, and the Netherlands is about 6.4 years (own calculations from PIRLS data).

⁷ The data are downloadable from the website of the Kultusministerkonferenz (www.kmk.org). The study is described in detail in Baumert et al. (2003).

percent would be considered very high by normal standards, the sample is clearly biased in favour of the more educated and thus in the favour of those receiving a Gymnasium recommendation. Better-educated parents, who are more interested in the education of their children, also show more interest in participating in a scientific study on pupils' academic achievement and schools. In addition to unit non-response there is also a certain amount of missing information on track choice recommendations in completed parent questionnaires: parents either say there was no recommendation or they don't know if there was a recommendation. It is unclear how credible the former claim is. Track choice recommendations are always made, but in some federal states they are less formal than in others. Interestingly, one can also find a strong educational gradient in the proportion of children whose parents say they did not receive a recommendation or don't know whether they received one.

Table 1 shows the information status by (current type) of school. 55.2 percent of the pupils currently visiting Hauptschule have parents who provide valid information on secondary school track recommendations, whereas the parents of 85.8 percent of those currently visiting Gymnasium do so. Realschule and comprehensive schools are in-between. Reasons for missing information are roughly equally distributed between not knowing/not having received a track choice recommendation and unit non-response (parent questionnaire missing altogether). Table 1 also shows that there is education-related selectivity within each school type. We have classified each child by his or her test score on the PISA-E reading test score (conditional on school type and federal state). Across all school types, parents of children in the top third of students are about 10 percentage points more likely to provide valid information on the secondary school track recommendation than parents of children in the bottom third.

-- about here Table 1 --

One result of the selective responses of parents is that the raw recommendation rates for Gymnasium will overestimate the true rates. In the regression analysis below, we try to reduce any potential bias by controlling for educational family background. Moreover, we make an additional assumption about the missing value bias.⁸ We assume that all children whose parents say they have not received or do not remember a track choice recommendation

⁸ We have computed all regression below without making this assumption. The results – available on request – are actually very similar to those reported in this paper.

and who currently visit Gymnasium have in fact received a Gymnasium recommendation. A second possible assumption would be that all children whose parents did not answer the parent questionnaire and who currently visit Gymnasium have in fact received a Gymnasium recommendation. However, this would not enable us only to compute any descriptive statistics and regressions that make use of information in the parent questionnaire.

Because of slightly different school entry regulations in eastern and western Germany at the time when the children in the sample entered school, we do separate analyses for both sub-samples. The situation in eastern Germany is a little bit complicated because of the German unification in October 1990, which coincidentally is the time when the PISA cohort entered school. For all East German children turning six years old until May 1990, the old GDR rules applied (cut-off date end of May and school entry in September 1990). In July 1991, the new federal states adopted the West German school system. Thus, in addition to children turning six years old between June 1990 and May 1991, those turning six in June 1991 entered school in August/September 1991. Thereafter, East and West had the same rules. We cannot perfectly separate the East and West German parts of the sample, because the data contain no direct information on where the child lived at the time of school entry. Since migration rates of parents with school age children are generally low, we think that this is a minor problem. One exception is Berlin, which we exclude from the analysis (it is not known in which part of Berlin the child lived at the time of the PISA study).

Figures 3 and 4 show the proportion of pupils who were enrolled early, at the regular age and late, by month of birth.⁹ Children born in the first half (first five months, respectively) of the year show a very low probability of early enrolment (around 3 percent), whereas children born after the cut-off date show markedly higher rates of early enrolment (between 12 and 20 percent). Compared with the administrative data shown above, the overall early admittance rate of 10.8 percent seems to be too high. Again, this could be the result of sample selection (i.e. differential nonresponse concerning the parent questionnaire) or measurement error (when parents report the wrong year at school entry of their children). Either way, the legal possibility to admit children early if they turn six years old in the second half of the year is likely to account for most of the difference to children born in the first half year.

-- about here Figures 3 and 4 --

⁹ For the purpose of this paper we have also dropped all children from the sample that were enrolled more than one year early or more than one year late.

Late enrolment is also closely related to month of birth. In western Germany, the probability is largest for children born in June, i.e. closest to the cut-off date, and declines gradually for each additional month children are born before the cut-off date. For those who are born immediately after the cut-off date, the late enrolment rate is about one percent. In eastern Germany, we observe a very similar pattern, shifted by one month.

Overall, the results shown in Figures 3 and 4 suggest a considerable amount of selective variation in the proportion of children enrolling early or late related to month of birth: This variation could affect aggregate educational outcomes. Children born in the first half of the year and who are enrolled at the regular age are likely to constitute a positive selection among their peers, because less mature children are deferred. Those born in the second half year and enrolled at the regular age are likely to constitute a negative selection, because more mature children are enrolled early.¹⁰ If the analysis is confined to those who enter school at the regular age, regressions of educational outcomes on age at school entry are likely to produce downward-biased estimates. Older pupils entering at the regular age are on average weaker than randomly selected students born in the same month and year, whereas the younger pupils entering at the regular age are on average stronger than randomly selected pupils born in the same month and year.

If the analysis of educational outcomes includes all children, the effects of age at school entry are likely to be biased, too, although it is not clear a priori in which direction they are biased. For instance, the group of children who enter school in the same year and who are born in August mainly consist of the regularly and early enrolled. The early enrolled are most likely a positive selection of their own peers, but they are one year younger than their classmates enrolled at the regular age. Being part of a positive selection should raise educational outcomes, but being one year younger and less mature should more often decrease educational outcomes than not. The net effect on the average achievement of the August born in a specific class is thus unclear. A similar reasoning applies to those born shortly before the cut-off date. For instance, the group of children born in May consists of regularly enrolled and late enrolled. The late enrolled are most likely a negative selection among their peers but they are one year older than their regularly enrolled classmates. Again, the net effect on the average achievement is ambiguous.

¹⁰ Ability is not the only plausible reason for early or late enrolment. For instance, if the mother has relatively high opportunity costs of staying at home (not working in the labour market), parents might be inclined to send their children to school early. In our data, children of women with university degree are most likely to enrol early and least likely to enrol late. Of course, mother's education is also likely correlated with ability.

-- about here Figures 5 and 6 --

Figures 5 and 6 show the relationship between age at school entry and secondary school track recommendations. The graphs show three segments for early, regular, and late enrolment. In Figure 5, which shows the results for western Germany, the month of birth on the outer left side within each segment is June (representing, respectively, those aged five, six, and seven years and two months at school entry). The month of birth represented on the outer right side is July (representing, respectively, those aged six, seven and eight years and one month at school entry). In Figure 6, the graph is shifted by one month. Since the cut-off date is one month earlier, the youngest regularly enrolled child in eastern Germany is one month older than the youngest regularly enrolled child in western Germany (six years and three months). Each figure contains two sets of results. Full circles show the average Gymnasium recommendation rates for all cases with complete information only. Hollow circles show results, when we additionally make our assumption about the missing parent information on track choice recommendations.

Despite the differences in cut-off and school entry dates, Figures 5 and 6 are remarkably similar. They already illustrate the main results of this paper in a nice way. First, a simple regression of track choice recommendations on age at school entry will yield a negative coefficient. This is apparently due to the fact that children who enrol early have higher chances of getting a Gymnasium recommendation, whereas those who enrol late have substantially lower chances. The overall average for those enrolling late is 27 percent (22 percent under our additional track choice assumption), compared to 46 (41) percent for children who enter school at the regular age, and 50 (45) percent for those who enter school early. Notable differences between East and West can only be found for the latter group, where recommendation rates are about 4 percentage points higher in the East.

The second insight from Figures 5 and 6 is that, if early and late enrolment are controlled for, the overall effect of age at school entry on secondary school track choice recommendations appears to be positive rather than negative. In the case of regular enrolment the relationship is actually nearly linear. In the other two segments the picture is less clear-cut. Depending on which birth months are considered, the relationship could be either positive or negative. When the six leftmost and rightmost ages are excluded, because there are only very few observations, a slightly positive relationship between age at school entry and Gymnasium recommendations emerges for early entrants and a steep negative relationship emerges for late

entrants (notably, this holds independent of the region). Of course, it is in the two outer segments – early and late enrolment – where the selection effects are likely to have the strongest impact. Below, we account for selection in our regression analyses.

Before we discuss the regression results, we illustrate the importance of family background for the secondary track choice. We follow a parsimonious approach and use only few but crucial key variables to control for the pupil's individual background. In particular, we choose variables that are exogenous in the sense that they are already determined at the time of school entry, such as highest parental educational attainment, immigrant background, and whether parents have read to the child at pre-school age.

-- about here Table 2 --

Table 2 shows a description of the sample used in the regression analyses below. First of all, note the steep gradient between highest parental education and the probability of a child to receive a track recommendation for Gymnasium. Of those children whose parents have at most a Hauptschule leaving certificate, only 15 to 20 percent (depending on the assumption made) receive such a recommendation. Of those whose parents have finished university, about 70 percent received a recommendation for Gymnasium. Recent research based on large scale achievement tests in primary school (e.g. using PIRLS data) suggests that this gradient is not only due to the better performance of children with better educated parents (Lehmann & Peek, 1997, Bos et al. 2004). Apparently, the social background of a child in itself – which is known to the teacher or principal who formulates the recommendation – has an independent influence. Anecdotal evidence suggests that teachers are often concerned about the lack of "experience" of less educated parents with Gymnasium (as the most academic secondary track) and thus tend to give conservative recommendations.

Reading to the child in pre-school age leads to a 17 percentage point higher probability of receiving a Gymnasium recommendation. This is most likely information not known to the teacher and probably reflects differences in parental interest in their children's education and associated ability differences. Children with immigrant background (i.e. both parents are born abroad) are 17 percentage points less likely to receive a Gymnasium recommendation. Earlier research found evidence for discrimination *in favour* of immigrant children (Lehmann & Peek, 1997). One reason is that immigrant children are more concentrated in schools with disadvantaged backgrounds, in which standards for Gymnasium recommendations are

probably lower. Another reason might be that teachers expect some advances from increasing integration during the remainder of the school career.

Boys have 7 percentage points lower chances of being recommended to Gymnasium. Again, this confirms earlier findings in the literature (e.g. Lehmann & Peek, 1997). A possible reason for this finding is that – at the age of 10 or 11 – boys are less mature and than girls and thus perform worse when secondary school track recommendations are made. However, Lehmann & Peek show that when actual achievement (measured in standardised tests) is controlled for, the difference remains. One explanation is that girls comply better to other (social) expectations of teachers in primary schools.

4. Regression results

Linear probability regression results (with heteroskedasticity consistent standard errors) explaining the likelihood of receiving a Gymnasium recommendation are listed in Tables 3 and 4. We have also estimated each model (including selection correction and instrumental variables) with probit regressions and obtained very similar results. The advantage of the linear probability model is that the coefficients can be interpreted directly as marginal effects, so that we avoid the computational burden to obtain marginal effects and their standard errors in particular for the IV probit model.

We begin with the results for western Germany (Table 3). The first column shows a probit regression on age at school entry alone. As expected, the coefficient is negative and significant. Each month reduces the likelihood of obtaining a Gymnasium recommendation by 0.44 percentage points (i.e., the effect for a full year of twelve months would be about 5 percentage points). However, if dummy variables for early and late enrolment are included, the coefficient turns to significantly positive .44 percentage points per month. The enrolment dummies can be interpreted as crude indicators of student ability or maturity at school entry – independent of age. Plausibly, the early-enrolled have a 7 percentage points higher probability of receiving Gymnasium recommendations, whereas the late-enrolled have a 22 percentage points lower probability.

-- Table 3 about here --

In the third column we control for family background (but not for late or early enrolment), which reduces the effect of age at school entry to an insignificant effect of minus

0.14 percentage points. Thus, controlling for background alone already reduces the implausible negative effect of age to a large extent. Family background has the expected effects: higher parental education strongly increases the chances of a child to be recommended to Gymnasium. The difference between children whose parents did not finish school or finished Hauptschule (baseline) and those who finished university is nearly 50 percentage points. Children whose parents read to them daily at pre-school age have a 11.9 percentage point higher probability of being recommended to Gymnasium. A migration background decreases the probability by 15.2 percentage points. Girls are more often recommended to Gymnasium than boys. Note that the coefficients of these background variables remain fairly stable across all specifications.

In the fourth column we include control variables for late and early enrolment, which leads to a marked increase in the coefficient of age at school entry. We obtain a coefficient of 0.6 percentage points per month. Up to here, we have not taken into account the possibility that age at school entry is selective and might be correlated with unobserved characteristics.

In the fifth column of Table 3, we include only children enrolled according to school laws. This leads to a further increase in the effect of age at school entry to 0.72 percentage points per month. From the previous discussions it is clear that this group of children is a selective group, so that this coefficient could suffer from selectivity bias. In the sixth column we show the results of a selection correction model. The (probit) selection equation is reported in Table 5. Our exclusion restriction to identify the selection process and the outcome regression makes use of the birth month of a child (an equivalent strategy would be to use the theoretical age at school entry). We have seen in the discussion of our data that the birth month strongly affects the likelihood of regular enrolment. Also after controlling for state and family background, the pattern is quite similar to the one depicted in Figure 3. The month of birth dummies are jointly significant at a very high level ($\chi^2 = 325.5$, $df = 11$).

Other variables affecting the selection into regular enrolment are also significant. Parental education has a hump-shaped effect. The smallest probabilities are estimated for children whose parents did not finish school with a school leaving certificate or finished Hauptschule on the one hand and those who finished university on the other hand. The low education group is more likely to be selected into late enrolment and the high education group is more likely to be selected into early enrolment. If parents read daily to the child during pre-school age, there is a higher chance of regular enrolment. Immigrant children have a lower probability.

Although we have a very strong exclusion restriction and find a significant correlation between the error terms in selection and outcome equation, the results in the outcome equation are hardly affected. With few exceptions, the parameters are identical everywhere up to the second digit.

Finally, we have also followed an instrumental variables strategy, by instrumenting early and late enrolment with month of birth. This differs from most other papers using IV methods to study the effect of age at school entry on educational outcomes (e.g. Datar, 2006; Fertig & Kluge, 2004; Puhani & Weber, 2005; Frederiksson & Öckert, 2004). These papers instrument age at school entry directly without controlling for early or late enrolment. We believe that this identification strategy is flawed because – conditional on early or late enrolment – age at school entry is in fact exogenous (determined by the cut-off date rule).¹¹ Consider the regression model shown in the fourth column of Table 3. The potentially endogenous variables in this model are early and late enrolment and not age at school entry. If the endogeneity of the school enrolment decision is taken into account in the estimation, the coefficient of age at school entry will yield an unbiased estimate of the exogenous change in age at school entry on educational outcomes.

The chosen instrument is valid if month of birth affects educational outcomes – conditional on age at school entry – only via its effect on the enrolment decision made by parents or schools, which seems to be quite a plausible assumption. Our instrument passes the common diagnostic tests of instrument strength and overidentification. The F-values for joint significance in the IV first stage are 89.1 and 95.0 for early and late enrolment, respectively (df = 11, 14415). The partial R-squared are .06 and .10, and the Davidson-MacKinnon overidentification test does not reject the null hypothesis ($p = 0.37$). Moreover, we find no evidence that month of birth is selective with respect to observed parental background, i.e. there is no selective timing of births relative to the cut-off date.¹² We test this by running separate probit regressions of the likelihood of being born in the two months before and after the cut-off date on our background variables (results not shown). The only statistically significant correlation that we find indicates that immigrant children in eastern Germany have a higher likelihood of being born after the cut-off date. However, because the number of immigrants in eastern Germany is very low (the correlation is based on 27 immigrant observations), this is unlikely to affect overall results.

¹¹ IV estimates that instrument age at school entry directly yield much larger values for the coefficient of interest than OLS. In fact, the estimates double in size and become incredibly large. This relationship between OLS and IV can also be found in Puhani & Weber (2005).

Turning to the results, we find that unlike some of the cited related literature on the age effect on educational outcome, our IV approach leads to a similar effect of age at school entry on secondary track choice recommendations as OLS or selection correction regressions. Thus, although the enrolment choice is clearly endogenous, the endogeneity does not affect our earlier results in any significant way.

Table 4 shows the results for eastern Germany. The age-at-school-entry effects are in fact very similar to those obtained for western Germany, the size being only slightly larger. Among the remaining variables, differences are also small.

-- Table 4 about here --

Having established the positive effect of effect of age at school on secondary school track recommendations even in the presence of possible selectivity and endogeneity, we now deepen the analysis and see whether the effect varies across social backgrounds. To ease the exposition, we have recoded parental education into three groups (low, middle, and high, comprising the two bottom, middle, and top categories listed in Table 1). Figure 7 shows the proportion of children receiving Gymnasium recommendations by age, education, and region. Since we know from the regression analyses that selection effects related to early or late enrolment are a minor concern, we include only regularly enrolled children in Figure 7. We find increasing recommendation rates with age in all subgroups (all age trends are statistically significant at least at the 5 percent level).

-- Figure 7 about here --

The answer to the question where the age effect is strongest depends on the standard of comparison. The percentage point differences between the youngest and oldest children are quite similar across education groups. For instance, when looking at the difference between the younger half (born in January to June) and the older half (born during the remaining months) of the West German sample, one finds percentage point differences of 4.5, 3.1, and 3.3 for those who have parents with low, middle, and high education, respectively. In the East, the analogue differences are 7.4, 3.3, and 4.7 (see Table 5). Statistically, one cannot reject the

¹² Although this appears unlikely, one could argue that parents deliberately time childbirth relative to the cut-off date. Parents who want to give their children a head start would avoid birthdates shortly before the cut-off date.

hypothesis that the marginal effects are the same. In this sense, the age at school entry effect is homogenous across education levels. One could argue, however, that the different education groups are starting from very different levels. For instance, the "risk" of receiving a Gymnasium recommendation is 1.23 times higher for the older half than for the younger half of the West German children with low education parents. The same "relative risk" amounts to only 1.05 for children with high education parents. The difference between the two ratios is significant at the five percent level. In that sense, the disadvantage of entering school at a younger age is larger for children from socially or economically disadvantaged backgrounds. Put differently, the age at school entry effect amplifies the selectivity of the German school system. For West German children who are relatively young at school entry, the changes of receiving a Gymnasium recommendation when the parents have high rather than low education are about three times larger. For older children, the impact of family background reduces to 2.3, and the difference is significant at the 5 percent level. When similar comparisons are made for the East German sample, the results are even somewhat stronger, mainly because the age gradient for children with low education parents is quite strong.

--- Table 5 about here ---

5. Discussion

We started this paper by asking whether, in the context of the German secondary school track system, it makes sense for parents to defer the primary school entry of their children. It would make sense if late enrolment increased the likelihood of receiving a recommendation of the primary school to enter Gymnasium, the most academic and prestigious of the three German secondary school tracks. Using data from the German PISA-E study, we found that the answer is yes. According to our estimates, letting a child enter school one year later increases the chances of getting a Gymnasium recommendation by 7 to 8 percentage points.

The interesting question that follows immediately is: Why should that be? Of course, older children are on average more mature and most likely will perform slightly better at the end of primary school when recommendations are made. Perhaps relative age also has an effect, because younger children might have problems to assert themselves. But should the age difference matter for the track choice recommendation, given that this recommendation predetermines career opportunities? Shouldn't recommendations actually account for the

performance difference between older and younger students? For instance, one could introduce centralised recommendation tests with age-standardised results. But this would imply not to recommend older children to Gymnasium who perform even slightly better than younger children in the same class. This might be hard to justify either. A more radical solution to the problem of biased recommendations is to abandon the tracking system altogether. As was discussed above, this will not only reduce inequality but might also increase aggregate performance.

In practice, German parents have at least some limited influence on the secondary track choice. We currently continue our analyses by checking if deviations from the primary school recommendation vary systematically by age, possibly counteracting the bias introduced by the primary school teacher. In any case, taking the secondary school track choice completely out of the parents' hands – as it is planned in some German federal states – could be a mistake. Some injustice generated by school entrance or exit laws has probably to be accepted as long as children are born over the entire year. However, if parents are better at disentangling maturity due to age and ability, they should have a voice in deciding on their children's school career and even overrule the teacher's recommendation..

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Table 1: Selectivity of information on Gymnasium recommendation, by school type and reading test score (row percentages)..

	Full Information on Recommendation	DK/No Recommendation	Parent Questionnaire Missing
Hauptschule	55.2	25.2	19.6
- first test score tertile	51.0	26.7	22.3
- second test score tertile	56.3	25.6	18.1
- third test score tertile	60.3	24.9	14.8
Realschule	74.3	14.7	11.0
- first test score tertile	69.3	17.2	13.5
- second test score tertile	75.5	14.1	10.4
- third test score tertile	79.1	13.1	7.8
Gymnasium	85.8	6.7	7.5
- first test score tertile	81.2	8.9	9.9
- second test score tertile	86.5	5.9	7.6
- third test score tertile	90.7	5.3	4.0
Comprehensive School	58.9	25.6	15.6
- first test score tertile	52.2	29.0	18.8
- second test score tertile	60.8	25.7	13.5
- third test score tertile	65.2	22.7	12.2

Table 2: Sample Description

	Percent in sample	Percent GY recommended	Percent GY recommended (plus missing value assumption)
<i>Highest parental education</i>			
Did not finish/Hauptschule/POS 8	13.8	19.2	15.1
Realschule/ POS 10	16.5	31.3	26.8
Fachschule	30.9	37.1	32.3
Abitur	11.9	50.3	43.2
Fachhochschule	10.1	58.5	54.0
University	16.9	72.7	68.9
<i>Read to child at preschool age</i>			
Less than daily	48.8	35.3	30.0
Daily	51.2	52.1	47.2
<i>Immigrant Background</i>			
No	88.7	45.6	40.6
Yes	11.3	29.5	23.1
<i>Sex</i>			
Boy	49.6	40.3	35.2
Girl	50.4	47.7	42.1
<i>Month of birth</i>			
January	8.6	45.0	39.7
February	7.1	40.8	35.8
March	8.1	39.7	34.8
April	7.7	40.5	35.2
May	8.0	38.3	33.4
June	8.5	43.6	37.8
July	9.3	46.8	41.7
August	8.9	49.5	43.4
September	9.0	47.2	41.5
October	8.4	46.3	40.9
November	8.2	45.8	39.6
December	8.2	43.7	38.6
<i>State</i>			
Saarland	6.7	41.7	36.2
Rheinland-Pfalz	6.8	42.2	37.5
Nordrhein-Westfalen	7.5	39.1	33.4
Niedersachsen	6.0	39.1	35.4
Bremen	5.7	41.1	35.6
Schleswig-Holstein	6.8	38.0	35.9
Hamburg	3.6	67.2	64.8
Mecklenburg-Vorpommern	8.6	37.6	34.4
Brandenburg	6.7	47.0	40.3
Sachsen	8.3	45.2	38.8
Bayern	5.9	53.9	41.6
Baden-Württemberg	5.8	47.3	42.7
Hessen	7.6	43.5	36.1
Thüringen	8.9	43.4	36.9
Sachsen-Anhalt	5.2	55.2	49.5
Number of observations		22,201	26,989

Notes – excludes Berlin; missing value assumption: children whose parents say they have not received or do not remember a track choice recommendation and who currently visit Gymnasium have received a Gymnasium recommendation

Table 3: Linear probability regressions explaining the chances of receiving GY-track recommendations, western Germany

	Linear	Linear	Linear	Linear	Linear	Linear (Selection Corrected)	IV
Entry Age (Months)	-0.0044** (0.0008)	0.0044** (0.0012)	-0.0014* (0.0007)	0.0060** (0.0011)	0.0072** (0.0012)	0.0070** (0.0012)	0.0061** (0.0012)
Early Enrolment		0.0673** (0.0180)		0.0783** (0.0161)			0.0879 (0.0600)
Late Enrolment		-0.2224** (0.0169)		-0.1607** (0.0156)			-0.1504* (0.0642)
<i>Parents' education</i>							
Realschule/ POS 10			0.1156** (0.0135)	0.1154** (0.0134)	0.1135** (0.0153)	0.1106** (0.0153)	0.1157** (0.0135)
Fachschule			0.1362** (0.0101)	0.1346** (0.0101)	0.1349** (0.0116)	0.1325** (0.0117)	0.1349** (0.0103)
Abitur			0.2660** (0.0130)	0.2645** (0.0130)	0.2728** (0.0150)	0.2699** (0.0150)	0.2648** (0.0132)
Fachhochschule			0.3551** (0.0145)	0.3531** (0.0145)	0.3643** (0.0162)	0.3612** (0.0163)	0.3534** (0.0146)
Universität			0.4952** (0.0119)	0.4936** (0.0118)	0.5007** (0.0134)	0.4996** (0.0135)	0.4938** (0.0119)
<i>Other background</i>							
Read daily to child			0.1191** (0.0079)	0.1174** (0.0078)	0.1136** (0.0088)	0.1110** (0.0089)	0.1176** (0.0080)
Immigrant background			-0.1523** (0.0102)	-0.1416** (0.0103)	-0.1486** (0.0123)	-0.1346** (0.0131)	-0.1431** (0.0139)
Girl			0.0606** (0.0074)	0.0582** (0.0074)	0.0569** (0.0083)	0.0558** (0.0083)	0.0583** (0.0074)
Federal state dummies			YES	YES	YES	YES	YES
Constant	0.7508** (0.0605)	0.0642 (0.0991)	0.1820** (0.0570)	-0.4001** (0.0912)	-0.4944** (0.0984)	-0.4624** (0.0992)	-0.4085** (0.1044)
Observations	14,444	14,444	14,444	14,444	11,617	14,444	14,444
ρ						-0.1488** (0.0503)	
<i>P-value of endogeneity-test</i>							
Early enrolment							<0.001
Late enrolment							<0.001
<i>P-value overid. test</i>							
<i>Partial R-squared</i>							
Early enrolment							0.0633
Late enrolment							0.1016
<i>F-value first stage</i> (df=11,14415)							
Early enrolment							89.84
Late enrolment							94.96

Standard errors in parentheses; * significant at 5%; ** significant at 1%

Table 4: Linear probability regressions explaining the chances of receiving GY-track recommendations, eastern Germany

	Linear	Linear	Linear	Linear	Linear	Linear (Selection Corrected)	IV
Entry Age (Months)	-0.0026* (0.0010)	0.0059** (0.0015)	-0.0005 (0.0010)	0.0072** (0.0014)	0.0079** (0.0015)	0.0079** (0.0016)	0.0076** (0.0016)
Early Enrolment		0.1253** (0.0231)		0.1181** (0.0214)			0.1582 (0.0840)
Late Enrolment		-0.2525** (0.0262)		-0.2167** (0.0253)			-0.1542 (0.1673)
<i>Parents' education</i>							
Realschule / POS 10			0.0892** (0.0207)	0.0876** (0.0205)	0.1007** (0.0222)	0.1007** (0.0225)	0.0910** (0.0211)
Fachschule			0.1701** (0.0204)	0.1673** (0.0203)	0.1888** (0.0219)	0.1888** (0.0222)	0.1695** (0.0208)
Abitur			0.2992** (0.0251)	0.2980** (0.0249)	0.3267** (0.0270)	0.3267** (0.0271)	0.2996** (0.0255)
Fachhochschule			0.3640** (0.0246)	0.3629** (0.0244)	0.3738** (0.0266)	0.3738** (0.0265)	0.3649** (0.0245)
Universität			0.4986** (0.0222)	0.4947** (0.0220)	0.5072** (0.0239)	0.5072** (0.0240)	0.4964** (0.0224)
<i>Other background</i>							
Read daily to child			0.0688** (0.0097)	0.0683** (0.0097)	0.0681** (0.0104)	0.0681** (0.0105)	0.0698** (0.0099)
Immigrant background			-0.1764** (0.0515)	-0.1575** (0.0511)	-0.1365 (0.0736)	-0.1363 (0.0833)	-0.1806* (0.0725)
Girl			0.0990** (0.0095)	0.0955** (0.0095)	0.0945** (0.0102)	0.0945** (0.0103)	0.0964** (0.0098)
Federal state dummies			YES	YES	YES	YES	YES
Constant	0.6091** (0.0832)	-0.0773 (0.1208)	0.1290 (0.0814)	-0.4854** (0.1148)	-0.5532** (0.1216)	-0.5532** (0.1236)	-0.5269** (0.1391)
Observations	9,367	9,367	9,367	9,367	8,127	9,367	9,367
ρ						-0.0006 (0.1508)	
<i>P-value of endogeneity-test</i>							
Early enrolment							<0.001
Late enrolment							<0.001
<i>P-value overid. test</i>							
<i>Partial R-squared</i>							
Early enrolment							0.0393
Late enrolment							0.0494
<i>F-value first stage</i> (<i>df=11,9381</i>)							
Early enrolment							41.09
Late enrolment							23.67

Standard errors in parentheses; * significant at 5%; ** significant at 1%

Table 5: Selection and IV first stage regressions

	West			East		
	Selection Equation	IV first stage early enrolment	IV first stage late enrolment	Selection Equation	IV first stage early enrolment	IV first stage late enrolment
February	-0.1381 (0.0706)	-0.0122 (0.0075)	0.0362** (0.0110)	-0.1217 (0.1049)	0.0124 (0.0090)	0.0055 (0.0103)
March	-0.3179** (0.0667)	-0.0049 (0.0079)	0.0677** (0.0114)	-0.2433* (0.0964)	0.0084 (0.0082)	0.0258* (0.0106)
April	-0.4695** (0.0655)	-0.0063 (0.0078)	0.1077** (0.0125)	-0.5129** (0.0925)	0.0153 (0.0089)	0.0682** (0.0131)
May	-0.5255** (0.0648)	-0.0164* (0.0072)	0.1320** (0.0129)	-0.6218** (0.0903)	0.0052 (0.0080)	0.1104** (0.0144)
June	-0.9210** (0.0633)	-0.0152* (0.0073)	0.2580** (0.0150)	-0.7713** (0.0857)	0.1864** (0.0143)	-0.0269** (0.0073)
July	-0.6980** (0.0623)	0.2086** (0.0129)	-0.0431** (0.0073)	-0.4500** (0.0902)	0.1014** (0.0123)	-0.0324** (0.0070)
August	-0.4253** (0.0646)	0.1329** (0.0118)	-0.0471** (0.0072)	-0.4944** (0.0916)	0.1128** (0.0130)	-0.0336** (0.0069)
September	-0.3617** (0.0654)	0.1087** (0.0114)	-0.0367** (0.0074)	-0.5426** (0.0892)	0.1163** (0.0130)	-0.0225** (0.0077)
October	-0.4515** (0.0646)	0.1320** (0.0119)	-0.0371** (0.0074)	-0.4863** (0.0913)	0.1013** (0.0130)	-0.0247** (0.0074)
November	-0.4900** (0.0660)	0.1358** (0.0125)	-0.0333** (0.0077)	-0.4909** (0.0907)	0.1044** (0.0129)	-0.0252** (0.0076)
December	-0.4672** (0.0653)	0.1219** (0.0120)	-0.0231** (0.0083)	-0.5151** (0.0919)	0.0997** (0.0130)	-0.0156 (0.0084)
<i>Parents' education</i>						
Realschule/ POS 10	0.1015* (0.0470)	-0.0144 (0.0094)	-0.0123 (0.0089)	0.1301 (0.0837)	-0.0006 (0.0156)	-0.0276* (0.0123)
Fachschule	0.0803* (0.0365)	-0.0036 (0.0076)	-0.0177* (0.0069)	0.1108 (0.0818)	0.0012 (0.0154)	-0.0277* (0.0122)
Abitur	0.1031* (0.0435)	-0.0040 (0.0093)	-0.0245** (0.0085)	0.0797 (0.0939)	0.0183 (0.0177)	-0.0379** (0.0132)
Fachhochschule	0.1121* (0.0483)	-0.0074 (0.0097)	-0.0230** (0.0086)	-0.0120 (0.0919)	0.0278 (0.0177)	-0.0277* (0.0132)
Universität	0.0253 (0.0414)	0.0235** (0.0090)	-0.0313** (0.0076)	0.0323 (0.0866)	0.0278 (0.0166)	-0.0354** (0.0126)
<i>Other Background</i>						
Read daily to child	0.0998** (0.0258)	-0.0080 (0.0053)	-0.0178** (0.0046)	0.0509 (0.0338)	0.0011 (0.0061)	-0.0135** (0.0038)
Immigrant background	-0.4674** (0.0333)	0.0245** (0.0078)	0.1162** (0.0086)	-1.1044** (0.1364)	0.1156** (0.0421)	0.2469** (0.0444)
Girl	0.0430 (0.0245)	0.0202** (0.0050)	-0.0319** (0.0044)	0.0551 (0.0332)	0.0129* (0.0060)	-0.0215** (0.0038)
Federal state dummies	YES	YES	YES	YES	YES	
Constant	1.3690** (0.0691)	0.0115 (0.0111)	0.0754** (0.0107)	1.4671** (0.1116)	-0.0002 (0.0169)	0.0870** (0.0143)
Observations	14,444	14,444	14,444	9,367	9,367	9,367

Robust standard errors in parentheses; * significant at 5%; ** significant at 1%

Table 6: Differences between young and old children (at school entry), by region and parental education level

Parental education	West		East	
	Percentage point difference	Relative risk	Percentage point difference	Relative risk
Low	0.045	1.226	0.074	1.368
Medium	0.031	1.087	0.033	1.092
High	0.033	1.051	0.047	1.079

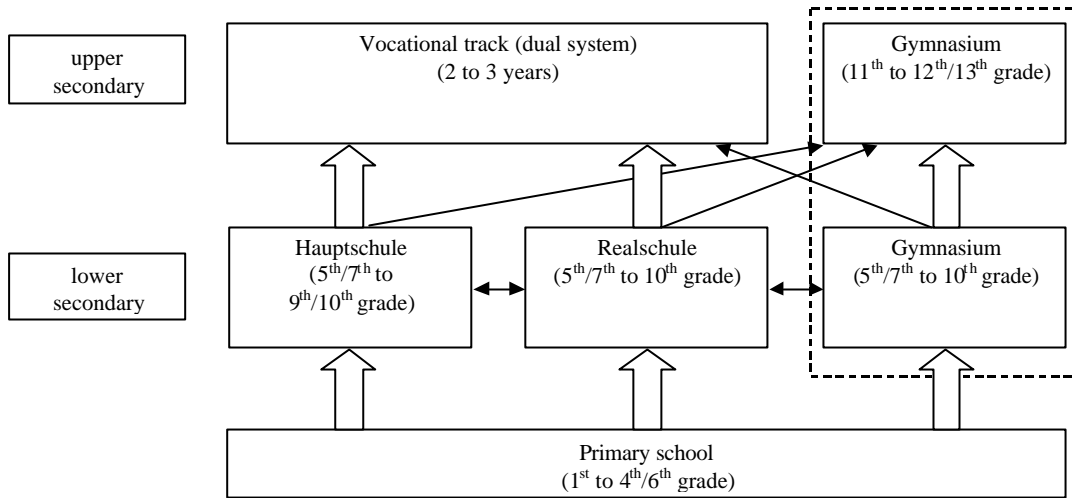


Figure 1: The German school system

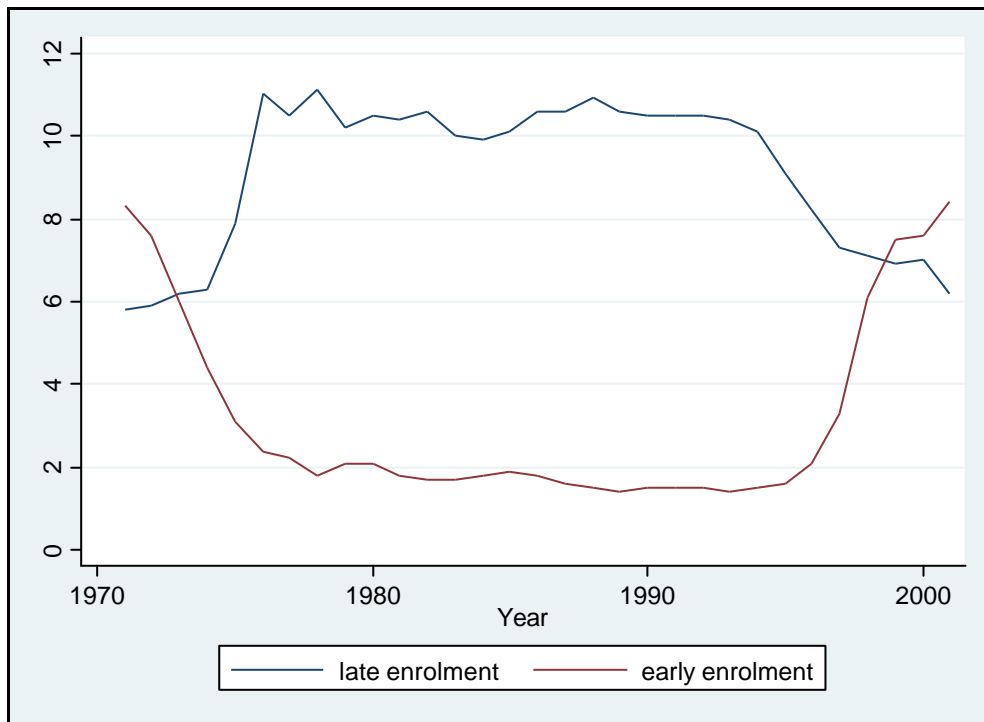


Figure 2: Early and late enrolments in the federal state of Baden-Württemberg (1971 to 2001). Source: Ministry of Education

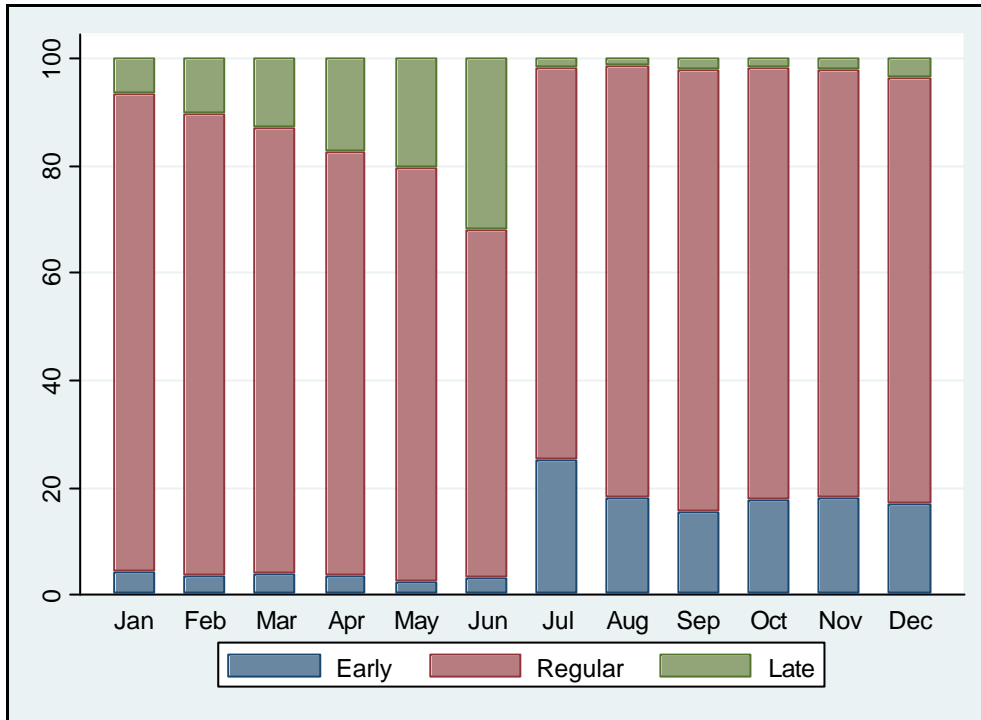


Figure 3: Proportion of Early, Regular, and Late Enrolment, by Month of Birth (western Germany). Source: PISA-E, own calculations

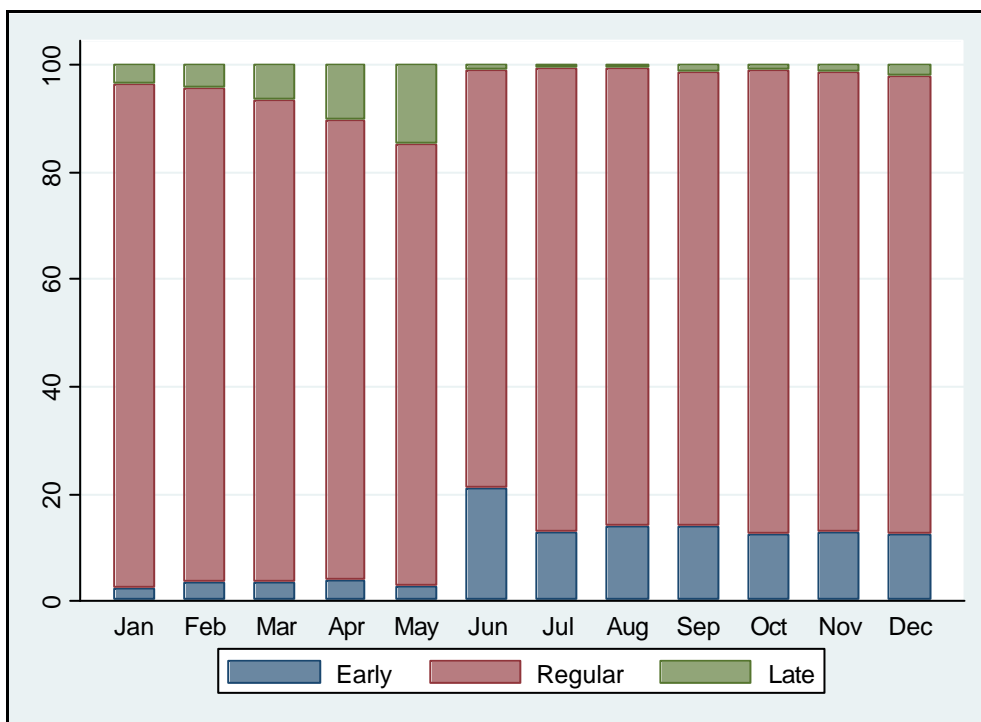


Figure 4: Proportion of Early, Regular, and Late Enrolment, by Month of Birth (eastern Germany). Source: PISA-E, own calculations

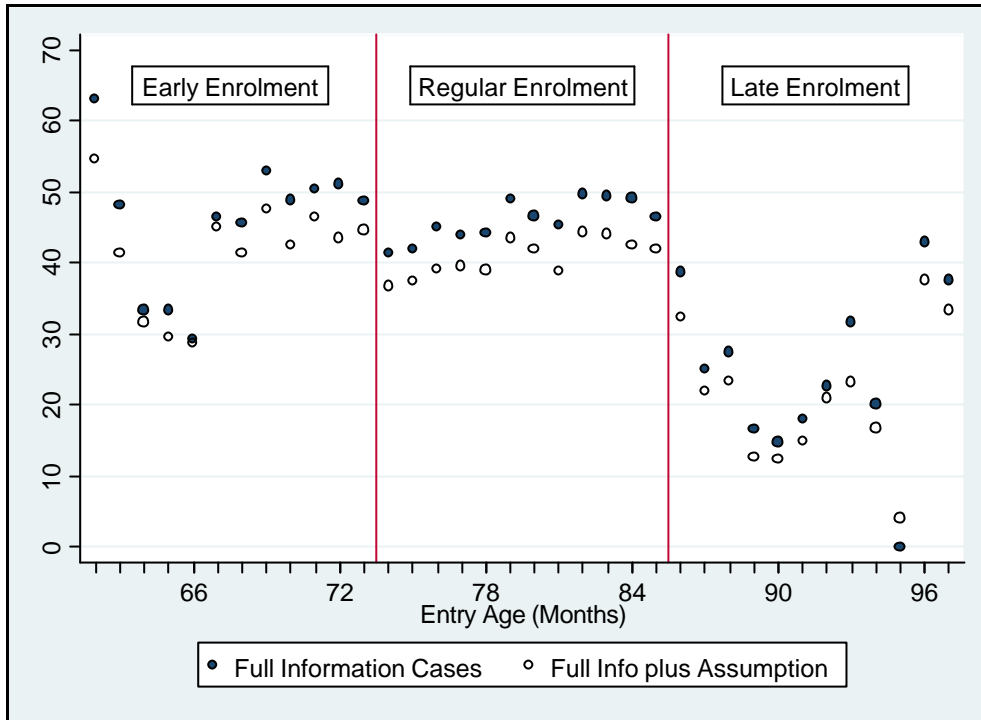


Figure 5: Percentage of pupils receiving recommendations for Gymnasium, by age at entry; western Germany

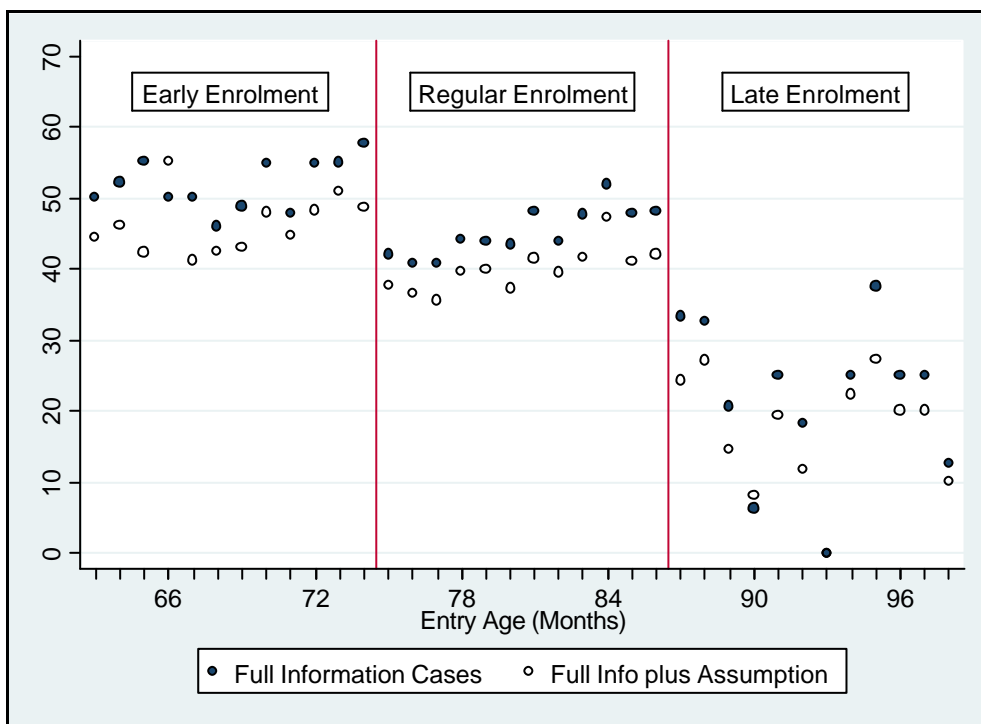


Figure 6: Percentage of pupils receiving recommendations for Gymnasium, by age at entry; eastern Germany

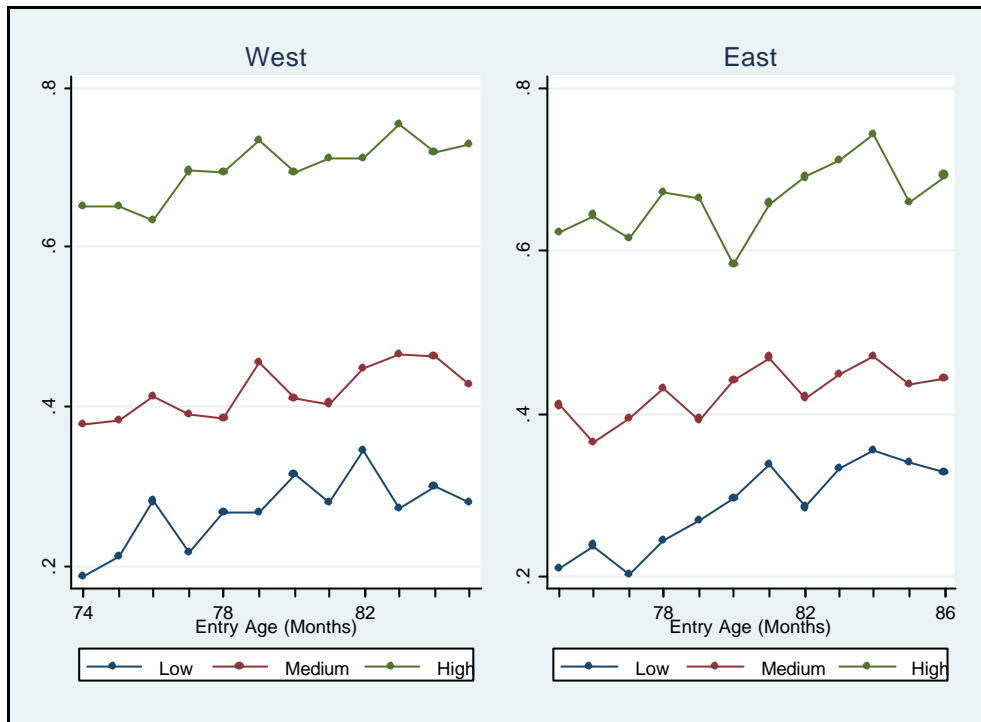


Figure 7: Percentage of pupils receiving recommendations for Gymnasium, by age at entry, parental education level, and region.