WHAT CAN GO WRONG WILL GO WRONG: BIRTHDAY EFFECTS AND EARLY TRACKING IN THE GERMAN SCHOOL SYSTEM

HENDRIK JÜRGES
KERSTIN SCHNEIDER

CESIFO WORKING PAPER NO. 2055
CATEGORY 1: PUBLIC FINANCE
JULY 2007

CESifo *Working Paper No. 2055*

WHAT CAN GO WRONG WILL GO WRONG: BIRTHDAY EFFECTS AND EARLY TRACKING IN THE GERMAN SCHOOL SYSTEM

Abstract

At the age of ten German pupils are given a secondary school track recommendation which largely determines the actual track choice. Track choice has major effects on the life course, mainly through labor market outcomes. Using data from the German PISA extension study, we analyze the effect of month of birth and thus relative age on such recommendations. We find that younger pupils are less often recommended to and actually attend Gymnasium, the most attractive track in terms of later life outcomes. Flexible enrolment and grade retention partly offset these inequalities and the relative age effect dissipates as students age.

JEL Code: I21, I28.

Keywords: educational tracking, month of birth effects.

Hendrik Jürges
MEA
University of Mannheim
L13, 17
68131 Mannheim
Germany
juerges@mea.uni-mannheim.de

Kerstin Schneider
Department of Economics
University of Wuppertal
Gaußstr. 20
42097 Wuppertal
Germany
schneider@wiwi.uni-wuppertal.de

June 2007
We are grateful to Dean Lillard and participants of the 2006 ESPE, EALE and VfS-meetings for helpful comments on an earlier version of this paper.

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 the age of ten), German pupils are typically given a more or less binding (depending on the 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 labor 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, factual mobility between tracks is low. If there is mobility, it is usually downward, from more to less academic tracks, i.e., children who do not meet the standards of their school are referred to a less academic school. Incidence of upward mobility is rare. Thus, the decision made at the end of primary school effectively limits the educational opportunities of children. For instance, in our data (described below), less than 5 percent of the students who had *not* received a recommendation for Gymnasium visited Gymnasium in grade 9, but 21 percent of those who had received a recommendation did not attend Gymnasium in grade 9.

A possible justification for school tracking is efficiency (Hallinan 1994, Brunello & Giannini 2004). 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, according to proponents of tracking, tracking will benefit weak and strong pupils alike, leading to better aggregate educational outcomes.

However, PISA 2000 and 2003 yield some evidence that first, Germany's tracked 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 neighboring countries performed better. Actually, this was already the result of the TIMSS study five years before the first PISA study (see e.g. Jürges & Schneider, 2004), which went largely unnoticed by the broader public. 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). Apparently, the German school system fails 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 better performing students in Germany are on a similar level as those in neighboring countries, weaker students in Germany perform much worse than weaker students in many other countries.

The three issues 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 creating a learning environment for weaker children with peers of similar ability will harm them more than increasing the learning speed will improve the achievement of the more gifted 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 (2006) 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 inefficiencies of the German tracking system that would also be harmful if tracking increased aggregate performance. In the following, we analyze the determinants of secondary school track recommendations made by teachers and the actual choices made by parents (and students). 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 analyze the effect of relative age. Since enrolment is only once a year, the age-range within a class is at least one year. Being a year older when the recommendation is made in fourth grade could increase one's chances to be sent to Gymnasium. The reason is that at the age of ten, one year of age difference could also make a difference in terms of maturity and academic achievement (in the following, we generally focus on Gymnasium recommendations versus Haupt-/Realschule recommendations).

If there is an effect of relative age on the recommended and chosen 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 ("redshirting"). Second, relative age 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. Teachers

should recommend students based on their assessment of future academic performance. If teachers' 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. In any case, teachers' guidelines for recommendations should mention the potential age bias so that teachers are aware of it when they make the recommendation.[1]

A number of recent economic studies has analyzed birthday effects on academic achievement, for instance years of schooling (Angrist & Krueger, 1992), standardized test results (Bedard & Dhuey 2006; Datar 2006; Strøm 2004; Leuven, Lindahl, Oosterbeek & Webbink, 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 labor 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).

Datar (2006) studies the effect of age at kindergarten entrance 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 0.2 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

[1] We have studied recommendation guidelines for two German states (Baden-Württemberg, Berlin). None of them explicitly mentions relative age as a factor to be taken into account when formulating the recommendation.

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 (2007) find positive and strong effects of school entry age on standardized 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 state of Hessen).

Bedard & Dhuey (2006) present the most comprehensive study to date of relative age at school entry effects. Using data from TIMSS 1995 and 1999, and studying 19 different countries (but not Germany), they find significant age effects on test scores in all countries. What is more important, the size of the effect systematically varies across countries. The age effect is largest in those countries where compliance to the cut-off date rule is nearly perfect: England, Iceland, Japan, and Norway. They also find that grade retention and late enrolment (i.e. systematic deviations of the actual age of a 4th grader, say, from the assigned age) reduce the age effect by about one third.

It is not surprising that relative age effects – especially at young ages – are omnipresent.[2] The important question is whether such initial disadvantages in life have long-lasting effects. The German school system gives more reason to worry in this respect than other countries' systems. Birthday effects may be long-lasting because children are separated early (at the age of ten) into different secondary school types. This separation is based on a recommendation given by the primary school. Clearly, the teacher's recommendation should not only reflect the current ability but also include a forecast on future development of the child. Such forecast should certainly not be affected by the relative age of a child in 4th grade.

We estimate the effect of relative age on Gymnasium recommendation and follow students from primary school to 9th grade to see whether the age effect dissipates over time. This could be true if for instance students do not adhere to the recommendation when they enter secondary school or change school types in the course of secondary school. Using data from the German PISA 2000 extension study (PISA-E), we find that relative age at recommendation has a significant and sizeable effect on teacher's recommendations to enter Gymnasium. Younger pupils are less often recommended to Gymnasium. Since relative age at school entry is largely driven by institutional birth date regulations concerning school entry, this type of recommendation bias is arbitrary. We also find that early and late enrolment, non-compliance with the recommendation, and grade retention partly offset this bias, thereby confirming the effectiveness of these policies in reducing possible inequalities in education

[2] Relative age effects appear to be particularly pronounced in competitive environments such as sports (see. e.g. Barnsley et al. 1985, 1992).

opportunities. Further, the relative age effect dissipates as students get older but does not vanish. This is mostly due to selective Gymnasium drop-outs. Finally, we find no evidence that postponing the recommendation by another two years, for instance by extending primary schools to six years or introducing a two year orientation stage between primary and secondary school, reduces the age bias in a quantitatively or statistically significant way.

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 relative age effects with the literature on educational tracking in a novel way, leading to important policy conclusions for the practice of educational tracking in Germany.

2. Institutional background

We now give a brief description of the German school system, where we emphasize those aspects that are most relevant for understanding the importance of secondary school track recommendations in the German context. Figure 1 gives a stylized overview of primary and secondary education in Germany (see Jonen and Eckardt (2006) for a detailed description of the German school system).

All children in Germany attend primary school, which covers grades 1 to 4, and in two states (Berlin and Brandenburg) grades 1 to 6. There is no formal exit examination at the end of primary schooling. Rather, students are allocated to one of the three secondary school types on the basis of their general 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.

The *Hauptschule*, *Realschule*, and *Gymnasium* are the three main types of secondary schools; 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 12 or 13 (depending on the state). Depending on their academic performance, students can switch between school types. Downward mobility is more common than upward mobility. A fourth type of school, the

Gesamtschule (comprehensive school), does not appear in this graph. The comprehensive school offers all lower secondary level leaving certificates, as well as providing upper secondary education. However, it does not exist in all states, and where it exists, it usually plays a minor role, with less than 10 percent of all children attending a comprehensive school. Yet another type of secondary school, the *Orientierungsstufe* will play a role in our analyses later on. After attending primary school for four years, students in the states of Niedersachsen and Bremen move on to a two year orientation stage. The orientation stage can be either organized as an independent school or be part of a primary or secondary school (actually, in both states, the orientation stage has been abolished recently). The objective of the orientation stage has been to allow students a smoother transition between primary and secondary schools.

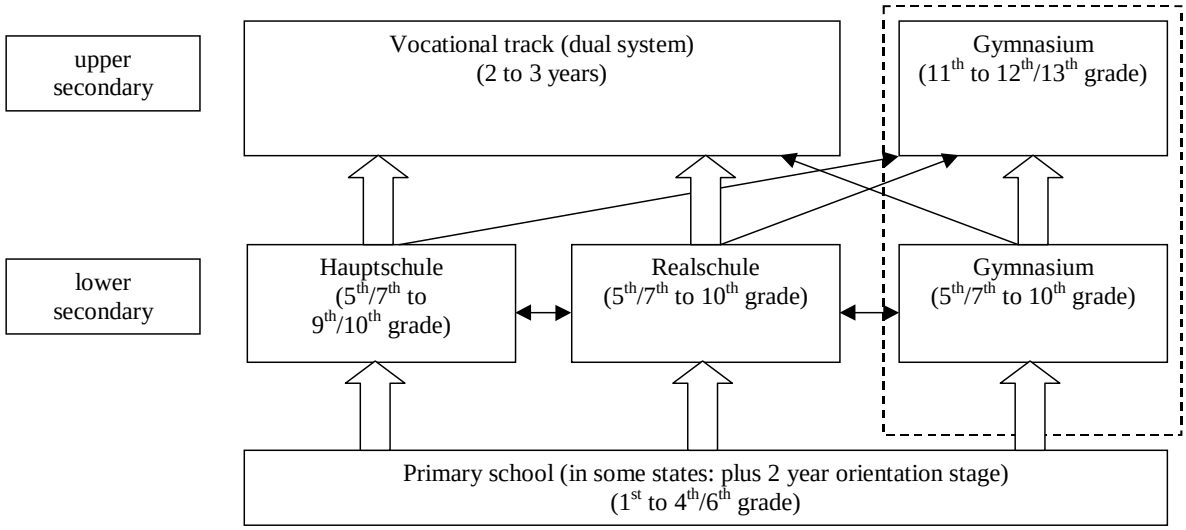

Figure 1: The German school system

As in most other countries, age at school entry in Germany is defined relative to a specific cut-off date. Until recent years, this date was June 30th in West Germany and May 31st in the former GDR. These cut-off dates applied to all children in our sample. The rule is that children who turn 6 on or before June 30th are admitted to primary school in that school year, which starts in August or early September. Children who turn 6 after June 30th are admitted to primary school one year later (in recent years, many states in Germany have deferred the cut-off date by three, sometimes even six months, admitting ever younger children to primary school).

If everyone complied with the cut-off date rule and if there was no grade retention, the oldest children in a class (born in July or June, respectively) would always be eleven month older than the youngest (born in June or May, respectively). In this paper we estimate how this age difference affects the secondary school track recommendation given by the primary school in fourth grade. We are also interested in how flexible enrolment and grade retention modify the age effect.

Before children are admitted to primary school, they have to pass some basic maturity test. Children who are old enough to enter school, but do not pass this test, are admitted to primary school one year later (*late enrolment*). Children who are born after the cut-off date (but before Dec 31st) may be admitted to school provided they pass the maturity test (*early enrolment*). In both cases (late and early enrolments), the final decision is made by the primary school principal, who tends to follow the request of the parents. Moreover, children who do not fulfil minimal performance criteria are not promoted to the next grade. The decision not to promote lies entirely with the school but children may repeat classes on their own (or their parents') demand.

3. Estimation strategy

We compute two sets of estimates for two different subsamples. The first set contains the results of linear regressions (with heteroskedasticity-consistent standard errors) of Gymnasium recommendations and Gymnasium attendance on the *assigned relative age at recommendation*. These are reduced form regressions that show the net effect of month of birth created by the German education system. This effect is the most policy relevant in terms of describing inequalities in educational access due to the way the school system is organized. If we found no age effect in the reduced from regressions, this could be because there was no month of birth effect in the first place or the system was flexible enough to offset these age effects. The possibilities of early and late enrolment or grade retention and skipping, introduces some flexibility that could possibly counteract the age effect.

The second set of estimates contains the results of instrumental variables regressions of Gymnasium recommendations on the *actual* age at recommendation, using *assigned relative age* as instruments. These estimates can only be different from the first set of regressions if actual age is not always identical to assigned relative age, i.e. if a non-random selection of students enrol early or late or repeat classes. In contrast to earlier studies using the same instrumental variables strategy, we are not primarily interested in the IV estimates but in the difference between the reduced form and the IV results. The IV approach provides an

estimate of the month of birth effect that we could expect if there was no possibility of early and late enrolment or grade retention and skipping. These results are of primary interest in studies that aim at estimating the effect of relative age on student achievement taking account of the confounding effect of selective enrolment or grade retention. In our context, the difference between the IV estimate and the reduced form regressions is more interesting however, because it identifies the effect of the flexible enrolment policy on the chances of getting Gymnasium recommendations and visiting Gymnasium.

We estimate reduced form and IV regressions first on the full sample and then on a restricted sample, where sample members are only those students who were born immediately before and after the threshold. In West Germany these are the June and July born, in East Germany these are the May and June born, respectively. The purpose of this exercise is to substantiate the claim that month of birth is in fact exogenous, i.e. uncorrelated with any relevant omitted or unobserved individual characteristics. We argue that while there may be seasonal variation in fertility that is correlated with family characteristics, birth planning is sufficiently imprecise to consider it random (and thus uncorrelated with any potential unobserved confounders) whether a child is born a few weeks before or after the school entry cut-off date. Also, any other potential seasonal variation of characteristics with month of birth (health, personality) should be negligible in our restricted sample.

Finally, we also compute each model with and without the inclusion of a few important individual background variables, thereby controlling for possible correlations between birth dates and observed background.

4. Data description

The data used in this study are drawn from the extension to the German PISA 2000 study (PISA-E), which are downloadable from the website of the German *Kultusministerkonferenz* (www.kmk.org).[3] PISA-E is described in detail in Baumert et al. (2003). In particular, we use the sample that contains information on children who visited 9th grade in 2000, independent of their age. The total sample after deleting cases of item non-response contains data on 26,112 students from all 16 German states.

The data contain detailed retrospective information on the school career of the children up to grade 9, including age at school entry, whether classes were repeated (and which), as well as track choice recommendations and actual track choices in grades 5, 7, and 9. The latter

[3] The members of the Kultusministerkonferenz (KMK) are the state ministers of education.

four variables are our main outcome variables. Table 1 shows the proportion of students receiving a Gymnasium recommendation and attending Gymnasium in grades 5, 7, and 9, by state.

Table 1. Proportion of students receiving Gymnasium (GY) recommendation, and attending Gymnasium in grades 5, 7, and 9, by state and type of primary school (in percent).

State / Type of Primary School	Recom-mendat-ion	Grade 5	Grade 7	Grade 9	N
Four year primary schools					
Saarland	37.7	37.1	33.1	32.3	1,606
Rheinland-Pfalz	39.4	33.3	34.9	33.2	1,672
Nordrhein-Westfalen	34.8	33.7	31.2	28.7	1,871
Schleswig-Holstein	37.0	38.7	37.6	34.8	1,652
Hamburg	66.7	64.1	61.7	59.1	772
Mecklenburg-Vorpommern	35.5	28.6	33.0	28.0	2,259
Sachsen	39.6	30.1	31.0	28.8	2,211
Bayern	42.2	39.8	36.1	34.2	1,546
Baden-Württemberg	43.7	39.3	38.2	37.9	1,576
Hessen	36.8	28.4	34.2	28.6	1,927
Thüringen	37.5	30.7	30.8	28.3	2,368
Sachsen-	51.8	48.4	46.7	46.5	1,314
Total (unweighted)	40.2	35.5	35.6	33.1	20,774
Six year primary schools					
Brandenburg	41.4	4.2	39.0	37.7	1,766
Berlin	53.0	8.1	58.6	55.3	810
Four year primary schools plus orientation stage					
Niedersachsen	37.1	4.9	40.0	37.5	1,505
Bremen	38.1	5.1	41.1	37.2	1,257
Total (unweighted)	40.4		37.0	34.5	26,112

Overall, more than 40 percent of the sample have received a Gymnasium recommendation. Actual attendance rates are lower: 37 percent in grade 7 and decreasing to 34.5 percent in grade 9. This illustrates the fact that during the course of lower secondary school more students leave Gymnasium for the less prestigious school tracks than students enter Gymnasium. Still, it is remarkable to find that there is a gap between recommendation and actual attendance in grade 5. Obviously some parents decide not to send their child to Gymnasium despite having received the recommendation.[4] In Table 1, we also find large differences in recommendation rates between different states, hence we always control for state in the regressions.

[4] Some additional analyses show a clear education gradient. Less educated parents are more likely not to send their children to Gymnasium although they have a recommendation. Conversely, better educated parents are more likely to send their children to Gymnasium

Table 2: Description of enrolment choices, grade retention and background variables

	Four year primary schools		Six year primary schools		Four year plus orientation	
Variable	Percent in sample	Percent GY recom-mended	Percent in sample	Percent GY recom-mended	Percent in sample	Percent GY recom-mended
Enrolment						
Early	3.4	49.5	3.1	63.7	5.5	38.6
Regular	88.3	41.4	92.5	45.1	81.0	40.3
Late	8.3	23.3	4.3	30.4	13.5	20.4
Repeated Class						
No	96.1	41.5	97.8	45.8	92.0	40.2
Yes	3.9	7.1	2.2	10.7	8.0	7.3
Highest parental education						
Hauptschule/POS 8	13.0	16.5	6.2	23.3	19.9	15.8
Realschule/ POS 10	16.4	27.6	19.5	27.4	13.7	30.6
Fachschule	31.6	33.1	29.4	37.9	26.3	31.2
Abitur	11.7	45.7	11.3	48.6	13.0	40.3
Fachhochschule	10.3	55.7	11.5	55.6	9.3	51.2
University	16.9	70.3	22.2	69.0	17.6	67.8
Read to child at preschool age						
Less than daily	48.5	31.4	53.1	37.9	44.3	24.9
Daily	51.5	48.4	46.9	53.2	55.7	47.6
Immigrant Background						
No	90.7	41.8	96.3	44.8	82.4	40.2
Yes	9.3	24.2	3.7	52.1	17.6	25.1
Sex						
Boy	48.5	37.0	46.7	39.7	47.4	34.3
Girl	51.5	43.2	53.3	49.8	52.6	40.4
Number of observations	20,774		2,576		2,762	

Table 2 describes, for each primary school type, the prevalence of flexible enrolment and grade retention in our sample as well as the individual background variables used in this study. Throughout the paper, we follow a parsimonious approach and use only a few but crucial key variables to control for the pupil's individual background. In particular, we only choose variables that are exogenous in the sense that they are already determined at the time of school entry, such as student sex, the highest parental educational attainment, immigrant background, and whether parents have read to the child at pre-school age. The table also contains some bivariate evidence on the relationship between various characteristics and recommendation rates for Gymnasium, in order to illustrate the importance of family background for secondary track recommendations and the ensuing choices.

Early enrolment rates in Germany are fairly low. In our data we find rates of about 3 to 5 percent. Late enrolment is more than twice as common as early enrolment except in the two

---

although they have not received a recommendation. The most likely explanation is that the better educated have different education aspirations.

states with six year primary schools. The proportion of students recommended for Gymnasium differs substantially between the three enrolment groups. In the group of states with four year primary schools, the average recommendation rates for those enrolling early is 49.5 percent, compared to about 41.4 percent for children who enter school at the regular age, and 23.3 percent for those who enter school late. The bivariate relationship between enrolment and Gymnasium recommendations suggests that students who enrol early (late) are a positive (negative) selection in terms of ability.

The proportion of students who had to repeat a class in primary school is between 2 and 8 percent. Again, the low proportion of Gymnasium recommendations among those who repeat a class in primary school is very low and suggests that repeating class indicates low ability.

Table 2 also shows a steep gradient between highest parental education and the probability of a child to receive a track recommendation for Gymnasium. In states with four year primary schools (including those with orientation stage), children whose parents have finished university have a 4.3 times higher chance than children whose parents have at most a Hauptschule (or POS8, which is the East German equivalent) leaving certificate. With six year primary schools, the relative advantage is only 3.0. The difference between primary school types is interesting because it indicates that separating children later might reduce inequalities in access to better education. 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 – 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 and thus tend to give conservative recommendations.

Daily reading to a child at pre-school age is associated with a 17 to 23 percentage point higher probability of that child 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., where both parents are born abroad, are up to 17 percentage points less likely to receive a Gymnasium recommendation. The difference is smallest in the six year primary school states. Again, this indicates that separating children later might be beneficial for children from disadvantaged backgrounds.

Boys have 6 to 10 percentage point 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 to 12 – 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 standardized tests) is controlled for, the difference remains. One explanation is that girls comply better with other (social) expectations of teachers in primary schools.

5. How flexible enrolment and grade retention affect relative age

We begin our analysis by studying the relationship between the assigned relative age on the one hand and the average relative age at school enrolment and at receiving the secondary track recommendation on the other hand. Put differently, we show how flexible enrolment and grade retention in primary school affect the average relative age at enrolment and recommendation. The purpose of this exercise is to show how and when the initial age differences due to the cut-off date rule are mitigated by other institutional rules of the school system.

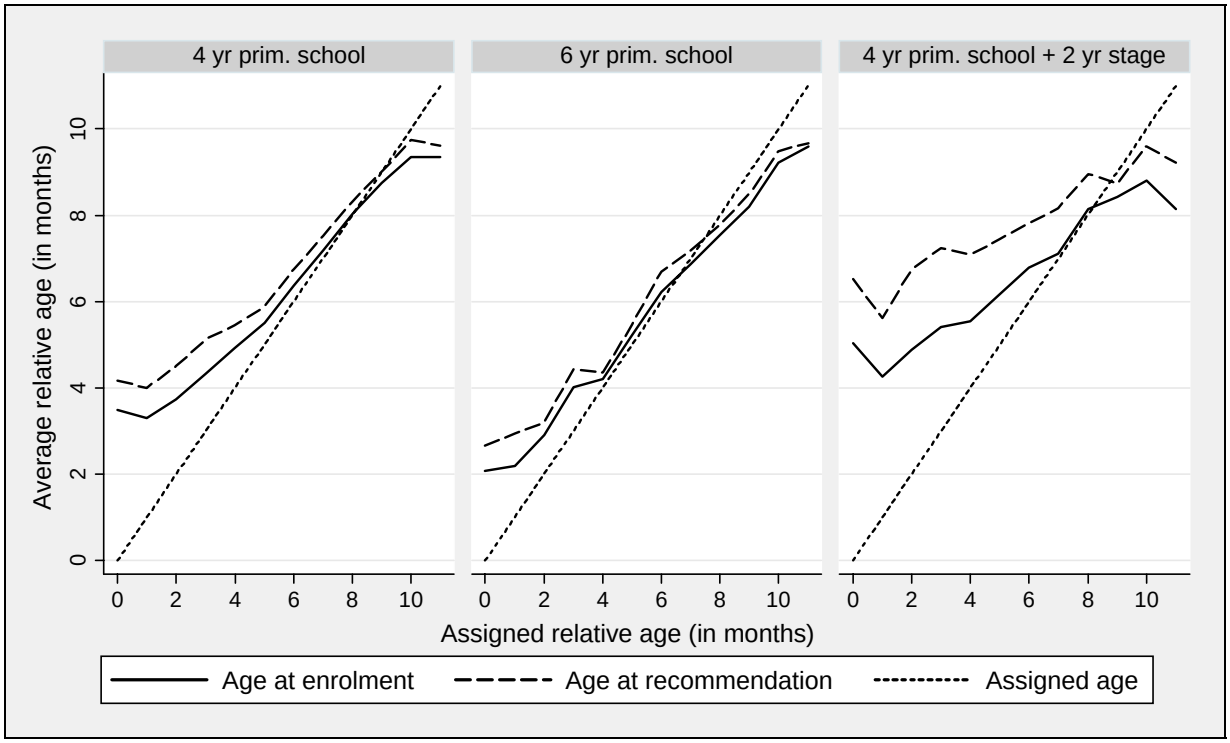

Figure 2: The relationship between assigned relative age and actual relative age at school entry and secondary track recommendation

Figure 2 illustrates the relationship between assigned and actual ages by type of primary school. Following Bedard & Dhuey (2006), we coded assigned relative age from 0 (months) for children born immediately before the cut-off date (the June-born in western Germany and the May-born in eastern Germany) to 11 (months) for those born immediately after the cut-off date. The dotted lines have a slope of one and show the hypothetical relative age at school entry and recommendation if everyone complied to the cut-off date rule. The solid lines show the average age at enrolment. They generally have a slope of less than one. Students born shortly before the cut-off date are more likely to enrol late than others and students born shortly after the cut-off date are more likely to enrol early. In fact, 30 percent of those born in the month preceding the cut-off date enrol late compared to two percent of those born immediately after the cut-off date. Conversely, 17 percent of the latter group enrol early compared to 0.3 percent of the former group.

As a result the average age difference at school entry of students born immediately before and after the cut-off date shrinks from 11 months to less than 6 months (in the four year primary school sample). The former are on average older than their assigned age and the latter are on average younger. If there is a relative age effect on how primary school teachers formulate their secondary school track recommendations or on actual track choices, flexible enrolment reduces the average effect on a given cohort of children by about one half (this argument is essentially drawing on the difference between the reduced form and the IV estimates shown in the next section).

The dashed lines show the average relative age at recommendation, i.e. in grades 4 and 6, respectively. They generally lie above the solid lines because grade retention always increases the average age. Moreover, the dashed lines are somewhat flatter than the solid lines, which indicates that students born shortly before the cut-off date are more likely to repeat grades than students after the cut-off date. Grade retention thus further reduces relative age difference but compared to flexible enrolment the additional effect is small.

6. Birthday effects on secondary track choice

Our estimation results for the effect of relative age on the probability of Gymnasium recommendations and on the probability of actually attending Gymnasium are summarized in Tables 3, 4, and 5. In these tables, we only report the parameters of interest, i.e. the table cells contain estimated relative age effect obtained from different regression. For instance, Table 3 contains the results of 32 different regressions: The four rows represent the four dependent variables (Gymnasium recommendation and Gymnasium attendance in grades 5, 7, and 9) and the columns represent different estimators. Full regression results including the coefficients of control variables and first stages of the IV estimators can be obtained from the authors on request.

6.1. Four grade primary schools

We begin our analysis by estimating the net (reduced form) effect of assigned relative age on recommendation rates (see columns denoted RF) in the full sample. Our results suggest that an eleven month difference in assigned relative age leads to a 10 percentage point difference in terms of receiving a Gymnasium recommendation (note that in contrast to the preceding section, we now code relative age so that the regression coefficients show the effect of eleven months). This holds independent of whether covariates are controlled for or not. A ten percentage point difference is about 0.25 times the average probability of getting a Gymnasium recommendation and about equal to the difference between having parents with a Realschule leaving certificate degree and having parents with a Hauptschule or no leaving certificate. The net effect is thus in fact sizeable and – in our view – large enough to warrant a reassessment of the system of early tracking. The background characteristics controlled for are neither individually not jointly significantly correlated with the assigned relative age, which supports the conjecture that the month of birth (relative to the cut-off date) is exogenous.

The columns denoted IV show the results of instrumental variables regressions of the chances of getting a Gymnasium recommendation on the actual relative age in fourth grade, using assigned relative age as instruments. As explained above, the IV parameter estimates the relative age effect if everyone had entered school at the assigned age, i.e., if there was no possibility of early or late enrolment, and if there was no grade retention until grade 4. Given the selectivity of early and late enrolment and grade retention, it is not surprising that this counterfactual is much larger than the net effect of assigned relative age. Comparing the estimated effect size of about 17 percentage points to the 10 percentage points net effect

suggest that grade retention and enrolment flexibility reduce the relative age disadvantage of the young, i.e. those born shortly before the cut-off date, by about 7 percentage points or about 40 percent.

Table 3: Reduced form and IV-estimates of relative age effects on the probability of getting a Gymnasium recommendation and attending Gymnasium in grades 5, 7, and 9 in states with four grade primary schools (all states except Berlin, Brandenburg, Bremen, and Niedersachsen).

	Full sample (N = 20,774)				Cut-off date sample (N = 3,568)			
	RF		IV		RF		IV	
Dependent variable	without controls (1)	with controls (2)	without controls (3)	with controls (4)	without controls (5)	with controls (6)	without controls (7)	with controls (8)
GY recommended	0.096**	0.099**	0.164**	0.170**	0.073**	0.082**	0.147**	0.166**
	(0.011)	(0.010)	(0.019)	(0.017)	(0.016)	(0.015)	(0.034)	(0.031)
GY grade 5	0.078**	0.082**	0.134**	0.140**	0.064**	0.072**	0.128**	0.147**
	(0.010)	(0.010)	(0.018)	(0.017)	(0.016)	(0.014)	(0.033)	(0.030)
GY grade 7	0.062**	0.065**	0.106**	0.112**	0.040*	0.048**	0.080*	0.098**
	(0.010)	(0.010)	(0.018)	(0.017)	(0.016)	(0.015)	(0.032)	(0.030)
GY grade 9	0.059**	0.062**	0.101**	0.107**	0.033*	0.042**	0.067*	0.085**
	(0.010)	(0.009)	(0.018)	(0.016)	(0.016)	(0.014)	(0.032)	(0.029)

Notes: + p<0.10, * p<0.05, ** p<0.01; heteroskedasticity-robust standard errors in parentheses;
RF = reduced form estimate (effect of assigned relative age); IV = instrumental variables estimate (effect of actual relative age instrumented by assigned relative age); control variables are: parents' education level, student sex, immigrant status, whether parents read daily to child at pre-school age; all regressions control for state.

At this point it should be noted that – as in most other studies following the same identification strategy – assigned relative age proves to be a good instrumental variable for actual relative age in a technical sense. F-statistics and partial R-squared values of the instrument in the first stage regression exceed thresholds of weak instrument by considerable margins. For instance in the full sample, the F-statistics are 4,422 in the regression without and 4,677 in the regression with individual control variables included. The partial R-squared is .173 in both cases. In the restricted sample, the F-statistics are 907 and 918 and partial R-squared values are .198 and .192, respectively. However, given that nearly 90 percent of the students enrol at the assigned age and only 5 percent repeat class in primary school, it would be surprising to find assigned age a weak instrument for actual age at recommendation.

The second set of results in Table 3 uses the sample restricted to students born immediately before and after the threshold. As explained above, this sample restriction serves to substantiate the exogeneity assumption regarding month of birth. We argued that parental characteristics which influence student achievement might also be related to seasonal variations in fertility. Still, family planning is imprecise enough to assume that being born a few weeks before or after the school entry cut-off date is a chance event and hence

uncorrelated with any omitted and unobserved family characteristics. Moreover, other potential seasonal variation of students' characteristics with month of birth such has health or personality should be negligible.

In the restricted sample, we find a net effect of assigned relative age of about 7 to 8 percentage points, which is slightly smaller than the effect in the full sample. However, due to the large standard error in the restricted sample, the effects are not statistically different.

If there was no early and late enrolment or grade retention, the assigned relative age effect would be as large as 15 to 17 percentage points, as can be inferred from the IV estimations. Again, these findings are in the same range as those in the full sample, and they suggest that – as far as Gymnasium recommendation are concerned – age disadvantages are effectively reduced by about one half through the remaining flexibility of the system.

We now continue by studying how the relative age effect dissipates through the school career. Table 3 also shows the effects of a one year age difference on the probability of visiting Gymnasium in grade 5 (i.e. immediately following recommendation), grade 7, and grade 9. For instance, the full sample reduced form estimates without control variables are 7.8 percentage points in grade 5, 6.2 percentage points in grade 7 and 5.9 percentage points in grade 9. In other words, by grade 9, the initial disadvantage of younger students is reduced by more than one third. This finding is robust across estimation methods (OLS vs. IV), samples (full sample vs. restricted sample) and specifications (with or without the inclusion of individual background control variables). Moreover, the effect of relative age is statistically different from zero regardless of the specification chosen.

The mechanism by which the age effect dissipates is simple. As noted earlier, the proportion of students attending Gymnasium falls over time. However, this is a selective process. The age gradient of Gymnasium recommendations and attendance becomes flatter because more older than younger students do not attend Gymnasium in spite of such recommendation. This can be explained by the fact that parents can always decide to send their child to a secondary school type below recommendation but not above recommendation. Judging from our analysis, the parents' decisions counteract the relative age effect. Moreover, more older than younger students drop out of Gymnasium between grades 5 and 9, which again reduces the relative age bias in the primary school recommendation. This is illustrated in Figure 3, which shows, by relative assigned age, the difference between the proportion of students attending Gymnasium in grades 5, 7, and 9, respectively, and the proportion of students who received a recommendation for Gymnasium. The percentage difference can be interpreted as a net drop-out rate. For instance, among students with the lowest assigned

relative age, the proportion attending Gymnasium in grade 7 is 3.1 percentage points lower than the proportion who received a recommendation for Gymnasium (see the dashed line). Among the students with the highest assigned age, this difference is 6.4 percentage points. Thus the initial advantage of the older students shrinks by more than 3 percentage points.

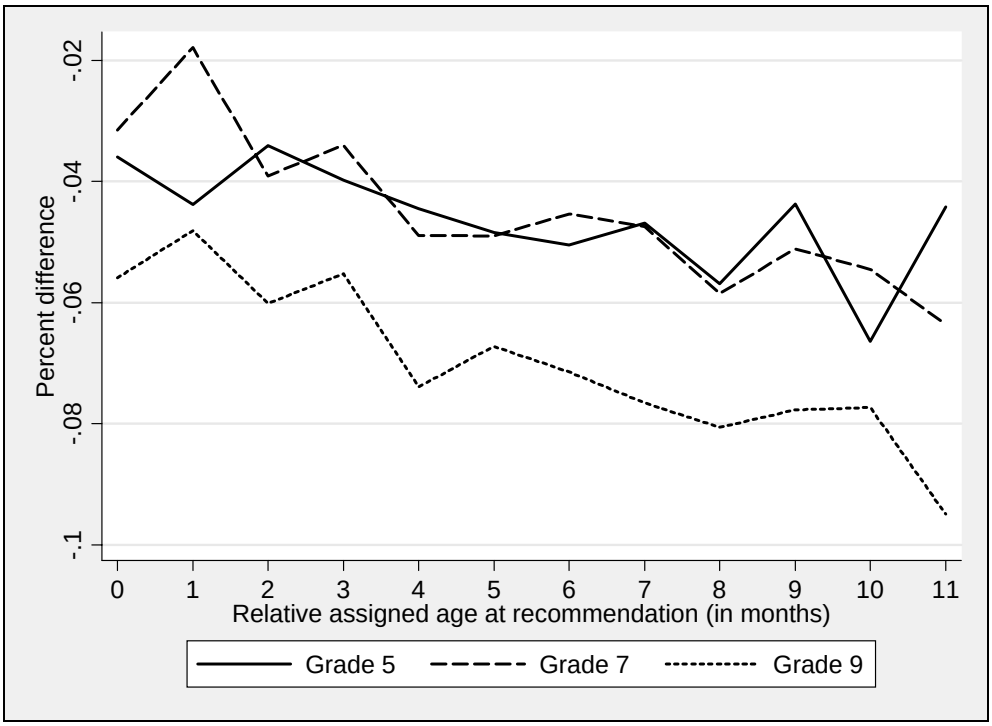

Figure 3: Difference between the proportion of students attending Gymnasium in grades 5, 7, and 9 and the proportion of students who received a recommendation for Gymnasium, by relative assigned age (sample restricted to states with 4 year primary schools).

6.2 Six grade primary schools

In the two German states with six year primary schools (Berlin and Brandenburg), students receive their recommendation when they are on average two years older than their peers in states with four grade primary schools. In this section we will study whether delaying the age at recommendation by two years reduces the age bias. As mentioned before, our data do not allow us to distinguish whether June born students in Berlin have entered school as the youngest group (if they lived in West Berlin) or as the oldest group (if they lived in East Berlin). We have thus excluded all June born students from Berlin from our sample.

The regression results for Berlin and Brandenburg are shown in Table 4. We basically ran the same regressions for this much smaller sample as for students in four year primary school states, of course except those for attending Gymnasium in grade 5 (when everyone

attended primary school). First, we find statistically significant relative age effects on the probability of receiving a Gymnasium recommendation across all samples, specifications and estimation methods. Second, although in the full sample the estimated effect sizes are somewhat smaller than those we find for the four year primary schools, the respective differences are not statistically significant. Thus six year primary schools do not solve the problem of age biased recommendations. It is not even clear whether they reduce the problem.[5]

Table 4: Reduced form and IV-estimates of relative age effects on the probability of getting a Gymnasium recommendation and attending Gymnasium in grades 7 and 9 in states with six grade primary schools (Berlin, Brandenburg).

	Full sample (N = 2,576)				Cut-off date sample (N = 432)			
	RF		IV		RF		IV	
Dependent variable	without controls (1)	with controls (2)	without controls (3)	with controls (4)	without controls (5)	with controls (6)	without controls (7)	with controls (8)
GY recommended	0.076*	0.095**	0.108*	0.136**	0.103*	0.111*	0.158*	0.170*
	(0.032)	(0.030)	(0.046)	(0.044)	(0.050)	(0.046)	(0.078)	(0.073)
GY grade 7	0.058+	0.077**	0.083+	0.110*	0.086+	0.091+	0.132+	0.139+
	(0.032)	(0.030)	(0.046)	(0.043)	(0.049)	(0.046)	(0.077)	(0.073)
GY grade 9	0.049	0.069*	0.070	0.098*	0.081	0.086+	0.124	0.132+
	(0.032)	(0.029)	(0.046)	(0.043)	(0.049)	(0.046)	(0.077)	(0.072)

Notes: + p<0.10, * p<0.05, ** p<0.01; heteroskedasticity-robust standard errors in parentheses;
RF = reduced form estimate (effect of assigned relative age); IV = instrumental variables estimate (effect of actual relative age instrumented by assigned relative age); control variables are: parents' education level, student sex, immigrant status, whether parents read daily to child at pre-school age; all regressions control for state.

Third, with respect to actual Gymnasium attendance in grades 7 and 9, the relative age bias gradually levels off and eventually becomes statistically insignificant when individual background is not controlled for. Although insignificant, the effects of relative age remain sizeable: we find an eleven-month age advantage with respect to grade 9 Gymnasium attendance of 4.9 percentage points in the full sample and 8.1 percentage points in the cut-off point sample. When individual background is controlled for, the estimated reduced form effects are 6.9 and 8.6 percentage points, respectively, and they are both statistically different from zero. To summarize, we find no evidence that six year primary schools are more beneficial to younger students than four year primary schools. This holds in the short run –

[5] This stands in some contrast to the earlier finding that the recommendation rate gradient with respect to parental education is smaller in states with six-year primary schools. An alternative explanation for this finding would be a smaller ability difference between children of high and low-education parents in such states.

with respect to Gymnasium recommendations – as well as in the medium run – with respect to actual attendance.

6.3 Four grade primary schools plus orientation stage

As explained above, some German states chose a third way of organizing the transition between primary and secondary schools by introducing a two-year orientation stage (including grades 5 and 6). The explicit aim of the orientation stage – abolished recently – was to improve the education system by providing a smoother link between primary and secondary schools and to make sure that students receive the "correct" secondary school track recommendation. The orientation stage combined characteristics of both primary and secondary schools. Students were taught together in most subjects, but there was also some internal tracking in key subjects such as German and mathematics.

Table 5: Reduced form and IV-estimates of relative age effects on the probability of getting a Gymnasium recommendation and attending Gymnasium in grades 7 and 9 in states with four grade primary schools plus orientation stage (Niedersachsen, Bremen).

	Full sample (N = 2,762)				Cut-off date sample (N = 488)			
	RF		IV		RF		IV	
Dependent variable	without controls (1)	with controls (2)	without controls (3)	with controls (4)	without controls (5)	with controls (6)	without controls (7)	with controls (8)
GY recommended	0.098**	0.074**	0.306**	0.218**	0.035	0.037	0.142	0.145
	(0.029)	(0.026)	(0.100)	(0.082)	(0.044)	(0.040)	(0.185)	(0.158)
GY grade 7	0.089**	0.064*	0.278**	0.189*	0.014	0.005	0.056	0.018
	(0.029)	(0.027)	(0.101)	(0.083)	(0.044)	(0.040)	(0.183)	(0.156)
GY grade 9	0.073*	0.047+	0.227*	0.138+	0.022	0.019	0.088	0.073
	(0.029)	(0.026)	(0.098)	(0.080)	(0.043)	(0.039)	(0.181)	(0.154)

Notes: + p<0.10, * p<0.05, ** p<0.01; heteroskedasticity-robust standard errors in parentheses;
RF = reduced form estimate (effect of assigned relative age); IV = instrumental variables estimate (effect of actual relative age instrumented by assigned relative age); control variables are: parents' education level, student sex, immigrant status, whether parents read daily to child at pre-school age; all regressions control for state.

Whether the orientation stage was successful in improving the allocation of students to secondary school types can also be judged by the size of the relative age bias in Gymnasium recommendation and attendance rates. Our results – derived from regression analyses along the same lines those above – are shown in Table 5. As it turns out, they are quantitatively similar to what we have obtained before. In the full sample, the estimated reduced form effect of having the highest rather than the lowest assigned relative age is 9.8 percentage points without control variables and 7.4 percentage points with control variables. The effect diminishes in secondary school but remains sizeable and statistically significant until grade 9.

The full sample instrumental variables estimates, which measure the relative age effect in the absence of flexible enrolment and grade retention are much larger than in states with four or six year primary schools. Controlling for individual characteristics, our estimates suggest a difference of nearly 22 percentage points between the youngest and oldest students. This is largely due to the fact that early as well as late enrolment was more common in Niedersachsen and Bremen than in the other states (cf. Figure 2). For instance, 45 percent of the June born in Niedersachsen and Bremen enrolled late while the corresponding figure in the other 14 states is on average 20 percent. In essence our results indicate that – in terms of the relative age bias – nearly nothing was gained by introducing an orientation stage, but flexible enrolment had a very large bias reducing effect. Finally, we find considerably smaller and insignificant effects of relative age on Gymnasium recommendations and attendance in the restricted sample. However, because of large standard errors, the results are also generally not significantly different from the full sample results.

7. Discussion

In this paper, we study birthday effects in the German school system. As in most other countries, school entry is subject to a cut-off date rule. Children who are born before a specific cut-off date are admitted to school in that year, children born after the cut-off date are admitted one year later. Thus there will be an eleven month difference in assigned relative age between children born in the month before the cut-off date and those born in the month after the cut-off date. Relatively older children are relatively more mature, perform better in school and have a higher level of social competence. Perhaps younger children also have problems to assert themselves in a group of older children.

Although birthday effects have been documented in many countries, they do not raise too many concerns because one would generally believe that such birthday effects level off when children get older. However, in the German school system, there is more reason to worry than elsewhere. Birthday effects may be long-lasting because most children are separated into different types of schools on the basis of their scholastic achievement at the age of 10, i.e. when birthday effects are still relatively strong.

We therefore study the effect of relative age on a child's chances of getting a primary school recommendation for Gymnasium and of actually attending Gymnasium, the most academic and prestigious of Germany's secondary school tracks. Using data from the German PISA-E study, we find that an eleven month difference in assigned relative age is associated with a ten percentage point difference in receiving a Gymnasium recommendation in grade 4

and a six percentage point difference in actually attending Gymnasium in grade 9. This is the net birthday effect observed in the German school system.

The age effect would be even larger if there was no possibility of early and late enrolment, if the parents had no influence on the secondary school choice, and if there was no grade retention. However, the relatively young children have a higher probability of delaying school entry and of repeating classes in primary school. Thus some of the children with the lowest assigned age are actually among the oldest in their class (and vice versa), which increases their chances of getting a Gymnasium recommendation. We estimate that selective enrolment and grade retention, which reflect both the school's and the parents' information about the relative maturity of a child, reduce the birthday effect by about 40%. From the perspective of the individual parents, it does make sense to deliberately delay the school entry of "marginal children", or to have them repeat one class in primary school in order to give them a head start in their education career.

We substantiate our findings by performing the analyses on a sample restricted to students born in the two months immediately before and after the cut-off date. The overall evidence found in this paper is that results in this restricted sample restricted are not different from the full sample results. We interpret this as evidence that a selective timing of births does drive the full sample results.

The birthday effect also raises a normative question. Should the assigned age matter for the track choice recommendations, given that assigned age is random and recommendations predetermine career opportunities? Probably not. A solution often proposed to the problem of age biased recommendations is to abandon the current form of the tracking system altogether or track children at a later age, as is common practice in other countries. As was discussed above, such a regime change might not only reduce educational inequality but also increase aggregate performance. Since some of the 16 German states have a six year primary school system, we had the opportunity to perform a (limited) test of the idea that late tracking reduces the age effect. However, we find no evidence that the age effect is weaker when recommendation are given in grade 6 rather than grade 4. One reason may be that tracking after 6^{th} grade is still too early.

In practice, German parents have at least some limited influence on the secondary track choice and we believe that parents should know about the age effect, so that they can possibly counteract biased recommendations by the primary school. Still, some injustice generated by school entrance or exit laws has probably to be accepted as long as children are born during the entire year.

References

Angrist, Joshua & Alan B. Krueger (1992). The Effect of Age at School Entry on Educational Attainment: An Application of Instrumental Variables with Moments from Two Samples. *Journal of the American Statistical Association* 87 (418), 328-336.

Artelt, Cordula; Baumert, Jürgen; Klieme, Eckhard; Neubrand, Michael, Prenzel, Manfred; Schiefele, Ulrich; Schneider, Wolfgang, Schümer, Gundel Schümer, Stanat, Petra, Tillmann, Klaus-Jürgen, Weiß, Manfred (eds.) (2001). *PISA 2000 Zusammenfassung zentraler Befunde*, Max-Planck-Institut für Bildungsforschung, Berlin.

Barnsley Roger H, Thompson, AH & Paula E. Barnsley (1985). Hockey success and birth-date: The relative age effect. Journal of the Canadian Association for Health, Physical Education, and Recreation, Nov.-Dec., 23-28.

Barnsley Roger H., Thompson, AH & Philipe Legault (1992). Family planning: Football style, the relative age effect in football. *International Review for the Sociology of Sport* 27, 77-88

Baumert, Jürgen, Artelt, Cordula, Klieme, Eckhard, Neubrand, Michael, Manfred Prenzel Schiefele, Ulrich; Schneider, Wolfgang, Tillmann, Klaus-Jürgen, Weiß, Manfred (eds.) (2003) *PISA 2000 – Ein differenzierter Blick auf die Länder der Bundesrepublik Deutschland*. Opladen:Leske +Budrich.

Bedard, K. & Dhuey, E. (2006). The persistence of early childhood maturity: international evidence of lung-run age effects. *Quarterly Journal of Economics* 121, 1437-1472.

Bos, W., Voss, A., Lankes, E.-M., Schwippert, K., Thiel, O. & Valtin, R. (2004). Schullaufbahnempfehlungen von Lehrkräften für Kinder am Ende der vierten Jahrgangsstufe. In W. Bos, E.-M. Lankes, M. Prenzel, K. Schwippert, R. Valtin & G. Walther (eds.), *IGLU. Einige Länder der Bundesrepublik Deutschland im nationalen und internationalen Vergleich* (pp. 191-228). Münster: Waxmann.

Brunello, Giorgio & Giannini, Massimo (2004). Stratified or Comprehensive? The Economic Efficiency of School Design. Scottish Journal of Political Economy 51, 173-193.

Datar, Ashlesha (2006). Does delaying kindergarten entrance give children a head start? *Economics of Education Review* 25, 43-62.

Dustmann, Christian (2004). Parental Background, Secondary School Track Choice, and Wages. *Oxford Economic Papers* 56, 209-230.

Eide, Eric R. & Mark H. Showalter (2001). The Effect of Grade Retention on Educational and Labor Market Outcomes. *Economics of Education Review* 20, 563-576.

Fertig, Michael & Jochen Kluve (2005). *The Effect of Age at School Entry on Educational Achievement in Germany*. IZA Discussion Paper 1507.

Frederiksson, Peter & Björn Öckert (2004). *Is Early Learning Really More Productive? The Effect of School Starting Age on School and Labour Market Performance*. Mimeo, University of Uppsala.

Hallinan, Maureen T. (1994). Tracking. From Theory to Practice. Sociology of Education 67 (2): 79-84.

Hanushek, Erik & Ludger Wößmann (2006). Does Educational Tracking Affect Performance and Inequality? Differences-in-Differences Evidence across Countries. *Economic Journal* 116, C36-C76.

Jonen, Gerdi & Thomas Eckardt (2006): *The Education System in the Federal Republic of Germany 2004*. Secretariat of the Standing Conference of the Ministers of Education (KMK).

Jürges, Hendrik & Kerstin Schneider (2004). International Differences in Student Achievement: An Economic Perspective. *German Economic Review* 5 (3). 357-380.

Lehmann, R. H. & Peek, R: *Aspekte der Lernausgangslage von Schülerinnen und Schülern der fünften Jahrgangsstufe an Hamburger Schulen. Bericht über die Untersuchung im September 1996*. Hamburg (Behörde für Schule, Jugend und Berufsausbildung, Amt für Schule) 1997.

Leuven, Edwin, Mikael Lindahl, Hessel Oosterbeek & Dinand Webbink (2004). *New evidence on the effect of time in school on early achievement*. Mimeo.

Puhani, Patrick A. & Andrea M. Weber (2005). Does the Early Bird Catch the Worm? Instrumental Variable Estimates of the Educational Effects of Age at School Entry in Germany. *Empirical Economics* 32, 359-386.

Strom, Bjarne (2004), *Student achievement and birthday effects*. Mimeo, Department of Economics, Norwegian University of Science and Technology.

CESifo Working Paper Series

(for full list see www.cesifo-group.de)

1992 Wladimir Raymond, Pierre Mohnen, Franz Palm and Sybrand Schim van der Loeff, The Behavior of the Maximum Likelihood Estimator of Dynamic Panel Data Sample Selection Models, May 2007

1993 Fahad Khalil, Jacques Lawarrée and Sungho Yun, Bribery vs. Extortion: Allowing the Lesser of two Evils, May 2007

1994 Thorvaldur Gylfason, The International Economics of Natural Resources and Growth, May 2007

1995 Catherine Roux and Thomas von Ungern-Sternberg, Leniency Programs in a Multimarket Setting: Amnesty Plus and Penalty Plus, May 2007

1996 J. Atsu Amegashie, Bazoumana Ouattara and Eric Strobl, Moral Hazard and the Composition of Transfers: Theory with an Application to Foreign Aid, May 2007

1997 Wolfgang Buchholz and Wolfgang Peters, Equal Sacrifice and Fair Burden Sharing in a Public Goods Economy, May 2007

1998 Robert S. Chirinko and Debdulal Mallick, The Fisher/Cobb-Douglas Paradox, Factor Shares, and Cointegration, May 2007

1999 Petra M. Geraats, Political Pressures and Monetary Mystique, May 2007

2000 Hartmut Egger and Udo Kreickemeier, Firm Heterogeneity and the Labour Market Effects of Trade Liberalisation, May 2007

2001 Andreas Freytag and Friedrich Schneider, Monetary Commitment, Institutional Constraints and Inflation: Empirical Evidence for OECD Countries since the 1970s, May 2007

2002 Niclas Berggren, Henrik Jordahl and Panu Poutvaara, The Looks of a Winner: Beauty, Gender, and Electoral Success, May 2007

2003 Tomer Blumkin, Yoram Margalioth and Efraim Sadka, Incorporating Affirmative Action into the Welfare State, May 2007

2004 Harrie A. A. Verbon, Migrating Football Players, Transfer Fees and Migration Controls, May 2007

2005 Helmuth Cremer, Jean-Marie Lozachmeur and Pierre Pestieau, Income Taxation of Couples and the Tax Unit Choice, May 2007

2006 Michele Moretto and Paolo M. Panteghini, Preemption, Start-Up Decisions and the Firms' Capital Structure, May 2007

2007 Andreas Schäfer and Thomas M. Steger, Macroeconomic Consequences of Distributional Conflicts, May 2007

2008 Mikael Priks, Judiciaries in Corrupt Societies, June 2007

2009 Steinar Holden and Fredrik Wulfsberg, Downward Nominal Wage Rigidity in the OECD, June 2007

2010 Emmanuel Dhyne, Catherine Fuss, Hashem Pesaran and Patrick Sevestre, Lumpy Price Adjustments: A Microeconometric Analysis, June 2007

2011 Paul Belleflamme and Eric Toulemonde, Negative Intra-Group Externalities in Two-Sided Markets, June 2007

2012 Carlos Alós-Ferrer, Georg Kirchsteiger and Markus Walzl, On the Evolution of Market Institutions: The Platform Design Paradox, June 2007

2013 Axel Dreher and Martin Gassebner, Greasing the Wheels of Entrepreneurship? The Impact of Regulations and Corruption on Firm Entry, June 2007

2014 Dominique Demougin and Claude Fluet, Rules of Proof, Courts, and Incentives, June 2007

2015 Stefan Lachenmaier and Horst Rottmann, Effects of Innovation on Employment: A Dynamic Panel Analysis, June 2007

2016 Torsten Persson and Guido Tabellini, The Growth Effect of Democracy: Is it Heterogenous and how can it be Estimated?, June 2007

2017 Lorenz Blume, Jens Müller, Stefan Voigt and Carsten Wolf, The Economic Effects of Constitutions: Replicating – and Extending – Persson and Tabellini, June 2007

2018 Hartmut Egger and Gabriel Felbermayr, Endogenous Skill Formation and the Source Country Effects of International Labor Market Integration, June 2007

2019 Bruno Frey, Overprotected Politicians, June 2007

2020 Jan Thomas Martini, Rainer Niemann and Dirk Simons, Transfer Pricing or Formula Apportionment? Tax-Induced Distortions of Multinationals' Investment and Production Decisions, June 2007

2021 Andreas Bühn, Alexander Karmann and Friedrich Schneider, Size and Development of the Shadow Economy and of Do-it-yourself Activities in Germany, June 2007

2022 Michael Rauscher and Edward B. Barbier, Biodiversity and Geography, June 2007

2023 Gunther Schnabl, Exchange Rate Volatility and Growth in Emerging Europe and East Asia, June 2007

2024 Erkki Koskela and Ronnie Schöb, Tax Progression under Collective Wage Bargaining and Individual Effort Determination, June 2007

2025 Jay Pil Choi and Marcel Thum, The Economics of Politically Connected Firms, June 2007

2026 Jukka Pirttilä and Roope Uusitalo, Leaky Bucket in the Real World: Estimating Inequality Aversion Using Survey Data, June 2007

2027 Ruslan Lukach, Peter M. Kort and Joseph Plasmans, Strategic R&D with Knowledge Spillovers and Endogenous Time to Complete, June 2007

2028 Jarko Fidrmuc, Neil Foster and Johann Scharler, Labour Market Rigidities, Financial Integration and International Risk Sharing in the OECD, June 2007

2029 Bernardina Algieri and Thierry Bracke, Patterns of Current Account Adjustment – Insights from Past Experience, June 2007

2030 Robert Dur and Hein Roelfsema, Social Exchange and Common Agency in Organizations, June 2007

2031 Alexander Libman and Lars P. Feld, Strategic Tax Collection and Fiscal Decentralisation: The Case of Russia, June 2007

2032 Øystein Foros, Hans Jarle Kind and Greg Shaffer, Resale Price Maintenance and Restrictions on Dominant Firm and Industry-Wide Adoption, June 2007

2033 Jan K. Brueckner and Kurt Van Dender, Atomistic Congestion Tolls at Concentrated Airports? Seeking a Unified View in the Internalization Debate, June 2007

2034 Viet Do and Ngo Van Long, International Outsourcing under Monopolistic Competition: Winners and Losers, June 2007

2035 Nadia Fiorino and Roberto Ricciuti, Determinants of Direct Democracy, June 2007

2036 Burkhard Heer and Alfred Maussner, Inflation and Output Dynamics in a Model with Labor Market Search and Capital Accumulation, June 2007

2037 Konstantinos Angelopoulos, Jim Malley and Apostolis Philippopoulos, Public Education Expenditure, Growth and Welfare, June 2007

2038 Maarten Bosker, Steven Brakman, Harry Garretsen and Marc Schramm, Adding Geography to the New Economic Geography, June 2007

2039 Steffen Henzel, Oliver Hülsewig, Eric Mayer and Timo Wollmershäuser, The Price Puzzle Revisited: Can the Cost Channel Explain a Rise in Inflation after a Monetary Policy Shock?, July 2007

2040 Rosario Crinò, Service Offshoring and White-Collar Employment, July 2007

2041 Carsten Hefeker and Michael Neugart, Labor Market Regulation and the Legal System, July 2007

2042 Bart Cockx and Muriel Dejemeppe, Is the Notification of Monitoring a Threat to the Unemployed? A Regression Discontinuity Approach, July 2007

2043 Alfons J. Weichenrieder, Profit Shifting in the EU: Evidence from Germany, July 2007

2044 Annika Alexius and Bertil Holmlund, Monetary Policy and Swedish Unemployment Fluctuations, July 2007

2045 Axel Dreher, Jan-Egbert Sturm and Jakob de Haan, Does High Inflation Cause Central Bankers to Lose their Job? Evidence Based on a New Data Set, July 2007

2046 Guglielmo Maria Caporale and Luis A. Gil-Alana, Long Run and Cyclical Dynamics in the US Stock Market, July 2007

2047 Alessandro Balestrino, It is a Theft but not a Crime, July 2007

2048 Daniel Becker and Michael Rauscher, Fiscal Competition in Space and Time: An Endogenous-Growth Approach, July 2007

2049 Yannis M. Ioannides, Henry G. Overman, Esteban Rossi-Hansberg and Kurt Schmidheiny, The Effect of Information and Communication Technologies on Urban Structure, July 2007

2050 Hans-Werner Sinn, Please Bring me the New York Times – On the European Roots of Richard Abel Musgrave, July 2007

2051 Gunther Schnabl and Christian Danne, A Role Model for China? Exchange Rate Flexibility and Monetary Policy in Japan, July 2007

2052 Joseph Plasmans, Jorge Fornero and Tomasz Michalak, A Microfounded Sectoral Model for Open Economies, July 2007

2053 Vesa Kanniainen and Panu Poutvaara, Imperfect Transmission of Tacit Knowledge and other Barriers to Entrepreneurship, July 2007

2054 Marko Koethenbuerger, Federal Tax-Transfer Policy and Intergovernmental Pre-Commitment, July 2007

2055 Hendrik Jürges and Kerstin Schneider, What Can Go Wrong Will Go Wrong: Birthday Effects and Early Tracking in the German School System, July 2007