Why Does Height Matter for Educational Attainment? Evidence from German Pre-Teen Children

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Abstract

Several studies have shown that body height is positively associated with educational attainment. In this paper, we investigate the mechanisms behind this relationship using data on German pre-teen students. We show that (i) taller children are more likely to enroll in 'Gymnasium', the most academic secondary school track, and that (ii) primary school teachers give better recommendations to taller students. This holds even when controlling for academic achievement and parental background. In addition, we present some evidence that height and social skills are positively associated already at age 2-3. Our results imply that controlling for social skills would significantly reduce estimates of the height-school premium. With respect to education policy, our findings suggest that early school tracking might increase disadvantages for students with low social skills.

JEL-Code: I21, I28, J24.

Keywords: height, educational tracking, educational attainment, social skills.

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1 Introduction

There is extensive and consistent evidence that taller adults earn higher wages (Case and Paxson, 2008b; Persico et al., 2004; Heineck, 2005). In addition, various studies show that body height is also positively related to educational attainment. Case et al. (2009), for example, argue that half of the labor market height premium in Britain can be explained by the positive association between height and educational attainment. The positive relationship between height and educational attainment is documented both in studies that use large samples and in smaller within-siblings comparisons. Teasdale et al. (1991) document this relationship for Denmark; Bielicki and Charzewski (1983) for Poland; Silventoinen et al. (2000) for Finland; Magnusson et al. (2006) for Sweden; and Cinnirella and Winter (2009) for 14 European countries.

In this paper, we investigate the mechanisms behind this relationship using data on German pre-teen students. We show that taller children are more likely to enroll in 'Gymnasium', the most academic secondary school track. We find that primary school teachers give better recommendations to taller students; most importantly, this holds even when we control for academic achievement. As a potential explanation for the *height-school premium* we also show that taller children tend to have higher social skills already at age 3.

This is the first study that sheds light on the relationship between height and secondary school track choice in Germany, where the tracking decision is a strong predictor of final educational attainment.[1] We contribute to the literature in two ways. First, we explore the role of height for the transition from primary to secondary school, that is, the secondary school track decision. Second, we add new evidence on the relationship between noncognitive skills and height. Our results are in line with Doyle et al. (2009) who report evidence from recent studies that social skills developed early in life are important for future educational success.

[1] The German schooling system is reviewed in Section 2.

The early tracking decision is very important in Germany because it determines to a large extent final educational attainment and thus affects future labor market outcomes. Dustmann (2004), for example, documents that the German tracking system produces low intergenerational mobility and shows that different secondary school tracks translate into substantial wage differentials later in life. In fact, the German school system is characterized by rigid early tracking. After primary school, at about age 10, students are tracked into different school types that vary by the academic content of the curriculum. Because mobility between different secondary school types is quite limited (Jürges and Schneider, 2007), the tracking decision strongly determines final educational attainment.

In order to study the impact of height on the secondary school track decision, we employ a longitudinal dataset that observes students immediately before and after tracking. Besides a measure of height, the data include information on students' academic achievement at the end of primary school and their socioeconomic background. Furthermore, we exploit another feature of the German school system which allows us to study the determinants of the transition from primary to secondary school: When children are in the forth grade, primary school teachers provide a recommendation for the secondary school track on which parents base the school decision for their children.[2] We observe these teacher recommendations for all children in the sample.

Our first result is that controlling for parental background and students' school performance at the end of primary school, taller students have a significantly higher probability of enrolling in 'Gymnasium', the most academic secondary school track. Second, we show that the association between height and the tracking decision is due to primary school teachers' recommendations: controlling for students' academic achievement, taller students are more likely to receive a recommendation for 'Gymnasium'. One possible explanation for this finding could be that taller people are more intelligent. Case and Paxson (2008b), for

[2]This recommendation is more or less binding, depending on the state schooling laws. We discuss the role of these recommendations in more detail below.

example, suggest that taller workers earn higher wages because they are more intelligent. They show that height and cognitive abilities are positively correlated already at age 3 and throughout childhood.[3] But to the extent that students' cognitive abilities affect teachers' recommendations mainly through academic achievement (for which we control), our results suggest that height has an effect on recommendations independent of cognitive abilities.

A growing body of research documents that noncognitive skills developed during early childhood are important predictors of later educational attainment (Bowles et al., 2001; Chamorro-Premuzic and Furnham, 2005; Heckman and Rubinstein, 2001; Heckman et al., 2006).[4] In the second part of the paper, we investigate a possible mechanism behind the positive association between height and teacher recommendation. For this purpose, we use a different dataset on German children aged 2 to 3 to analyze whether—and how strongly—height is associated with social skills, one form of noncognitive skills. We find that taller children aged 2 to 3 have higher social skills than shorter children, net of health status, parents' education, and family income. Because height at age 3 is strongly correlated with height at age 10 and differences in noncognitive skills among very young children tend to persist throughout childhood,[5] it is possible that primary school teachers reward taller students for their higher social skills.

Finally, we find a consistent gender-specific pattern: results in both datasets are statistically significant only for boys. In this respect, there is some evidence from psychological studies that the relationship between social skills and body height is more pronounced for

[3]Case and Paxson (2008b) suggest that the pre-natal environment and nutrition during childhood determine both body height and cognitive ability. Heineck (2009) finds a nonlinear relationship between height and cognitive skills among German adult males. He shows that the height-wage premium disappears once cognitive abilities are taken into account.

[4]Noncognitive skills (also called personality traits) developed during infancy and childhood also predict a variety of labor market outcomes such as wages and risk-taking behavior in adulthood.

[5]For evidence from psychological literature on the persistence of personality traits (that is, noncognitive skills), see Caspi and Silva (1995); Caspi (2000); Newman et al. (1997); and Roberts and DelVecchio (2000). Carneiro et al. (2003); Cunha et al. (2006); and Cunha and Heckman (2007) present evidence on the early emergence of gaps in both cognitive and noncognitive abilities. Borghans et al. (2008) review empirical studies that relate personality traits and cognitive abilities to adult outcomes.

boys than for girls. Biller (1968), for example, shows that, according to ratings of kindergarten teachers, body height is related to the social behavior of young boys: Tall boys tend to be more dominant in their male peer group than short boys. Eisenberg et al. (1984) find that mothers of preschool children rate tall boys as more competent than short boys, while this pattern is less clear for girls.

Our hypothesis that higher social skills are associated with higher educational attainment is in line with Persico et al. (2004) who explain the height-wage premium in the labor market with accumulated social skills. They show that the adult height premium is essentially eliminated when controlling for teen height. They argue that taller teenagers are more likely to participate in sport activities and clubs during adolescence, thereby accumulating social skills that are rewarded later in the labor market. In contrast to Persico et al. (2004), we cannot directly test whether the height-school premium disappears once social skills are controlled for; instead, we provide some evidence that differences in social skills across individuals of differing height arise at a very early stage in life.

The rest of the paper proceeds as follows. Section 2 briefly describes the German school system. Section 3 reports the results on the relationship between height and secondary school track choice and between height and teacher recommendations. Section 4 presents the results on the association between height and social skills during early childhood. We discuss our findings in Section 5 and conclude with Section 6.

2 The German Schooling System

As the German school system differs considerably from that in the U.S. and many other countries, we provide an overview of the aspects relevant to this study.[6] A characteristic feature of the German school system is the secondary school track choice at a very early

[6]See Lohmar and Eckhardt (2008) for a more detailed description of the German school system.

stage. After completing 4 years of primary school (*Grundschule*),[7] students are allocated to one of three different secondary school types at about age 10. The three school types are general school (*Hauptschule*), intermediate school (*Realschule*), and high school (*Gymnasium*).[8] General schools provide basic general education and last five years (in some states six years). Intermediate schools provide a more extensive general education and usually cover grades 5 to 10. The intermediate school leaving certificate qualifies a student to attend a school that provides vocational or higher education entrance qualification, whereas a leaving certificate from general school allows only attendance of vocational schools. High schools provide the most academic education and cover grades 5 to 12 (or 5 to 13, depending on the federal state schooling laws). The high school leaving certificate (*Abitur*) is a prerequisite for attending university or other institutions of higher education. Thus, high school is the only secondary school track that provides direct entry into tertiary education.

Parents' secondary school track decision for their child is, to a large extent, based on a teacher recommendation. At the end of primary school, students do *not* take any ability test which might provide information on the child's academic potential. Neither do formal exit examinations exist which could facilitate secondary school track decisions. Instead, primary school teachers usually recommend a secondary school track for each student. This recommendation is primarily based on the academic achievement of the student, especially on the performance in math and German. This recommendation is more or less binding, depending on the state's schooling laws. If the teacher's recommendation is at odds with the parents' wishes, the final decision lies either with the parents, the secondary school, or the school supervisory authority, depending on the state laws. Parents with lower education might be less confident about, or less interested in, their child's education and

[7] In two states, Berlin and Brandenburg, primary school lasts 6 years.

[8] In the school year 2006/07, the distribution between the three secondary school types was as follows: 22 percent of the students attended general school, 27 percent attended intermediate school, and 51 percent attended high school (Federal Statistical Office, 2008, p. 133). In some states, a fourth type of secondary school exists. Comprehensive schools (*Gesamtschule*) offer all lower and upper secondary education levels. Where comprehensive schools exist, only a minor fraction of students attends this school type.

thus consider the recommendation as more binding than parents with higher educational attainment (Dustmann, 2004). In contrast, more highly educated parents might be more likely to send their child to high school even if high school recommendation was not received.

Mobility between secondary schools is theoretically possible but limited in practice. Jürges and Schneider (2007) use the German extension study of PISA (Programme for International Student Assessment), a cross-sectional dataset representative for the cohort of 15-year-old students, and show that mobility is limited, with downward mobility being more common than upward mobility. They find that less than 5 percent of the students who had *not* received a recommendation for high school attended high school in grade 9 (the 5th grade of secondary school). In contrast, 21 percent of those students who received a recommendation for high school did not attend high school in grade 9. Because (upward) mobility is limited in practice, the secondary school track decision at the end of primary school strongly determines final educational attainment.

3 Height, School Track, and Teacher Recommendation

In this section, we present regression results on the relationship between height and secondary school track choice and on the association between height and teacher recommendation.

3.1 The Youth Panel

In order to examine the role of height for the secondary school track decision, we use the Youth Panel (*Kinderpanel*), a longitudinal dataset which focuses on the transition from primary to secondary school. This study is conducted by the German Youth Institute (*Deutsches Jugendinstitut*), the largest German non-university social science research in-

stitute in the area of children, youths, and families. The survey consists of three waves that were collected in autumn 2002, spring 2004, and autumn 2005. The target population are German-speaking children aged 5 to 12 who live with their German-speaking parents in Germany. Children were sampled on the basis of the register of residents in 100 representatively selected municipalities. The total sample consists of 2,830 children. Face-to-face interviews have been conducted with mothers and children, whereas fathers were asked to complete a questionnaire.[9]

We restrict the sample to children who have attended secondary school in the last wave and whose height has been reported by the mother. Thus, our final sample consists of 189 boys and 226 girls who were mainly born between October 1993 and September 1994. All children in the final sample attended primary school in the first and second wave and secondary school in the third wave. Mothers report the height of their offsprings (only) in wave 3, that is, immediately after the secondary school track decision took place. When height was reported, children were between 11.0 and 12.75 years old.[10]

As we are interested in assessing the effect of height when the transition from primary to secondary school takes place, we need to adjust reported height because it was reported for students from two different grades (5th and 6th grade). We maintain reported height of 5th graders, that is, those students who entered secondary school only a few months before height was reported. We subtract the average height difference between 6th and 5th graders from the height of 6th graders. This adjustment is done separately for boys and girls.[11] It ensures that the adjusted measure reflects height as if it was reported at the beginning of secondary school (5th grade) for all students in the sample.

[9]The dataset and all questionnaires (in German language) are available online at http://213.133.108.158/surveys/index.php?m=msg,0&gID=4.

[10]Strauss and Duncan (1996) show that measured height and mother-reported height are very close for 12-year-old children in a U.S. sample. Thus, it seems reasonable to assume that reported height in our sample does not suffer from systematic measurement error.

[11]The relative position within the height distribution is very stable at this age. Medical literature reports a height correlation coefficient of 0.98 between age 11 and age 12 for boys (see Humphreys et al., 1985, p. 1467).

Most importantly, we also observe students' school performance. Mothers report their offsprings' school performance in mathematics, orthography, and reading at the end of primary school, that is, immediately before secondary school tracking takes place.[12] Similar to German school grades, mothers indicate academic performance of their children on a scale from 1 to 4: "very good" (1), "good" (2), "not so good" (3), and "not good at all" (4). As noted above, teachers base their school recommendations primarily on the performance in math and German. Thus, we are able to control for the child's academic achievement in those subjects on which primary school teachers base their recommendations. We observe teachers' recommendations for all children in our sample.

Table 1 presents descriptive statistics by sex. *Secondary School Track* and *Teacher Recommendation* are the two outcomes in our estimations. Both dependent variables are binary and equal 0 if the student attends (received a recommendation for) general school or intermediate school, and equal 1 if the student attends (received a recommendation for) high school.[13] In our sample, 54.5 percent of the boys attend high school, while 56.1 percent of the boys received a recommendation for high school. The respective fractions are larger for girls: 61.1 percent attend high school and 63.7 percent received a recommendation for high school. For both sexes, the proportion of high school recommendations is marginally larger than the proportion of students who actually attend high school. Most boys and girls comply with the primary teacher's recommendation: 88.7 percent of the boys with a high school recommendation actually attend high school (89.6 percent among girls).

Height refers to the adjusted measure described above. Means and standard deviations of height are very similar across sexes. Boys perform better in math (1.68) than girls (1.94), while girls do better in orthography (1.88) and reading (1.58) than boys (2.22 and

[12]School performance is reported in wave 2 when 69.3 percent of the boys and 75.2 percent of the girls in our sample attended the last grade of primary school. School performance refers to the penultimate grade of primary school (grade 3) for the other students. We assume that performance in grade 3 is a good proxy for performance in grade 4.

[13]General school and intermediate school are combined because of the small sample size.

1.76, respectively). We also control for mother's school degree and whether she received a degree at a university or at a university of applied sciences (*Fachhochschule*).[14] Finally, we control for family income. *High Household Income* is a binary variable which indicates whether the net monthly household income exceeds a threshold of 3250€.[15]

Since previous literature has shown that relative age in primary school has an impact on educational outcomes (Angrist and Krueger, 1992; Puhani and Weber, 2007), we control for age at the end of 4th grade. Similar to other countries, school entry age in Germany is defined by a specific cut-off date (often June 30). Children who turn 6 before that date usually start primary school in August or early September. Children who turn 6 after the cut-off date start primary school one year later. However, children might enroll one year earlier or one year later than scheduled by the cut-off date. Therefore, we include two binary variables that indicate whether a child was enrolled early (about 7 percent in our sample) or late (about 3 percent).

3.2 Results

As secondary school track and teacher recommendation are binary outcomes, we run standard probit models. In particular, we estimate the following model:

$$Prob(y_i^c = 1|h_i, \boldsymbol{X}_i) = \Phi(\alpha h_i + \boldsymbol{\beta X}_i) \tag{1}$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function. The dependent variable y_i^c denotes either the secondary school track or the teacher recommendation for individual i. Thus, we run two separate probit models with c={secondary school track, teacher recommendation}. Our explanatory variable of interest, height, is denoted by h_i.

[14] All estimation results are robust to including also father's educational attainment.

[15] This threshold denotes the top quartile of the income distribution in our sample.

The vector $\mathbf{X}_i$ contains additional control variables at the individual level such as school grades and a rich set of family background variables.

Table 2 presents the estimated coefficients and standard errors (in parentheses) of the probit models. Column (1) shows that height is significantly associated with high school attendance for boys. The magnitude of the effect is also economically significant: a 1 cm increase in height is associated with a 1.6 percentage points increase in the probability of attending high school. Thus, a one standard deviation increase in height is associated with an 11.4 percentage points higher probability of attending high school. The magnitude of the height effect is similar to the effect of performing *good* at math relative to performing *not so good* or *not good at all* (13.7 percentage points). The one standard deviation height effect is also similar in size to the effect of coming from a family with a top quartile household income instead of coming from a family with a lower household income (12.6 percentage points). Given the rich set of control variables, these results indicate that height has a significant effect on the secondary school track decision independent of students' academic performance and parental background.

As described above, school recommendations of primary school teachers play an important role for the secondary school track choice. Column (2) shows that height is strongly related to teacher recommendations for boys. The coefficient on height is highly significant and—given the high rates of compliance with teacher recommendations—of similar magnitude than the height coefficient in the secondary school track model (Column 1).[16] A one standard deviation increase in height is associated with an increase of 13.6 percentage points in the probability of receiving a high school recommendation. A comparison with the observed unconditional probability that a boy receives a high school recommendation (56 percent) reveals the economic importance of this relationship. The magnitude of this effect is particularly remarkable given that we control for students' academic performance

[16]We tested for nonlinear height effects in both models and did not find any evidence for it.

at the end of primary school which is supposed to be the most important determinant of teacher recommendations. Indeed, school performance has the expected sign and high explanatory power in both models.[17] Good grades in math and orthography are strongly associated with the recommendation and attendance of high school. Reading skills have no additional, independent impact on teacher recommendations. Contrary to previous studies, we do not find a statistically significant effect of relative age on the secondary school track decision.

The positive association between height and high school attendance is much smaller and statistically insignificant for girls (p-value = 0.31; see Column 3). Similarly, height and teacher recommendation are not correlated among girls (Column 4). Note, however, that the impact of school performance at the end of primary school is similar across sexes. The difference is that good or very good math skills seem to be more important for girls than for boys, whereas good orthography performance seems to matter more for boys. However, overall school performance is a strong predictor of secondary school track and teacher recommendation for both boys and girls.

We cannot directly control for students' cognitive abilities in these models. To the extent that intelligence is positively correlated with height, the coefficient on height would be biased upward. In fact, recent studies have shown a positive association between height and cognitive abilities. Case and Paxson (2008b), for example, suggest that taller workers have on average higher wages because they are more intelligent. They show that height is positively correlated with cognitive abilities already at age 3. We assume, however, that students' cognitive abilities affect teacher recommendations primarily through school performance; this would imply that the estimated height coefficients are unbiased. Given that we control extensively for students' school performance, we suggest that height affects teacher recommendations independent of cognitive abilities.

[17] Separate probit models with school performance as the only explanatory variable (not reported) yield high pseudo R^2 measures: 0.307 in the male and 0.244 in the female sample.

In principle, various channels could cause the relationship between height and teacher recommendations (for boys). One possibility is that teachers discriminate against short students because they have a preference for taller people. Another—more testable—possibility is that taller children have certain traits that are rewarded by teachers. In fact, we suggest that height might be a marker for social skills which are unobservable to the econometrician but observable to the teacher. It is possible that better school recommendations for taller boys are due to higher social skills. We provide some evidence for this hypothesis in the next section.

4 Height and Social Skills During Early Childhood

The results presented in the previous section show that taller boys are, *ceteris paribus*, more likely to attend the most academic secondary school track than shorter boys. This relationship is due to the fact that taller students are more likely to receive a teacher recommendation for high school, controlling for academic achievement in primary school and parental background. In this section, we provide evidence that taller boys have higher social skills already during early childhood. We argue that this finding is a possible explanation for the height-school premium. For this purpose, we use a different dataset which consists of the offsprings of the respondents to the German Socio-Economic Panel (GSOEP).

4.1 The German Socio-Economic Panel Study

The GSOEP is a large annual household survey representative of the German resident population.[18] Participants answer detailed questionnaires covering such diverse topics as demographic characteristics, educational attainment, and health.[19] The data used in this

[18]For a detailed description of the GSOEP see Schupp and Wagner (2002), Haisken-DeNew and Frick (2003), and Wagner et al. (2007).

[19]All questionnaires, in German and in English, are available online at http://panel.gsoep.de/soepinfo2008/.

section derive from the mother-child questionnaires which collect information on children between age 2 and 3. They contain questions on the child's health, including height and weight, and most importantly, on the child's adaptive behavior. Data have been collected in 2005, 2006, and 2007.

Height and weight as well as the assessments of the child's adaptive behavior are reported by the mother. Due to the German health-care system for infants, misreporting of height and weight should not be an issue: Height and weight of infants are measured on a regular basis due to mandatory (and free of charge) preventive medical check-ups. At each check-up, the anthropometric measures are updated in a medical record booklet which is kept by the family. Cawley and Spiess (2008) report that 98 percent of the GSOEP children take part in these regular check-ups.

Mothers are asked to indicate the level of a variety of developmental outcomes for their child. The outcomes collected in the GSOEP are a modified version of the German Vineland scale that has been developed to study children's behavioral development in Germany (see Tietze, 1998).[20] More precisely, mothers are asked to rate their child's ability in performing different tasks in four domains: social skills, verbal skills, motor skills, and activities of daily living. We discard the domains *motor skills* and *daily activities* because we assume that these noncognitive abilities will not affect future educational attainment. This choice is based upon the studies of Cunha and Heckman (2008, 2009) which show that noncognitive skills developed during early childhood are strong determinants of later educational attainment and labor market outcomes. In fact, their studies include, among

[20]See Sparrow et al. (1984) for the original Vineland scale. Schmiade et al. (2008) use the GSOEP mother-children data and study the instrumental quality (reliability, validity, and sensitivity) of the 20-item mother questionnaire on the adaptive behavior of their children in the domains of language, everyday skills, motor skills, and social relationships. They conclude that the conditions of objectivity and reliability are largely fulfilled. Furthermore, they find that the scale is valid and that it is sensitive with respect to children's age.

others, personality traits such as antisocial behavior and peer problems which are similar to our measure of social skills.[21]

Mothers are asked to indicate their child's abilities with "yes", "to some extent" or "no." Our dependent variables *social skills* and *verbal skills* equal the number of "yes"-answers across the five tasks of the respective domain. Thus, the dependent variables can range from zero to five. Given the categorical nature of the dependent variables, we employ ordered probit models to examine the relationship between height and social and verbal skills.[22]

Explanatory variables include height, health status, age of the child, age of the mother, educational attainments of the parents, and net household income. A recent paper by Cawley and Spiess (2008)—employing the same dataset—shows that obesity is correlated with social and verbal skills. Thus, we present our results both with and without an indicator for obese children. Obesity is defined according to clinical weight classifications using standard reference values for German children (see Kromeyer-Hauschild et al. 2001). Children are defined as obese if their body mass index (BMI) is above the historic 97th percentile. According to this definition, 7.0 percent of the boys and 10.3 percent of the girls in the sample are obese.

Table 3 presents descriptive statistics by sex. The sample consists of 330 boys and 340 girls. The means of the two dependent variables, *social skills* and *verbal skills*, are large for both sexes: the mean score of social skills is 3.9 for boys and 4.2 for girls. Average verbal skills is 4.1 for boys and 4.2 for girls. Boys are slightly taller than girls and the standard deviations of height are very similar across sexes. We also control for bad health status of

[21]Tasks in the domain *social skills* include the child's ability in (i) calling familiar people by name, (ii) participating in games with other children, (iii) getting involved in role-playing games, (iv) showing a preference for certain friends, and (v) calling own feelings by name. The domain *verbal skills* includes the abilities in (i) understanding brief instructions, (ii) forming sentences with at least two words, (iii) speaking in full sentences (with four or more words), (iv) listening attentively to a story for five minutes or longer, and (v) passing on simple messages.

[22]Standard OLS regressions yield very similar results.

the child because serious or chronic illnesses might affect the development of both body height and social and verbal skills. The binary variable *Health status* equals 1 if the mother reported at least one of the following illnesses for her child: asthma, chronic bronchitis, spastic/acute bronchitis, hearing impairment, nutritional disorders, or motor impairment.

4.2 Results

Ordered probit estimates in Table 4 show that taller boys tend to have higher social skills than shorter boys (Column 1). Controlling for obesity does not change the result qualitatively, though the point estimate of height becomes slightly smaller (Column 2). The magnitude of the height effect is economically significant: A one standard deviation increase in height is associated with a 5.6 percentage points increase in the probability that the social skills index equals the highest value. Compared with a predicted baseline probability of 37.9 percent, this effect amounts to a 14.8 percent higher probability that a boy's social skills are maximum.[23] In line with our height-school premium findings, there is no significant relationship between height and social skills for girls. A bad health status is not significantly related to social skills for either boys or girls. Furthermore, the estimates reveal some structural differences between boys and girls that are difficult to explain. The presence of more siblings in the household, for example, is negatively related to social skills for boys, but positively related to social skills for girls. Similarly, household income is positively associated with social skills for boys but not for girls.[24] Yet, as expected, attending a day-care center is positively related to social skills for both sexes.

Table 5 reports ordered probit results for children's verbal skills. There is no significant association between height and verbal skills for boys (Columns 1 and 2). For girls, the association is positive and significant only when obesity is not taken into account

[23]This marginal effect was computed for a 3-year-old boy with average male height, with a 33-year-old mother living in West Germany.

[24]Cawley and Spiess (2008) find similar differences across sexes.

(Columns 3 and 4). Obesity and verbal skills are significantly negatively related for both boys and girls, as was documented by Cawley and Spiess (2008). As expected, bad health is a strong predictor of low verbal skills for both boys and girls. This finding holds even when the negative impact of obesity is taken into account. The sex-specific differences of the other control variables described above are also present with verbal skills as dependent variable.

In sum, we find that taller boys have significantly higher social skills than shorter boys already at age 2 to 3, independent of health status, parental education, family income, and attendance of a day care center. This relationship is not present for girls. It is noteworthy that the same gender pattern exists for the relationship between height and the attendance/ recommendation of high school.

5 Discussion

Pure discrimination against short students could be one mechanism behind the height-school premium. Yet, another possible explanation—consistent with our findings—is that teachers reward higher social skills. This explanation would be consistent also with recent research which shows that social skills are strong predictors of educational attainment and labor market outcomes (Cunha and Heckman, 2008, 2009).

Since our empirical analysis is based on two distinct datasets, establishing this finding requires two bridge hypotheses. First, social skills are persistent over time, that is, children with higher social skills at age 3 tend to have higher social skills also at age 10. Cunha and Heckman (2009, p. 12) present evidence for this assumption when they stress that the formation of social skills originates before formal schooling begins and that differences across individuals persist throughout childhood. Psychologists have conducted longitudinal studies to investigate the persistence of personality traits from early childhood into adulthood.

They consistently find that differences in personality traits at age 3, such as extraversion, are predictors of personality differences in adolescence and adulthood (see, for example, Caspi and Silva, 1995; Caspi, 2000; Newman et al., 1997; Roberts and DelVecchio, 2000).

The second bridge hypothesis is that individuals maintain their *relative* height position: Children who are relatively tall at age 3 are relatively tall at age 10. Studies on human biology report a strong correlation between height during childhood and adult height. Tanner et al. (1956) document very large *intra*-individual correlation coefficients of body height between age 2 and age 5 ($\rho = 0.83$) and age 3 and age 5 ($\rho = 0.87$). Furthermore, they show that height at age 3 is the best predictor of adult height ($\rho = 0.80$) among all height measurements up to age 5.[25] Case and Paxson (2008a) also report a strong association between height at age 3 and adult height, with a correlation coefficient greater than 0.7 for both males and females.

In the light of this evidence, it is reasonable to assume that the positive relationship between height and social skills observed for boys aged 2 to 3 is likely to persist up to age 10. Thus, it is possible that social skills affect the crucial secondary school track decision.

Findings from the psychological literature add to the understanding why height is positively related to social skills and why this relationship is stronger for boys than for girls. The physical appearance of children (for example, height) influences the way in which they are perceived by adults and also modifies their self-perception. This mechanism is expected to be stronger among males than females because height is a physical attribute that corresponds more closely to masculinity than femininity (Melamed, 1992). Eisenberg et al. (1993) find that teachers' ratings of constructive coping and attentional control in preschool are positively related to social skills among boys but not among girls. Eisenberg et al. (1984) provide evidence that mothers of preschool children rate tall boys as more

[25] All figures refer to males. Figures for females are very similar.

competent than short boys as well, whereas this pattern is less clear for girls. Villimez et al. (1986) find that teacher attributions of academic competence for older girls were *negatively* related to height, whereas teacher ratings of older boys' academic performance was *positively* related to height. Finally, Smith and Niemi (2007) report that, at the start of kindergarten, teachers underrate the ability of boys who are shorter than the perceived height norm.

6 Conclusion

In this paper, we examine the relationship between body height and secondary school track decision for pre-teen children in Germany. First, we find that—ceteris paribus—taller boys are more likely to attend the most academic secondary school track (Gymnasium) than shorter boys. Second, we find that this relationship is due to primary school teachers giving "better" school recommendations to taller boys, independent of their academic achievement. In addition, we find that height is positively associated with social skills already at age 2 to 3. Given the time persistence of the relationship between height and social skills, it is possible that teachers give better recommendations to taller students as they observe higher social skills. We show that both the height-school premium and the height-social skills relationship are significant only for boys. Our findings are in line with recent research about the early development of noncognitive skills as an important factor of future educational success (Cunha et al., 2006; Cunha and Heckman, 2007).

Besides investments in early childhood, the institutional setting of the school system is another factor that might affect educational outcomes. In Germany, students are sorted into different educational paths at about age 10. This secondary school track decision is crucial because it strongly determines students' future labor market outcomes. In fact, critics of the tracking school system argue that students in low-ability classes are system-

atically disadvantaged by worse learning environments which increase the skill gap across ability groups. Furthermore, they argue that the tracking decision—which partly depends on student's family background—will increase disadvantages for students with a low socioeconomic background. Hanushek and Woessmann (2006), for instance, present evidence that early tracking increases educational inequality, measured as the country-specific dispersion of test scores obtained in international student achievement tests. Our results imply that (early) school tracking might not only be detrimental for students with a low socioeconomic background but possibly also for students with low social skills.

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Tables

Table 1: Descriptive Statistics (Youth Panel)

	Males		Females	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Secondary School Track				
General or Intermediate School	0.455		0.389	
High School	0.545		0.611	
Teacher Recommendation				
General or Intermediate School	0.439		0.363	
High School	0.561		0.637	
Height in cm	148.2	7.3	148.4	7.5
School Grade (in wave 3)				
5th Grade	0.307		0.248	
6th Grade	0.693		0.752	
Age at end of 4th grade	10.5	0.4	10.4	0.4
Early Primary School Enrollment	0.069		0.075	
Delayed Primary School Enrollment	0.032		0.031	
Small town (< 20,000 people)	0.429		0.385	
School Performance in Primary School				
Math	1.68	0.66	1.94	0.67
Orthography	2.22	0.79	1.88	0.73
Reading	1.76	0.62	1.58	0.64
Mother's Education				
General School	0.222		0.217	
Intermediate School	0.450		0.398	
High School	0.328		0.385	
University (of applied sciences) Degree	0.212		0.217	
High Household Income	0.249		0.217	
Observations	189		226	

Notes: *General school* is Hauptschule, *intermediate school* is Realschule, and *high school* is Gymnasium. *School Performance in Primary School* was reported by the mother when the child was either in 3rd or 4th grade of primary school. Mothers' performance assessments range from 1 (very good) to 4 (not good at all). *High Household Income* equals 1 if the monthly net household income exceeds 3250 €.

Table 2: Relationship between Height, Secondary School Track, and Teacher Recommendation (Youth Panel)

	Males		Females	
Dependent Variable:	Secondary School Track	Teacher Recommendation	Secondary School Track	Teacher Recommendation
	(1)	(2)	(3)	(4)
Height	0.041**	0.042**	0.009	–0.007
	(0.019)	(0.020)	(0.016)	(0.016)
Math: Very Good	1.537***	2.188***	2.294***	2.378***
	(0.467)	(0.610)	(0.433)	(0.446)
Math: Good	0.290	1.306**	1.384***	1.364***
	(0.478)	(0.611)	(0.361)	(0.338)
Orthography: Very Good	1.855***	2.081***	1.013**	1.433***
	(0.513)	(0.521)	(0.449)	(0.446)
Orthography: Good	1.113***	1.598***	0.665*	0.490
	(0.308)	(0.335)	(0.356)	(0.325)
Reading: Very Good	0.251	0.887	0.683	0.998*
	(0.605)	(0.689)	(0.517)	(0.517)
Reading: Good	0.391	0.871	–0.118	0.543
	(0.551)	(0.639)	(0.472)	(0.476)
Age at end of 4th grade	0.180	0.118	–0.312	–0.035
	(0.360)	(0.365)	(0.362)	(0.350)
Early school enrollment	0.309	0.509	–0.256	0.353
	(0.630)	(0.601)	(0.483)	(0.474)
Late school enrollment [a]	—	–1.077	–0.317	–0.374
		(0.727)	(0.663)	(0.629)
Small town/countryside	Yes	Yes	Yes	Yes
State dummies	Yes	Yes	Yes	Yes
Mother's education	Yes	Yes	Yes	Yes
High household income	Yes	Yes	Yes	Yes
Observations	183 [a]	189	226	226
Pseudo R-Squared	0.494	0.511	0.460	0.453

Notes: Coefficients from probit models reported with standard errors in parentheses. The dependent variables *Secondary School Track* and *Teacher Recommendation* equal 0 for general school (*Hauptschule*) and intermediate school (*Realschule*), and equal 1 for high school (*Gymnasium*). Reference categories for mother's performance assessments are "Not so good" and "Not good at all." *State dummies*, due to the small sample size, are constructed as follows: Bayern, Baden-Würrtemberg, Hessen & Rheinland-Pfalz; all East German states; Niedersachen & Bremen; Schleswig-Holstein & Hamburg. *Mother's Education* includes the following dummy variables: intermediate school, high school, and University/University of Applied Sciences Degree. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

[a] *Late school enrollment* predicts outcome perfectly in Column (1). 6 observations dropped.

Table 3: Descriptive Statistics (GSOEP)

	Males		Females	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Social skills	3.9	1.2	4.2	1.0
Verbal skills	4.1	1.1	4.2	1.0
Height (in cm)	95.2	6.4	93.6	6.7
Obesity	0.070		0.103	
Health status	0.233		0.141	
Child in day care center (more than 4 hrs per week)	0.391		0.371	
Age of child (in months)	33.7	4.1	33.4	3.9
Age of mother (in years)	33.4	5.7	33.5	5.4
Mother is immigrant	0.161		0.141	
Number of other children in household	0.9		0.9	
West Germany	0.764		0.768	
Single parent household	0.091		0.109	
Net monthly household income (in Euro)	2754	1507	2774	1567
Mother's Education				
No school degree	0.024		0.006	
General school	0.148		0.165	
Intermediate school [a]	0.442		0.474	
High school	0.342		0.321	
Vocational training	0.645		0.688	
University (of applied sciences) degree	0.224		0.218	
Father's Education				
Vocational training	0.597		0.544	
University (of applied sciences) degree	0.233		0.250	
Observations	330		340	

Notes: The outcome variables *Social skills* and *Verbal skills* are indices based on mother's information. The indices range from 0 to 5. *Health status* is a dummy variable that takes on the value 1 if the mother reported at least one of the following illnesses for her child: asthma, chronic bronchitis, spastic/acute bronchitis, hearing impairment, nutritional disorders, or motor impairment.
[a] Also contains the category *Other school degree*.

Table 4: Relationship between Social Skills and Height during Early Childhood (GSOEP)

Dependent variable: Social skills	Males		Females	
	(1)	(2)	(3)	(4)
Height (in cm)	0.031***	0.023**	0.013	0.007
	(0.011)	(0.011)	(0.010)	(0.011)
Obesity	—	–0.596**	—	–0.337
		(0.252)		(0.221)
Health status	–0.110	–0.122	0.053	0.070
	(0.146)	(0.146)	(0.186)	(0.187)
Child in day care center (more than 4 hrs per week)	0.293*	0.266*	0.260*	0.287*
	(0.154)	(0.154)	(0.158)	(0.159)
Age (in months)	0.114	0.058	0.303	0.306
	(0.217)	(0.219)	(0.207)	(0.207)
Age squared	–0.001	–0.000	–0.004	–0.004
	(0.003)	(0.003)	(0.003)	(0.003)
Age of mother (in years)	0.002	0.004	–0.024*	–0.024*
	(0.014)	(0.014)	(0.014)	(0.014)
Mother is immigrant	0.178	0.209	–0.398**	–0.401**
	(0.183)	(0.184)	(0.195)	(0.195)
Number of other children in household	–0.208***	–0.207***	0.214***	0.222***
	(0.072)	(0.072)	(0.075)	(0.076)
West Germany	–0.270	–0.303*	0.043	0.069
	(0.182)	(0.183)	(0.181)	(0.181)
Single parent household	0.249	0.283	–0.969***	–0.914***
	(0.337)	(0.338)	(0.326)	(0.328)
Net monthly household income (in 1000 Euro)	0.150***	0.148***	–0.026	–0.020
	(0.057)	(0.057)	(0.047)	(0.047)
Parents' Education	Yes	Yes	Yes	Yes
Indicator for imputed income	Yes	Yes	Yes	Yes
Observations	330	330	340	340
Pseudo R-Squared	0.059	0.065	0.055	0.057

Notes: Ordered probit coefficients reported with standard errors in parentheses. The dependent variable *Social skills* is an index which ranges between 0 and 5 for boys and between 1 and 5 for girls. *Obesity* is a binary variable indicating obese children according to the German clinical definition. *Parents' Education* contains the following dummy variables: mother has no school degree, mother has general school degree, mother has high school degree, school degree of mother missing; mother completed vocational training; mother completed university degree; father completed vocational training; father completed university degree; mother education missing, father education missing. *Health status* is a dummy variable that takes on the value 1 if the mother reported at least one of the following illnesses for her child: asthma, chronic bronchitis, spastic/acute bronchitis, hearing impairment, nutritional disorders, or motor impairment. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Table 5: Relationship between Verbal Skills and Height during Early Childhood (GSOEP)

Dependent variable: Verbal skills	Males		Females	
	(1)	(2)	(3)	(4)
Height (in cm)	0.012	–0.001	0.023**	0.016
	(0.011)	(0.011)	(0.010)	(0.011)
Obesity	—	–0.923***	—	–0.392*
		(0.259)		(0.219)
Health status	–0.369**	–0.399***	–0.433**	–0.416**
	(0.150)	(0.151)	(0.186)	(0.187)
Child in day care center (more than 4 hrs per week)	0.288*	0.239	0.163	0.195
	(0.162)	(0.163)	(0.166)	(0.167)
Age (in months)	0.364	0.277	0.115	0.121
	(0.228)	(0.232)	(0.238)	(0.240)
Age squared	–0.004	–0.003	–0.001	–0.001
	(0.003)	(0.003)	(0.004)	(0.004)
Age of mother (in years)	0.035**	0.039***	–0.025*	–0.024*
	(0.014)	(0.014)	(0.014)	(0.014)
Mother is immigrant	0.099	0.149	–0.604***	–0.614***
	(0.188)	(0.189)	(0.197)	(0.198)
Number of other children in household	–0.219***	–0.222***	0.248***	0.259***
	(0.074)	(0.074)	(0.076)	(0.076)
West Germany	–0.017	–0.079	0.328*	0.363*
	(0.188)	(0.189)	(0.187)	(0.188)
Single parent household	0.445	0.516	–1.071***	–1.017***
	(0.344)	(0.347)	(0.328)	(0.330)
Net monthly household income (in 1000 Euro)	0.044	0.042	–0.104**	–0.100**
	(0.058)	(0.058)	(0.048)	(0.048)
Parents' Education	Yes	Yes	Yes	Yes
Indicator for imputed income	Yes	Yes	Yes	Yes
Observations	330	330	340	340
Pseudo R-Squared	0.092	0.106	0.112	0.116

Notes: Ordered probit coefficients reported with standard errors in parentheses. The dependent variable *Verbal skills* is an index which ranges between 0 and 5. *Obesity* is a binary variable indicating obese children according to the German clinical definition. *Parents' Education* contains the following dummy variables: mother has no school degree, mother has general school degree, mother has high school degree, school degree of mother missing; mother completed vocational training; mother completed university degree; father completed vocational training; father completed university degree; mother education missing, father education missing. *Health status* is a dummy variable that takes on the value 1 if the mother reported at least one of the following illnesses for her child: asthma, chronic bronchitis, spastic/acute bronchitis, hearing impairment, nutritional disorders, or motor impairment. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

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