

Discussion Paper No. 07-051

**Duration and Intensity of  
Kindergarten Attendance and  
Secondary School Track Choice**

Tim Landoigt, Grit Muehler, and Friedhelm Pfeiffer

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Zentrum für Europäische  
Wirtschaftsforschung GmbH

Centre for European  
Economic Research

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## Non-technical summary

By exposing children to stimulating learning environments, interaction with caregivers and peers, kindergarten may contribute to cognitive and non-cognitive skill formation as well as to the development of social competencies. When evaluating the impact of kindergarten, it is necessary to distinguish between countries with publicly provided “special” early childhood intervention programmes and countries with a high share of public provision within “normal” institutional child care settings as their scope and therefore their impacts naturally differ. Regarding kindergarten, as the institutional child care setting which is reality for most German children nowadays, evidence becomes more mixed, however. Positive effects occur due to the fact that children when exposed to a stimulating learning environment at young ages, develop their cognitive and non-cognitive capacity in a manner which is never achieved again later on. On the contrary, negative effects may result from separation and absenteeism of the parents. Furthermore, the child care exposure itself may cause child aggression and non-compliance leading to delinquency or even criminal behavior later on. All of these effects can be shown to depend heavily on the quality of the kindergarten and its interaction between children’s characteristics as well as parental investments and behavior.

In this paper, we disentangle the two dimensions of kindergarten attendance, duration and intensity. Analyzing several specifications and different combinations of length and intensity, allows us to explicitly take into account the institutional diversity of child care settings. Thus, we can assess whether longer care exposure, either in terms of years of education or in terms of daily care time, is associated with attending the highest secondary school track. Our results show that kindergarten non-attendance and kindergarten full-day attendance are associated with a significantly lower probability to attend the highest secondary school track. However, we can also show that children attending kindergarten full-day have a specific family profile which is similar to children who never attend any kind of institutional child care. Compared to (half-day) kindergartners, the mother is less educated, family income is lower and they are more likely to live in non-German families. School track choice therefore results from a combination of both, family background characteristics and kindergarten outcomes. The negative results for full-day attendance when controlling for these characteristics could be an indication that full-day kindergarten attendance does not compensate enough for the missing educational stimulation at home.

# Duration and Intensity of Kindergarten Attendance and Secondary School Track Choice

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July 31, 2007

## Abstract

This paper investigates the relationship between kindergarten attendance and secondary school track choice in West-Germany. Our analysis is based on a panel of 12 to 14-year olds with information from age two on, drawn from the German SocioEconomic Panel (GSOEP) 1984–2005. We estimate binary probit models to assess the impact of the duration (in years) and the intensity (half-day or full-day) of kindergarten attendance. Our results indicate that kindergarten non-attendance is associated with a significantly lower probability to attend the highest secondary school track (“Gymnasium”). Further, full-day attendance is associated with a decreasing probability of attending the highest secondary school track for every duration of preschool child care. Thus, intensity seems to matter more than duration.

**Keywords:** kindergarten, preschool education, school placement

**JEL-classification:** I21, J12, J13

**Acknowledgements:** We would like to thank the “Förderkreis Wissenschaft und Praxis am Zentrum für Europäische Wirtschaftsforschung e.V.” for the financial support. Friedhelm Pfeiffer acknowledges financial support from the German Research Foundation under grants PF 331/2 (“Microeconomic Methods to Assess Heterogeneous Returns to Education”) and PF 331/3 (“Wages, Rent-Sharing and Collective Wage Bargaining”). We thank Andreas Ammermueller, Kathrin Goeggel, Philippe Mahler, Maresa Sprietsma, Henrik Winterhager and seminar participants at the universities of Zurich and Freiburg for helpful comments. All remaining errors are ours.

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# 1 Introduction

Recent empirical evidence from neurobiology, developmental psychology and educational economics states that early childhood education is especially important for later skill formation (for a summary see e.g. Cunha, Heckman, Lochner, and Masterov, 2006). Adequate skill formation prior to elementary school may not only extend the period of investment in human capital but may also rise later returns to education. Early child care such as kindergarten intends not only to care for children but also to prepare children for school. By exposing children to stimulating learning environments, interaction with caregivers and peers, kindergarten may contribute to cognitive and non-cognitive skill formation as well as to the development of social competencies.

When evaluating the impact of kindergarten, it is necessary to distinguish between countries with publicly provided “special” early childhood intervention programmes and countries with a high share of public provision within “normal” institutional child care settings as their scope and therefore their impacts naturally differ. Literature, especially in the U.S. and U.K., is quite vast for special intervention programmes (for an overview Currie, 2001) and generally attests substantially positive effects, especially for children from disadvantaged backgrounds (e.g. Belfield, Nores, Barnett, and Schweinhardt, 2005). Regarding kindergarten, as the institutional child care setting which is reality for most German children nowadays, evidence becomes more mixed, however. Positive effects occur due to the fact that children when exposed to a stimulating learning environment at young ages, develop their cognitive and non-cognitive capacity in a manner which is never achieved again later on (e.g. Lamb, 1998; Magnuson, Ruhm, and Waldfogel, 2007). On the contrary, negative effects may result from separation and absenteeism of the parents (e.g. Waldfogel, 2002; NICHD, 1997). Furthermore, the child care exposure itself may cause child aggression and non-compliance leading to delinquency or even criminal behavior later on (e.g. NICHD, 1998; Belsky, 2001; Phillips and Adams, 2001). All of these effects can be shown to depend heavily on the quality of the kindergarten (e.g. Love, Schocet, and Meckstroth, 1996; Blau and Mocan, 2002) and its interaction between children’s characteristics as well as parental investments and behavior.

As early childhood education and care services in Germany are publicly provided, institutional child care is the dominant child care setting (Bien, Rauschenbach, and Riedel, 2006). The type of center-based care and the share of children attending it depends mainly on child’s age. Originally, there have been separate institutions for infants and toddlers up to the age of three (“Kinderkrippe”), such for children from three to six (“Kindergarten”) and for out-of-school care up to the age ten or twelve (“Kinderhort”). Over the last years especially the states in the eastern part of Germany overcame this splitting in favor of age-mixed child care settings (“Kindertagesstätten”) which may cover two to all of the age

groups mentioned before. In West-Germany the classical kindergarten is still the dominant child care setting. The coverage rate of child care in Germany differs considerably between East and West Germany. Prior to re-unification the coverage in the East was 100 percent in full-day care whereas in West Germany 70 percent of the children from the population group of three to six years of age were cared for in an institutional child care setting. In 2002, 88 percent of children in West-Germany could attend kindergarten, whereas East-Germany shows a coverage rate of 105 percent indicating an over-supply of child care places (Statistisches Bundesamt, 2004).

Secondary school in Germany is organized in a three-track system. Selection into one of the three different school tracks takes place directly after the four years of primary education. Deciding for one of the tracks consequently leads to the attendance of the corresponding school type: higher secondary school (“Gymnasium”) with additional eight or nine years of education, intermediate secondary school (“Realschule”) with additional six years of schooling and lower secondary school (“Hauptschule”) with additional five years of schooling. The school types differ not only in the amount of schooling provided but also in leaving certificates. Only the degree obtained by attending the highest secondary school track permits entering university directly. The degree of the intermediate track qualifies for the apprenticeship system but offers as well the possibility to proceed to the higher level school after completion. In contrast to that, the lowest secondary school track is a general education secondary school which is compulsory for all pupils who do not transfer to the two other schools types. Although the degree qualifies as well for the apprenticeship system, students are faced with low employment chances upon completion (Bundesministerium für Bildung und Forschung, 2007). Therefore the probability of later labor market participation and its returns are quite different between the three school types. Especially the lowest and the highest school track do differ substantially. The track choice at ages ten or eleven is a result of parental (and child) preferences and teacher recommendation based on primary school performance.<sup>1</sup> After the initial track choice, switching between the tracks is scarce (Konsortium Bildungsberichterstattung, 2006)<sup>2</sup> It is possible however, and some federal states postpone switching between tracks by offering a six year primary school or an orientation period (“Orientierungsstufe”) in the first two years of secondary schooling.<sup>3</sup> To sum up, given that entering the highest secondary school track is important for tertiary education and the fact that switching between tracks is

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<sup>1</sup> Although all federal states aim at a co-operation between primary school teacher and parents when deciding for the secondary school track, the bindingness of the teacher recommendation and the conditions of admission in case of divergent opinions differ between the federal states.

<sup>2</sup> In the school year 2004/2005, 2.9 percent of the school children between grades 7 and 9 (which is equivalent to ages 12 to 14) change the school track chosen after primary school; 60 percent of them to a lower school track.

<sup>3</sup> In the federal states of Berlin and Brandenburg primary school goes up to the sixth grade, i.e. age 12. Until 2004 and 2005 respectively, Lower Saxony and Bremen had a 2 year orientation period after primary school.

possible but unlikely, school track choice is a valuable outcome variable to look at.

There are several studies, all based on the German Socio-Economic Panel (GSOEP), which investigate the determinants of secondary school track choice. Most of them focus on the impact of parental education (Dustmann, 2004), income (Tamm, 2007; Schneider, 2004; Jenkins and Schluter, 2002) or family structure (Mahler and Winkelmann, 2006; Francesconi, Jenkins, and Siedler, 2005) on school outcomes. Three studies concentrate on evaluating the relationship between kindergarten placement and school performance. Buechel, Spiess, and Wagner (1997) and Spiess, Buechel, and Wagner (2003) estimate a binary probit model for two samples: West German children and foreigners. Both studies find no influence of kindergarten attendance on the probability for the higher secondary school track (Gymnasium) for German children but a significantly positive relationship for immigrants. By applying a multinomial logit model and a Heckman selection model, Becker and Lauterbach (2004) find no significant relation between kindergarten attendance and later school track selection, neither for German nor for foreign children. The only study evaluating the association between the length of kindergarten attendance and attendance of the lowest secondary school track is Buechner and Spiess (2007). They find a negative association between the duration of kindergarten attendance and the probability to attend the lowest secondary school track.

In this paper, we disentangle the two dimensions of kindergarten attendance, duration and intensity. Analyzing several specifications and different combinations of length and intensity, allows us to explicitly take into account the institutional diversity of child care settings. Thus, we can assess whether longer care exposure, either in terms of years of education or in terms of daily care time, is associated with attending the highest secondary school track. Our results show that kindergarten non-attendance and kindergarten full-day attendance are associated with a significantly lower probability to attend the highest secondary school track. However, we can also show that children attending kindergarten full-day have a specific family profile which is similar to children who never attend any kind of institutional child care. Compared to (half-day) kindergartners, the mother is less educated, family income is lower and they are more likely to live in non-German families. School track choice therefore results from a combination of both, family background characteristics and kindergarten outcomes. The negative results for full-day attendance when controlling for these characteristics could be an indication that full-day kindergarten attendance does not compensate enough for the missing educational stimulation at home.

The remainder of this paper is organized as follows. Section 2 summarizes data, sample and explanatory variables. Section 3 outlines the empirical model. Section 4 presents results and discussion and section 5 concludes.

## 2 Data and Sample

The German Socio-Economic Panel (GSOEP) 1984–2005 is a representative panel that collects data on the household level for a wide range of topics including individual and family background as well as kindergarten and school experience (for further details see Haisken-DeNew and Frick, 2005). These households and new households formed by the original head, spouse and their children have been followed since 1984. For the purpose of evaluating preschool attendance and later school type selection, we mainly rely on the information provided by the parents through the household questionnaire. Therefore the main information we assemble, is whether a child has attended institutional child care, in which duration and intensity, and what secondary school type it currently visits. To account for differences in the availability and perception of kindergarten in the former East Germany, we restrict our sample to West-German children. Table A.1 provides an overview of the explanatory and other control variables which we will use in the empirical analysis.

We impose two restrictions when constructing our sample. First, secondary school track choice must be observed and second, we need the information on the childhood. As secondary school track choice takes place between ages ten and fourteen, we include all individuals for which we can observe a choice between one of the three distinct tracks up to age fourteen.<sup>4</sup> In practice, this means that for each wave of the GSOEP we identify the 10 to 14-year-olds whose households were present in the panel since the year they have been two years old. In doing so, we cover the whole age interval from the year prior to kindergarten entry (age two) to the years where school track choice takes place (latest at age 14). Since the GSOEP consists of 22 waves beginning in 1984, the earliest birth cohort we can include is the one from 1982 (because they were two in 1984). The latest birth cohort we can include are the twelve-year-olds (born in 1993) as this is the youngest cohort for which we can observe track choice in 2005. Thus, our panel consists of 1,332 observations, 1,272 kindergartners and 60 non-kindergartners; 489 attending the highest secondary school track and 843 do not.

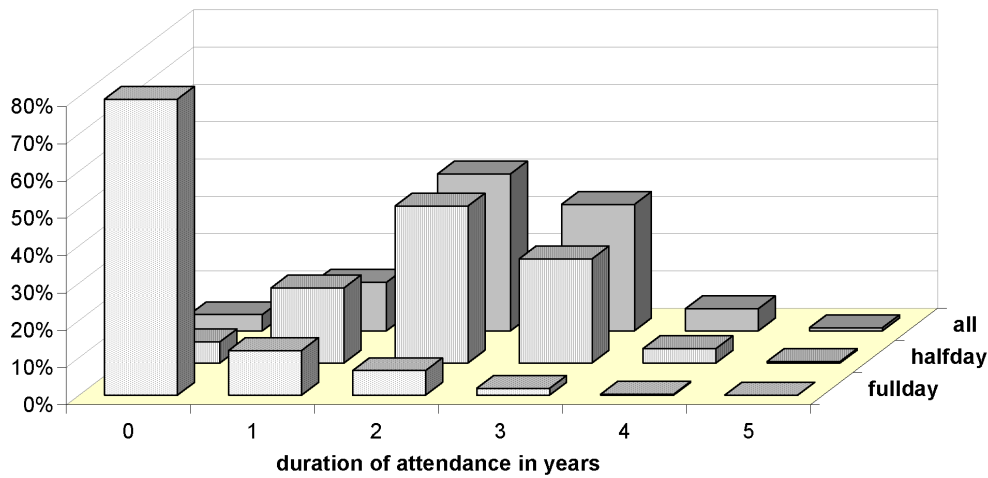
A first look at the duration of kindergarten attendance of the children in our sample reveals that only 4 percent never experience an institutional child care setting before they enter school (see Figure 1 and Table A.2). This number is a bit lower than stated

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<sup>4</sup> Preference is given to the initial track choice after primary school. We do also include children who pass the two year orientation period and then switch to one of the tracks, i.e. at age 12. 14-year olds which attend comprehensive schools or schools combining the lowest and intermediate track are excluded as their outcome in terms of secondary school type cannot be measured. Although we allowed for track choice to happen between ages 10 and 14, the youngest cohort for which we can observe it are twelve year olds. As the school year starts in September and the GSOEP information is gathered in April the year after, the information becomes visible in the data at a later age than the transition from primary to secondary school took place.



Figure 1: share of children for the different durations of kindergarten, half-day and full-day attendance in years



in official statistics (Konsortium Bildungsberichterstattung, 2006) which show a share of about 10 percent of the four to six year olds not attending kindergarten. However, these numbers are not exactly comparable as the official statistic is sorted by age and does not show whether child care attendance took place before. Furthermore, publicly provided child care is rationed in Germany (Wrohlich, 2005) and thus might not be available for all parents who demand it (Kreyenfeld and Hank, 2000).<sup>5</sup> Considering this, our sample underestimates the share of children not in kindergarten.

Most of the children attend kindergarten for a period of two or three years and the vast majority in half-day attendance. Figure 1 compares the shares of children attending kindergarten for one to five years and plots also the length of full-day and half-day attendance. The graph shows that the majority of children attend kindergarten for two or three years and never experience any full-day setting during their kindergarten years. Regardless of which duration, half-day attendance is the dominant setting for nearly 80 percent of the children who attend kindergarten. Table 1 shows the means of our main variables of interest for the four groups: all children in our sample, those who are not in kindergarten, those who are, only full-day, only half-day and those who experience both settings during their kindergarten attendance. As Table 1 shows, non-kindergartners differ in several characteristics from children who attend institutional child care prior to school entry. Although they enter primary and secondary school at about the same age as their counterparts, they are less often observed in the highest secondary school track.<sup>6</sup>

<sup>5</sup> Since 1996 parents can legally claim a half-day care slot when their child turns three. A large share of the children in our sample went to kindergarten before that year and are thus unaffected by the reform.

<sup>6</sup>Note that, although compulsory school starts at age six in Germany, only 50 percent of the Germany

They live in families with a lower income, where more than half of the mothers do only have the lowest or no school degree. Only 15 percent of the mothers in this subsample work half-time and only 3 percent work full-time. This corresponds to the fact that non-kindergartners have more siblings which might be one reason for the mother not to work. The children are furthermore much more often female and do have a non-German nationality.

When analyzing the sample of the children who go to kindergarten, differences between children who attend kindergarten always full-day during their childhood and children who attend kindergarten always half-day become visible. Full-day children enter kindergarten and primary school later than their half-day counterparts and do also spend less time in institutional pre-school care. They come from families with a lower income and more often from single-parent families. Mothers of those children are working more often half-time and full-time. The monthly household income is lower than for half-day children which might reflect the fact that single parents families more often rely on full-day care. Mothers have rather lower school and training degrees than the mothers of children in half-day care. Surprising is the large share of foreigners in the group of full-day children. This finding corresponds to what other studies for Germany (Bien, Rauschenbach, and Riedel, 2006) have found. One explanation for that finding could be that welfare reliance, single parenthood and low education are more prevalent among non-Germans. A second explanation might be that immigrants are provided with day care (if needed) when they participate at a German language course. As this is seen to be essential for successful integration into the work-force they are at the same time one of the highest eligible groups for a full-day slot.<sup>7</sup> To sum up, the group of full-day kindergartners seems to be more similar to the group of non-kindergartners than to the half-day attending children.

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six year-olds are actually already in primary school (Konsortium Bildungsberichterstattung, 2006). This is due to the school entry regulations which allows parents to hold back their children. Our quite high entry ages result from the fact that we report the age of the children in the year where they are firstly observed in kindergarten or school. Thus, on average children are half a year younger when they enter. Furthermore, we observe kindergarten attendance and school entry in the mid-eighties to mid-nineties where parents tended to enroll their children rather late for schooling.

<sup>7</sup> As subsidized child care is rationed in Germany, (full-day) child care slots are allocated by social criteria, the most important being workforce participation of the (single) parents.

Table 1: Means of variables

|                          | all     | not kita | in kita | half-day | full-day | mix     |
|--------------------------|---------|----------|---------|----------|----------|---------|
| kita duration            | -       | -        | 2.36    | 2.29     | 1.94     | 2.88    |
| age at kita entry        | -       | -        | 5.31    | 5.37     | 5.83     | 4.79    |
| age at school entry      | 8.13    | 8.12     | 8.13    | 8.12     | 8.49     | 8.08    |
| age at school choice     | 12.16   | 12.20    | 12.16   | 12.20    | 12.41    | 11.87   |
| gym                      | 0.37    | 0.08     | 0.38    | 0.41     | 0.18     | 0.28    |
| household income in Euro | 2150.75 | 1756.19  | 2169.36 | 2219.97  | 1764.75  | 2052.78 |
| welfare receipt          | 0.02    | 0        | 0.02    | 0.01     | 0.07     | 0.03    |
| two parents              | 0.97    | 0.98     | 0.97    | 0.98     | 0.94     | 0.97    |
| mother                   |         |          |         |          |          |         |
| age                      | 31.84   | 31.77    | 31.84   | 32.07    | 30.58    | 31.10   |
| work half-time           | 0.24    | 0.15     | 0.24    | 0.25     | 0.29     | 0.20    |
| work full-time           | 0.08    | 0.03     | 0.08    | 0.06     | 0.10     | 0.15    |
| no degree                | 0.08    | 0.25     | 0.07    | 0.07     | 0.14     | 0.04    |
| lowest                   | 0.24    | 0.38     | 0.24    | 0.21     | 0.46     | 0.30    |
| medium and training      | 0.49    | 0.37     | 0.50    | 0.50     | 0.38     | 0.51    |
| highest and training     | 0.10    | 0        | 0.11    | 0.12     | 0.01     | 0.07    |
| university               | 0.08    | 0        | 0.09    | 0.09     | 0.01     | 0.07    |
| # siblings               | 1.20    | 1.63     | 1.18    | 1.17     | 1.31     | 1.20    |
| female                   | 0.52    | 0.62     | 0.51    | 0.50     | 0.51     | 0.57    |
| foreign                  | 0.16    | 0.46     | 0.14    | 0.11     | 0.46     | 0.19    |
| N                        | 1,332   | 60       | 1,272   | 1,011    | 72       | 189     |

“Mix” states that children experience some time in both settings, half-day and full-day, during their kindergarten duration. The background characteristics are taken from the year prior to kindergarten entry. For the subsample of children which do not enter kindergarten, these are the characteristics at age three. The “age at”-variables pick up the year when the children are firstly observed in kindergarten, primary school and secondary school. That is in April the year after the kindergarten and school year started. Assuming a uniform age distribution would mean that the children are on average half a year younger when entering the institutions.

Source: GSOEP 1984–2005, own calculations.

This comparative analysis provides first insights on specific differences between children who attend kindergarten compared to those who do not, as well as between children who attend half-day versus those who only attend full-day. However, these bivariate correlations may suggest misleading conclusions. We thus turn now to a multiple regression analysis which is the objective of our empirical investigation.

### 3 Empirical model

The opportunity of further education and later employment chances depend on the school track chosen and differ substantially between the highest and the lowest track in Germany. As only graduating from the highest secondary school track permits to enter university directly, we focus our analysis on the estimation of a binary probit model. Our indicator variable  $Y_i$  is 1 if student  $i$  attends the highest school track (“Gymnasium”) and 0 if the student attends the intermediate (“Realschule”) or lowest secondary school track (“Hauptschule”).

The choice problem is described in the latent variable model

$$\begin{aligned}
 Y_i^* &= Kita'_i\gamma + X'_i\beta + \varepsilon_i & (1) \\
 Y_i &= \begin{cases} 1 & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* \leq 0 \end{cases}
 \end{aligned}$$

where  $Y_i^*$  is the latent variable which depends on a variable indicating some form of kindergarten attendance  $Kita'_i$ , a vector of children and family background characteristics  $X'$  and  $\varepsilon_i$  as the error term with zero mean and unit variance. As we want to disentangle kindergarten attendance into duration and intensity, we estimate four different models

$$M\ 1: Y_i^* = Kita'_i\gamma_1 + X'_i\beta + \varepsilon_i \quad (2)$$

$$M\ 2: Y_i^* = KitaDuration'_i\gamma_2 + X'_i\beta + \varepsilon_i \quad (3)$$

$$M\ 3: Y_i^* = Kita0'_i\gamma_1 + Kita1'_i\gamma_2 + Kita2'_i\gamma_3 + Kita4'_i\gamma_4 + Kita5'_i\gamma_5 + X'_i\beta + \varepsilon_i \quad (4)$$

$$\begin{aligned}
 M\ 4: Y_i^* &= Kita0'_i\gamma_1 + Kita1half'_i\delta_1 + Kita1full'_i\delta_2 + Kita2half'_i\delta_3 + Kita2full'_i\delta_4 \\
 &+ Kita1half1full'_i\delta_5 + Kita3full'_i\delta_6 + Kita4half'_i\delta_7 + Kita4full'_i\delta_8 \\
 &+ X'_i\beta + \varepsilon_i & (5)
 \end{aligned}$$

As a baseline specification we estimate a model where kindergarten attendance enters as a dummy variable which picks up the value one if the child has attended kindergarten for at least one year during its childhood. In Model 2, we attempt to evaluate the length of kindergarten attendance in years. As the relation between kindergarten attendance and school track choice might not be linear, Model 3 includes dummies for the years of kindergarten duration. The reference category is a three-year kindergarten period. Finally, in model 4 we add variables indicating full-day attendance. Reference category here is a three-years half-day kindergarten attendance. We estimate coefficients for the combinations for one year half- ( $Kita1half_i$ ) or full-day attendance ( $Kita1full_i$ ), two years half- ( $Kita2half_i$ ) or full-day attendance ( $Kita2full_i$ ), two years attendance with one year in half- and one year full-day care ( $Kita1half1full_i$ ), three years full-day atten-

dance ( $Kita3full_i$ ) and four or more years half-day ( $Kita4half_i$ ) and full-day attendance ( $Kita4full_i$ ).<sup>8</sup>

The kindergarten attendance coefficient might be biased if participation in preschool education depends on parental preferences in a way that our variable of interest may be correlated with unobservables. Thus, estimation results will be biased when neglecting social selectivity. Despite the richness of possible control variables provided by the GSOEP, there may be unobserved characteristics that distinguish children who attend kindergarten from their peers who do not. Presumably parents with high socio-economic background will know about the impacts of early skill formation and value kindergarten attendance more than parents from low socio-economic backgrounds. If parents from high socio-economic background also support their children more intensely by other means, our estimates might be biased upwards. As we can not separate the effect resulting from the kindergarten attendance itself from the effect resulting from parental educational preferences, we do not interpret our estimates as causal. We rather want to shed some light on the different child care settings and their relation to secondary school track choice.

In our regression setting, we observe the children in several points in time, the most important being the year prior to kindergarten entry and the year prior to school track selection. Thus, the selection of the adequate set of control variables is not straightforward. Using the set of control variables in the year prior to school track choice is the adequate approach to explain most of the variation in the track choice variable. But, the decision and duration of kindergarten attendance might influence these control variables. If, for example, kindergarten attendance allowed the mother to work, the monthly household income in the time of school choice is different than it would have been if the mother did not work. Nevertheless, the variables at both points in time are highly correlated. Since we want to analyze the relation between kindergarten attendance and secondary school track choice and assume that parental taste for education is rather stable over time, we include a set of control variables from the year prior to kindergarten entry.<sup>9</sup>

## 4 Results

The first step in our empirical strategy is the estimation of the relation between kindergarten attendance in general and secondary school track choice as stated in Model 1. We

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<sup>8</sup> The variable for four or more years of full-day attendance picks up the value one if the dominant setting is full-day care. Full-day is defined as dominant if the length of full-day attendance in years at least equals the length of half-day attendance. The results do not change when requiring the length of full-day attendance to be strictly larger than the length of half-day attendance.

<sup>9</sup> We use three different specifications with the a set of control variables from the year prior to kindergarten entry, the second with the set of controls prior to school track choice and the third with both sets. As the results do not differ substantially, we choose the first specifications for the reasons indicated in the text.

thus compare children who have been at least enrolled to kindergarten for one year during their childhood to children which never experienced any preschool education. The results of that regression are shown in the first column of Table 2.

Results show a significant positive association between kindergarten attendance and the marginal probability of attending the highest secondary school track (“Gymnasium”). The included control variables behave as expected. The coefficients for income and the education of the mother are positive and highly significant. Thus an increase in income in 1000 Euros per month increases the marginal probability of attending the highest secondary school track by about 11 percentage points. Even more important is the education of the mother. Finishing lower secondary school is already positively related to the probability of attending the highest school track compared to mothers without any school leaving certificate.<sup>10</sup> Full-time work of the mother in the year prior to kindergarten entry is associated with a significantly lower probability to attend “Gymnasium”. Furthermore, foreign children, children with siblings and boys have a significantly lower probability of attending the highest secondary school track.

However, when estimating the probit equation with a dummy for kindergarten attendance we are just able to describe the influence for children who attended kindergarten sometime between age three and age seven, regardless of the years they have actually spend in preschool care. We therefore include the duration of kindergarten attendance (in years) to analyze whether the relation might depend on the length of preschool education. The results in the second column of Table 2 show that that every additional year of kindergarten attendance is associated with a higher probability of attending the highest secondary school track. But the coefficient does not significantly differ from zero. The control variables in this regression behave as before.

However, there might be some doubt if the influence of kindergarten duration is truly linear. When using data from school entry test for the city of Osnabrueck, Becker and Biedinger (2006) found that attending kindergarten up to one year does not yield any advantages compared to non-attendance whereas there is a positive relation when attending kindergarten for more than one year. We thus employ a third specification in which the duration of kindergarten attendance enters as dummy variables. The dummy variables for each of zero to four years and more are assigned the value one if kindergarten was attended for that amount of time and zero if not. The reference category is three years attendance. Results from that specification are shown in the third column of Table 2. Our results, although not significant, confirm the finding of Becker and Biedinger. The positive relation between kindergarten attendance and school track choice is biggest for a duration of two years.

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<sup>10</sup>This variable is robust to other specifications such as years of education.

We extend the model by adding the intensity of kindergarten attendance in a fourth step. Including the intensity seems reasonable as it might not only matter for how many years children attend day care but also how many hours they stay there everyday. With the GSOEP we can observe if kindergarten is attended half-day or full-day.<sup>11</sup> We assess the intensity of the setting for each year and require the years of half-day and full-day attendance to add up to the total length of kindergarten duration. Nearly 80 percent of the children in our sample never experience any full-day setting during their years in institutional care. Six percent never experience a half-day setting and 15 percent pass through both types of intensity settings (see Table 1). The results of our fourth model are shown in Table 3. Compared to children who attend kindergarten three years half-day, attending kindergarten full-day does have a negative impact on secondary school track choice for all durations. The negative relation of full-day kindergarten compared to half-day attendance is surprising as one would expect extended ours of preschool education to be more stimulating than detrimental. However, research in that field is clearly mixed and the impact might considerably differ for children from different family backgrounds (Magnuson, Ruhm, and Waldfogel, 2007).

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<sup>11</sup> We do not make use of the information if care attendance occurs in the morning or afternoon as that information is only available for the waves from 1995 on.

Table 2: Regression results reporting marginal effects of kindergarten duration on highest secondary school track choice

| Variable                  | Coefficient and (Std. Dev.) |                      |                      |
|---------------------------|-----------------------------|----------------------|----------------------|
|                           | Model 1                     | Model 2              | Model 3              |
| KITA                      | 0.183**<br>(0.062)          |                      |                      |
| KITA DURATION             |                             | 0.017<br>(0.017)     |                      |
| KITA 0                    |                             |                      | -0.173**<br>(0.066)  |
| KITA 1                    |                             |                      | -0.019<br>(0.050)    |
| KITA 2                    |                             |                      | 0.037<br>(0.034)     |
| KITA 4                    |                             |                      | -0.015<br>(0.062)    |
| KITA $\geq$ 5             |                             |                      | 0.018<br>(0.188)     |
| INCOME                    | 0.111***<br>(0.021)         | 0.115***<br>(0.021)  | 0.110***<br>(0.021)  |
| WELFARE                   | -0.308***<br>(0.035)        | -0.308***<br>(0.037) | -0.309***<br>(0.034) |
| TWO PARENTS               | -0.125<br>(0.120)           | -0.125<br>(0.121)    | -0.132<br>(0.121)    |
| Mother                    |                             |                      |                      |
| AGE                       | 0.001<br>(0.003)            | 0.001<br>(0.003)     | 0.001<br>(0.003)     |
| WORK HALF-TIME            | -0.054<br>(0.035)           | -0.054<br>(0.035)    | -0.053<br>(0.035)    |
| WORK FULL-TIME            | -0.201***<br>(0.041)        | -0.204***<br>(0.041) | -0.199***<br>(0.041) |
| LOWEST SCHOOL DEGREE      | 0.337***<br>(0.097)         | 0.331***<br>(0.096)  | 0.329***<br>(0.097)  |
| MEDIUM DEGREE & TRAINING  | 0.396***<br>(0.082)         | 0.391***<br>(0.082)  | 0.390***<br>(0.082)  |
| HIGHEST DEGREE & TRAINING | 0.616***<br>(0.063)         | 0.614***<br>(0.063)  | 0.612***<br>(0.064)  |
| UNIVERSITY                | 0.699***<br>(0.037)         | 0.697***<br>(0.037)  | 0.697***<br>(0.038)  |
| FEMALE                    | 0.081***<br>(0.030)         | 0.078***<br>(0.030)  | 0.084***<br>(0.030)  |
| # OF SIBLINGS             | -0.080***<br>(0.018)        | -0.082***<br>(0.018) | -0.081***<br>(0.018) |
| FOREIGN                   | -0.122**<br>(0.048)         | -0.125**<br>(0.049)  | -0.122**<br>(0.049)  |
| N                         | 1,332                       | 1,332                | 1,332                |
| Pseudo $R^2$              | 0.2514                      | 0.2486               | 0.2532               |
| $\chi^2$                  | 440.29                      | 435.36               | 443.44               |

Significance levels: \* 10%, \*\* 5%, \*\*\* 1%. Further controls: city size, year and region dummies. Source: GSOEP 1984–2005, own calculations.



Table 3: Regression results reporting marginal effects of kindergarten intensity on highest secondary school track choice

|                           | Coefficient and (Std. Dev.) |         |
|---------------------------|-----------------------------|---------|
| KITA 0                    | -0.183**                    | (0.063) |
| KITA 1 HALF               | -0.021                      | (0.053) |
| KITA 1 FULL               | -0.123                      | (0.107) |
| KITA 2 HALF               | 0.021                       | (0.036) |
| KITA 2 FULL               | -0.117                      | (0.104) |
| KITA 1 HALF 1 FULL        | 0.088                       | (0.081) |
| KITA 3 FULL               | -0.141*                     | (0.067) |
| KITA $\geq$ 4 HALF        | 0.040                       | (0.071) |
| KITA $\geq$ 4 FULL        | -0.151                      | (0.086) |
| INCOME                    | 0.109***                    | (0.021) |
| WELFARE                   | -0.304***                   | (0.037) |
| TWO PARENTS               | -0.123                      | (0.120) |
| Mother                    |                             |         |
| AGE                       | 0.001                       | (0.003) |
| WORK HALF-TIME            | -0.040                      | (0.036) |
| WORK FULL-TIME            | -0.151                      | (0.044) |
| LOWEST SCHOOL DEGREE      | 0.330***                    | (0.098) |
| MEDIUM DEGREE & TRAINING  | 0.391***                    | (0.083) |
| HIGHEST DEGREE & TRAINING | 0.613***                    | (0.065) |
| UNIVERSITY                | 0.696***                    | (0.039) |
| FEMALE                    | 0.090***                    | (0.030) |
| # OF SIBLINGS             | -0.079***                   | (0.018) |
| FOREIGN                   | -0.123**                    | (0.049) |
| N                         | 1,332                       |         |
| Pseudo $R^2$              | 0.2577                      |         |
| $\chi^2$                  | 451.32                      |         |

Significance levels: \* 10%, \*\* 5%, \*\*\* 1%. Further controls: city size, year and region dummies. Source: GSOEP 1984–2005, own calculations.

To test the sensitivity of our results several robustness checks have been performed.<sup>12</sup> We first included kindergarten entry age in the estimation of Model 4 as there might be a separate influence from entering early (or late) which does not become visible in the length of kindergarten attendance. Table A.3 in the Appendix displays the results. Kindergarten entry age does not significantly affect secondary school track choice. Furthermore, including the age at the time of kindergarten entry does not substantially change the other coefficient estimates when compared to the model of Table 3.

<sup>12</sup> Besides the checks described in the text, we furthermore checked the robustness of our probit Model by performing the regressions using OLS. Although the magnitude of coefficients changes, the significant impact of not attending preschool care at all and three years of full-day care remains.

The same line of argument might hold for school entry age. Several studies found that this might significantly affect secondary school track choice (e.g. Puhani and Weber, 2005). Including additional dummy variables for the age where school attendance is firstly observed, does not change our main coefficients (see Table A.4 in the Appendix). Finally, all models have been estimated with lowest secondary school track as dependent variable. Table A.5 in the Appendix reports the results for the Model 2 specification. One additional year of kindergarten attendance is associated with a 2.8 percentage point decrease in the probability of attending the lowest secondary school type.<sup>13</sup>

Two channels seem plausible to explain the negative relationship between kindergarten non-attendance or full-day attendance and secondary school track choice. The first one is the kindergarten itself. One could argue that the negative impact of full-day attendance might be due to the pure length of the absence from the parents which might cause stress to the child in a way that negatively affects its development. This might be especially true for children with no or just one brother or sister at home. Those children might receive greater individual attention at home.<sup>14</sup> A second explanation might be that the quality of half-day and full-day settings systematically differ. As in Germany both types of care are in general carried out within the same institution, quality is likely to vary from one kindergarten to another rather than between half-day and full-day care. But if for example the more “learning oriented” activities like singing, painting or making crafts are taught in the morning and the afternoon is rather filled with free play, it might be more stimulating to the child to be with peers half-day and on its own or with the main caring parent (which is mostly the mother) for the other half. It would be desirable to use the information whether half-day attendance occurred in the morning or afternoon. Unfortunately, this information is firstly available for the waves from 1995 on which is too late with regard to our sampling design. But given the institutional framework of child care for Germany, half-day attendance means attendance in the morning for most children (Bien, Rauschenbach, and Riedel, 2006).

The second channel, which could drive the negative relation might be unobserved characteristics of the parents and the family background. Possible factors here could be problems within the family or behavior problems of the child, which could be on the one hand a reason for not attending kindergarten but on the other hand a motivation for parents to rely on non-parental care for longer hours. Child delinquency could be a result of changes

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<sup>13</sup> Although significant at the ten percent level, our coefficient is much smaller in magnitude compared to the study of Buechner and Spiess (2007). However, their sample size is with 168 observations smaller than the sample we use.

<sup>14</sup> To test for that, we included interaction terms in our Model 4 regression. Results for children with no siblings show significantly positive coefficients for children who attend kindergarten for three or more than three years half-day. Results for children with one sibling show that one year full-day attendance and two years attendance with at least one of the years full-day is associated with significantly lower probability of attending the highest secondary school track.

in the family structure. As we can observe the family structure during the whole childhood, we included changes, like the mother being unmarried, divorced or widowed, in our analysis. Besides the fact that the number of families exposed to those changes is minor, including them as controls in the regression does not change the results significantly.

As the descriptive statistics show, kindergartners are quite different from children who do not attend kindergarten. Furthermore, full-day attending children differ substantially from their half-day attending counterparts. They are much more similar to non-attending children than to half-day children. Thus, the explanation for the negative relation of non-attendance and full-day attendance might be attributable to family background characteristics. Education and family income thus might not fully-reflect the important sources on attitude towards education. Other proxies such as “numbers of books at home” as used in PISA may capture cultural capital and social status of the family more accurately. Although it is often argued that day care might have a positive influence for children from disfavored backgrounds, we do not find such evidence for the children in our sample. Children attending full-day care seem to stem more often from foreign, low-educated and low-income parental backgrounds. The negative results for full-day attendance when controlling for those characteristics could be an indication that full-day kindergarten attendance does not compensate enough for the missing educational stimulation at home. One explanation might be that the quality of kindergarten is not sufficient. The only empirical study on kindergarten quality for Germany (Tietze, 1998) shows that West-German full-day kindergarten groups vary substantially in their quality. Although 40 percent of full-day groups are attested to provide good quality, there is a considerable spread in quality between the different centers in the sample. Some of the full-day groups even fail to meet the minimal quality requirements. The authors thus conclude that West-German kindergarten groups with full-day care do have a particular need for qualification and supervision.

## 5 Conclusion

This paper examines the association between the attendance of institutional child care prior to school entry on the selection of the highest secondary school track. Our results based on longitudinal data for 12 to 14-year-olds from the German Socio-Economic Panel (GSOEP) confirm the findings of other studies (Buechel, Spiess, and Wagner, 1997; Spiess, Buechel, and Wagner, 2003; Becker and Lauterbach, 2004; Buechner and Spiess, 2007). Overall, kindergarten attendance is associated with a higher probability of attending the highest secondary school track. When disentangling the two dimensions of kindergarten attendance into duration (in years) and intensity (half-day or full-day), we can show that full-day care is associated with a decreasing probability of attending the highest secondary

school track for every duration of preschool child care. Although this seems to be counter intuitive, we can also show that children attending kindergarten full-day and half-day differ substantially in their family background. Children attending kindergarten full-day have a specific family profile which is similar to children who never attend any kind of institutional child care. Compared to (half-day) kindergartners, the mother is less educated, family income is lower and they are more likely to live in non-German families. School track choice therefore results from a combination of both, parental educational preferences and kindergarten outcomes. Studies from e.g. the U.S. have shown that disfavored children benefit most from high-quality child care programs (Belfield, Nores, Barnett, and Schweinhardt, 2005). In contrast to that, full-day kindergarten attendance in Germany seems not to compensate enough for the missing educational stimulation at home. As longitudinal studies on child care quality and child development in Germany are running for a short time (e.g. see BiKs, University of Bamberg), school and labor market outcomes are not yet available. Thus, more research should be devoted to the relationship between kindergarten quality, child development and primary school outcomes, in particular for disadvantaged children.

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# A Appendix

Table A.1: Description of variables

| Variable name             | Description   |
|---------------------------|---|
| GYM                       | dummy variable indicating whether the child attends higher secondary school                                     |
| KITA                      | dummy variable indicating whether child attended kindergarten at least one year during childhood                |
| KITA DURATION             | length of kindergarten attendance in years  |
| KITA 0                    | dummy variable indicating whether the child was not in kindergarten at all                                      |
| KITA 1                    | dummy variable indicating whether the child was in kindergarten for 1 year                                      |
| KITA 2                    | dummy variable indicating whether the child was in kindergarten for 2 years                                     |
| KITA 3                    | dummy variable indicating whether the child was in kindergarten for 3 years                                     |
| KITA 4                    | dummy variable indicating whether the child was in kindergarten for 4 years                                     |
| KITA $\geq 5$             | dummy variable indicating whether the child was in kindergarten for 5 or more years                             |
| KITA 1 HALF               | dummy variable indicating a one year half-day attendance  |
| KITA 1 FULL               | dummy variable indicating a one year full-day attendance  |
| KITA 2 HALF               | dummy variable indicating a two year half-day attendance  |
| KITA 2 FULL               | dummy variable indicating a two year full-day attendance  |
| KITA 1 HALF 1 FULL        | dummy variable indicating a two year attendance, one year half-day and one year full-day                        |
| KITA 3 FULL               | dummy variable indicating a three year half-day attendance  |
| KITA 3 FULL               | dummy variable indicating a three year full-day attendance  |
| KITA $\geq 4$ HALF        | dummy variable indicating a four or more year half-day attendance   |
| KITA $\geq 4$ FULL        | dummy variable indicating a four or more year full-day attendance   |
| Mother                    |   |
| WORK HALF-TIME            | dummy variable indicating whether the mother works half-time, i.e. less than 35 hours per week                  |
| WORK FULL-TIME            | dummy variable indicating whether the mother works full-time, i.e. more than 35 hours per week                  |
| NO SCHOOL DEGREE          | dummy variable indicating whether the mother has not finished school  |
| LOWEST SCHOOL DEGREE      | dummy variable indicating whether the mother has finished lower secondary school                                |
| MEDIUM DEGREE & TRAINING  | dummy variable indicating whether the mother has finished intermediate secondary school and vocational training |
| HIGHEST DEGREE & TRAINING | dummy variable indicating whether the mother has finished highest secondary school and vocational training      |
| UNIVERSITY                | dummy variable indicating whether the mother has finished highest secondary school and university               |
| INCOME                    | household gross-income last month (dimension 1000 Euro)   |
| WELFARE                   | dummy variable indicating whether household received welfare in the year prior to kindergarten entry            |
| TWO PARENTS               | dummy variable indicating whether the child currently lives with both parents or one parent and its partner     |
| FEMALE                    | dummy variable indicating whether the child is female   |
| # OF SIBLINGS             | variable indicating the number of siblings  |
| FOREIGN                   | dummy variable indicating whether Child has non-German nationality  |

$N=1,332$ . Further control variables: nine regional dummies indicating the federal state (reference category North-Rhine Westphalia, Lower-Saxony and Bremen as well as Rhineland-Palatinate and the Saarland were combined in one), seven city size dummies (reference category: cities with less than 2,000 inhabitants) and ten year dummies (reference year: 2000).

Source: GSOEP 1984–2005, own calculations.

Table A.2: Kindergarten duration and intensity in years

|                      | absolute & relative (in percent) |         |                     |         |                     |         |
|----------------------|----------------------------------|---------|---------------------|---------|---------------------|---------|
|                      | kindergarten duration            |         | half-day attendance |         | full-day attendance |         |
| not at all           | 60                               | ( 4.5)  | 72                  | (5.7)   | 1,011               | (79.5)  |
| one year             | 173                              | (13.0)  | 257                 | (20.2)  | 151                 | (11.9)  |
| two years            | 561                              | (42.1)  | 536                 | (42.1)  | 84                  | (6.6)   |
| three years          | 450                              | (33.8)  | 354                 | (27.8)  | 23                  | (1.8)   |
| four years           | 77                               | (5.8)   | 48                  | (3.8)   | 3                   | (0.2)   |
| more than four years | 11                               | (0.8)   | 5                   | (0.4)   |                     |         |
| Total                | 1,332                            | (100.0) | 1,272               | (100.0) | 1,272               | (100.0) |

Source: GSOEP 1984–2005, own calculations.



Table A.3: Estimation Results of Model 4 including the age where kindergarten attendance is first observed

| Coefficient and (Std. Dev.) |           |         |
|-----------------------------|-----------|---------|
| KITA 0                      | -0.194*   | (0.077) |
| KITA 1 HALF                 | -0.077    | (0.086) |
| KITA 1 FULL                 | -0.167    | (0.105) |
| KITA 2 HALF                 | -0.007    | (0.049) |
| KITA 2 FULL                 | -0.146    | (0.100) |
| KITA 1 HALF 1 FULL          | 0.058     | (0.086) |
| KITA 3 FULL                 | -0.142*   | (0.066) |
| KITA $\geq$ 4 HALF          | 0.023     | (0.086) |
| KITA $\geq$ 4 FULL          | -0.159    | (0.088) |
| <b>kita entry 3</b>         | 0.011     | (0.109) |
| <b>kita entry 5</b>         | -0.012    | (0.051) |
| <b>kita entry 6</b>         | 0.029     | (0.068) |
| <b>kita entry 7</b>         | 0.060     | (0.119) |
| <b>kita entry 8</b>         | 0.019     | (0.199) |
| INCOME                      | 0.108***  | (0.021) |
| WELFARE                     | -0.302*** | (0.037) |
| TWO PARENTS                 | -0.117    | (0.120) |
| Mother                      |           |         |
| AGE                         | 0.001     | (0.009) |
| WORK HALF-TIME              | -0.045    | (0.035) |
| WORK FULL-TIME              | -0.185*** | (0.043) |
| LOWEST SCHOOL DEGREE        | 0.329***  | (0.097) |
| MEDIUM DEGREE & TRAINING    | 0.388***  | (0.082) |
| HIGHEST DEGREE & TRAINING   | 0.616***  | (0.063) |
| UNIVERSITY                  | 0.696***  | (0.038) |
| FEMALE                      | 0.089***  | (0.029) |
| # OF SIBLINGS               | -0.080*** | (0.018) |
| FOREIGN                     | -0.121**  | (0.049) |
| N                           | 1,326     |         |
| Pseudo $R^2$                | 0.2576    |         |
| $\chi^2_{(50)}$             | 448.80    |         |

Significance levels: \* 10%, \*\* 5%, \*\*\* 1%. Further controls: city size, year and region dummies. Source: GSOEP 1984–2005, own calculations.

Table A.4: Estimation results of Model 4 including the age where school attendance is first observed

| Coefficient and (Std. Dev.) |           |         |
|-----------------------------|-----------|---------|
| KITA 0                      | -0.188**  | (0.062) |
| KITA 1 HALF                 | -0.029    | (0.054) |
| KITA 1 FULL                 | -0.120    | (0.110) |
| KITA 2 HALF                 | -0.021    | (0.037) |
| KITA 2 FULL                 | -0.122    | (0.103) |
| KITA 1 HALF 1 FULL          | 0.084     | (0.081) |
| KITA 3 FULL                 | -0.140*   | (0.066) |
| KITA $\geq$ 4 HALF          | 0.035     | (0.071) |
| KITA $\geq$ 4 FULL          | -0.154    | (0.084) |
| <b>school entry 6</b>       | 0.023     | (0.152) |
| <b>school entry 8</b>       | 0.042     | (0.039) |
| <b>school entry 9</b>       | 0.051     | (0.043) |
| <b>school entry 10</b>      | -0.019    | (0.110) |
| INCOME                      | 0.107***  | (0.021) |
| WELFARE                     | -0.304*** | (0.036) |
| TWO PARENTS                 | -0.125    | (0.120) |
| Mother                      |           |         |
| AGE                         | 0.001     | (0.003) |
| WORK HALF-TIME              | -0.042    | (0.035) |
| WORK FULL-TIME              | -0.183*** | (0.043) |
| LOWEST SCHOOL DEGREE        | 0.339***  | (0.097) |
| MEDIUM DEGREE & TRAINING    | 0.396***  | (0.082) |
| HIGHEST DEGREE & TRAINING   | 0.617***  | (0.064) |
| UNIVERSITY                  | 0.697***  | (0.038) |
| FEMALE                      | 0.088***  | (0.029) |
| # OF SIBLINGS               | -0.080*** | (0.018) |
| FOREIGN                     | -0.122**  | (0.049) |
| N                           |           | 1,329   |
| Pseudo $R^2$                |           | 0.2583  |
| $\chi^2_{(50)}$             |           | 451.42  |

Significance levels: \* 10%, \*\* 5%, \*\*\* 1%. Further controls: city size, year and region dummies. Source: GSOEP 1984–2005, own calculations.

Table A.5: Estimation results of Model 2 with lowest secondary school track as dependent variable

| Coefficient and (Std. Dev.) |           |         |
|-----------------------------|-----------|---------|
| KITA DURATION               | 0.028*    | (0.014) |
| INCOME                      | -0.161*** | (0.024) |
| WELFARE                     | 0.329***  | (0.130) |
| TWO PARENTS                 | -0.014    | (0.088) |
| Mother                      |           |         |
| AGE                         | -0.001    | (0.002) |
| WORK HALF-TIME              | 0.052     | (0.035) |
| WORK FULL-TIME              | 0.276***  | (0.064) |
| LOWEST SCHOOL DEGREE        | -0.086**  | (0.042) |
| MEDIUM DEGREE & TRAINING    | -0.211*** | (0.051) |
| HIGHEST DEGREE & TRAINING   | -0.260*** | (0.021) |
| UNIVERSITY                  | -0.284*** | (0.016) |
| FEMALE                      | -0.093*** | (0.026) |
| # OF SIBLINGS               | 0.064***  | (0.015) |
| FOREIGN                     | -0.036    | (0.037) |
| N                           | 1,332     |         |
| Pseudo $R^2$                | 0.2753    |         |
| $\chi^2_{(50)}$             | 452.74    |         |

Significance levels : \* : 10% \*\* : 5% \*\*\* : 1%  
Further controls: city size, year and region dummies.  
Source: GSOEP 1984–2005, own calculations.