FAMILY BACKGROUND OR CHARACTERISTICS OF THE CHILD: WHAT DETERMINES HIGH SCHOOL SUCCESS IN GERMANY?

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ABSTRACT

It is becoming more and more important to be highly skilled in order to integrate successfully into the labor market. Highly skilled workers receive higher wages and face a lower risk of becoming unemployed, compared to poorly qualified workers. We analyze the determinants of successful high school graduation in Germany. As our main database, we use the youth file of GSOEP for the period extending from 2000 to 2007. Because the decision as to which secondary school track to attend – general school (Hauptschule), intermediate school (Realschule) or high school (Gymnasium) – is made after the end of elementary school (Grundschule) at age of ten, parents are responsible for this decision. Therefore, the characteristics of the child as well as those of its parents are the main determinants of educational attainment. We also include the characteristics of grandparents in our regression framework, something which has not been done in any previous study so far. In order to disentangle the determinants of successful graduation at high school, we use the Cox proportional hazard model. We find markedly different determinants of successful graduation for males and females. Furthermore, the results indicate a strong linkage between mothers and daughters, as well as between fathers and sons.

INTRODUCTION

Globalization and skill biased technical change have increased the demand for highly skilled workers over the last few decades and led to a widening of the wage differential between high and low-skill workers (see Dustman 2007). In some industries, this leads to excess demand, which cannot be eradicated by the existing workforce in Germany. Low-skill workers are not suitable for filling the demand gap. In 2007, the unemployment rate of 18 % for low-skilled workers in the prime working age was five times higher than the rate for high-skilled workers. By contrast, the unemployment rate was three times higher for unskilled workers in 1999. Therefore, being highly skilled is becoming more and more important for successful integration into the labor market. Not only are wages higher for high-skilled workers, but also the risk of unemployment is lower than for low-skilled workers.

Thus, investment in formal education is extremely important. After completing elementary school (Grundschule), the decision as to which secondary school track to attend – general school (Hauptschule), intermediate school (Realschule) or high school (Gymnasium) – has to be made for ten year old pupils.[1] Thus, the division of pupils between the three school types takes place very early in Germany (see Soskice 1994, Winkelmann 1996 and Dustman 2004 for a detailed description of the German school system). Changes from a lower to a higher school type are very rare. After elementary school, teachers give a recommendation based on grades during elementary school and their personal view of the ability of the pupil, as to which school track is appropriate. Which school pupils will attend depends mainly on the decision of the parents, because children cannot decide on their own and the recommendations of teachers are not binding.[2]

Attending a university or other institution of higher education is possible after successful graduation from high school, which is usually at the age of 18-19. At the age of 15-16, pupils regularly graduate at intermediate school. If their grades are better than 2.5 (equivalent to B-C according to the American system) on average, pupils can choose to attend high school or a technical school. By allowing either of these, they can process to university Pupils who complete general school at the age of 15-16 have to earn an intermediate school equivalent certificate at a special technical school, before joining a program with the prospect of taking a school leaving exam which allows higher education attendance afterwards. Therefore, not only is there a lower level of educational training compared to intermediate and high school pupils at the age 10-15, but even good pupils from

general schools also have to overcome high hurdles in order to attend higher education institutions, because their education has not been so thorough. Especially for those pupils who did not start secondary school at the high school level, parental characteristics can account for the probability of graduating with a high school degree or equivalent.

Theoretically, education is an investment in human capital (see Becker 1964 and Mincer 1974). However, for pupils, the decision on how much to invest in human capital may be influenced heavily by their family background. Especially the father or/and mother set incentives for their child to make direct investments in education or other activities which are highly correlated with the level of human capital. However, we are not concerned about the precise manner in which parents influence the decisions of their children. We assume a decisive impact of parental characteristics on the educational attainments of their children. This assumption is supported by the literature which provides strong empirical evidence of such a relationship.

Recently, Dustmann (2004) shows that for Germany, the choice between one of the three school tracks after end of elementary school is influenced heavily by family background, particularly parental class. This holds also for subsequent career prospects of the pupils, which emphasizes the general relevance of the topic.[3] Dustman (2004) uses the German Socio-Economic Panel (GSOEP) data, which covers 4500 households with individuals born between 1920 and 1966. With PISA data from 2003 and GSOEP data from 2000 and 2001, Checci and Flabbi (2007) compare the German and Italian school system in order to determine the nature and level of institutional influence on childrens' choices. Besides a positive relationship between parental status and post secondary school choices, they report differences in the estimated coefficients by gender, as does Dustmann (2004). Nguyen and Taylor (2003) show that the effects of parental characteristics are also positive, but differ among ethnic groups and selected tracks for pupils' post-high school choices in the USA. Feinstein and Symons (1999) and Ermisch and Francesconi (2001) support these findings with similar evidence for the UK (see Li 2007 for China, Maani and Kalb 2007 for New Zealand). Chen and Kaplan (1999) concentrate on the relationship between family structure and educational attainment of the child. Accordingly, an intact family structure has a positive effect on the continuation of post secondary education (see also Kim 2004).

Additionally to family background, the personal characteristics of pupils can affect educational attainment either positively or negatively. A frequently considered variable is the part-time employment of pupils who are regularly in full time

education. According to Lewin-Epstein (1981), in 1980, 76 percent of senior high school pupils in the USA worked part time while in full time formal education. Moreover Schneider und Wagner (2003) report that 40 percent of 17 year old children were once employed part time in Germany, while undergoing full time formal education. However, significant negative effects of part time employment on educational attainment have only been found for American pupils whose weekly working hours exceed 15-20 hours (Lillydahl (1990)). Recently, for young males in the UK, Dustmann and van Soest (2007) report a small and negative influence of part time work on exam performance and on the decision to stay at school. For the decision of young adults to attend college, Mohanty and Finney (1997) reveal a positive quadratic impact of wages on the decision to attend college. An often hypothesized and empirically confirmed negative correlation between hours of television watching by adolescents and school performance seems not to be robust (see Zavodny 2006 and the cited literature therein). At least for preschool pupils, the ability of peers exerts a substantial positive influence on various different skill variables of young children (Henry and Rickman 2007).

To the best of our knowledge, this present study is the first to use the Cox proportional hazard model to analyze the determinants of successful graduation at high school, depending on the age of adolescents. We extend the literature by using the latest available data for Germany, which ranges from 2000 to 2007. As our main data source, we use youth-specific questions which are included in the GSOEP. This youth data set has not yet been used to analyze the determinants of successful graduation at high school. As indicated earlier, our data set contains not only information on the characteristics of adolescents and parents, but also information about grandparents.

The remainder of the paper is organized as follows. In Part 2, we describe the Cox proportional hazard model, which is used for estimation. Part 3 presents our database and summary statistics. The empirical results are presented in Part 4 and the final section concludes.

EMPIRICAL MODEL

In order to analyze the factors determining successful high school graduation, we use time-to-event analysis. This enables us to investigate the likelihood of the event occurring and the duration. Since successful graduation for high school is influenced heavily by the personal characteristics of adolescents and

family background, these characteristics have to be incorporated as covariates in order to explain the outcome.

We use the Cox proportional hazard model (see Cox 1972), which allows us to incorporate personal characteristics through the use of covariates. We select *age* as our waiting time concept. Thus, we can estimate the likelihood of graduating from high school at each possible age of the particular adolescent, depending on the personal characteristics.

The specification of the Cox proportional model is as follows (equation 1):

$$\lambda_i(t) = \lambda_0(t) e^{Xi(t)\beta} \ (1)$$

$\lambda_i(t)$ is the hazard rate of person i, $\lambda_0(t)$ is the baseline hazard rate and $Xi(t)\beta$ are the covariates and regression parameters. For the baseline hazard rate, the particular distributional form of the duration time is left unspecified. However, the estimation of the baseline hazard and the baseline survivor function is possible. The hazard rate is proportional and constitutes a fixed proportion over time. The covariates can be both time invariant and time variant. Since the proportionality assumption has to be fulfilled, covariates can only shift the hazard rate, but cannot change its shape.

We observe adolescents aged 17 up to the latest available survey wave. Ideally, we would observe adolescents from the date of birth until graduation from high school. Thus, we face the problem of truncation and censoring. Because we observe adolescents aged 17, our data is left truncated. For adolescents who are at probability of graduating and do not graduate from high school until the last observation period, we do not know whether they will graduate from high school at some point in the future. Thus, our data is right censored. Accordingly, left truncation and right censoring has to be taken into account when defining the likelihood function for estimating the Cox model. This can be done by separating the likelihood into two parts. One contains the right censored observations and the other the remaining observations. We take left truncation and right censoring into account when estimating the Cox model.[4]

DATA AND SUMMARY STATISTICS

For our analysis, we use the latest version of the GSOEP for the period ranging from 1984 to 2007. The GSOEP is a representative annual household survey (see Haisken-DeNew and Frick 2005 and Wagner et al. 2007 for a detailed

description of the GSOEP). Specifically, we use the youth questionnaire to analyze the determinants of successful graduation from high school. A yearly representative sample of adolescents aged 17 was asked initially about their relationship with their parents, leisure-time activities, past achievements at school and personal characteristics in 2000. Furthermore, they were asked about their educational plans and expectations for their career and family (see Schupp and Fruehling 2007a for a detailed description of the youth questionnaire). In subsequent years of the interview, adolescents are questioned by means of the regular GSOEP questionnaire. Thus, it is possible to follow adolescents across time. We merged the youth data set with the regular GSOEP data to obtain further personal information from the adolescents. For our analysis, we use only those adolescents who attend school during the first year they are interviewed.

Since family background is an important factor determining the school track decision of the child, personal characteristics of parents are a crucial factor for a successful high school graduation of their children. It is possible to directly identify the father as well as the mother of the adolescent. Consequently, we merged our dataset with one containing characteristics of the mother and the father in terms of their education and career training, detailed information on job biography and personal characteristics (see Schupp and Lenauweit 2007, Schupp and Fruehling 2007b, Schmidt 2007 and Frick and Schmitt 2007). We also included information about the grandparents.

Our variables determining successful graduation at high school are grouped into the following categories: residence, jobs and money, siblings, relationships, leisure time and sport, school, education and career plans, characteristics of parents and information about grandparents. Because of different characteristics, we dropped all adolescents with foreign nationality. Our constructed data set contains 1748 observations. On average, we observe 749 adolescents for 2.3 years. Because the determinants of successful graduation from high school might differ by gender, we split our sample accordingly. 372 adolescents are male and 377 female. The youngest adolescent in our data set is 17 years old and the oldest 25. The youngest male adolescent is 17 and the youngest female, 18.

In Table 1, summary statistics for the total sample and the two subsamples are displayed. On average, adolescents are 20.1 years old for the total sample, as well as for both subsamples. Slightly more than 90 percent of the adolescents living in their own room (not sharing with a sibling) in their parents' home and one quarter lives in East Germany. While in full time formal education, 47.3 percent earn an own income working part time. 3.4 percent more female than male adolescents earn

their own income. Approximately 9 percent have no siblings. For adolescents with siblings, 37.9 percent of respondents are the oldest in the family and 38.4 the youngest. 4 percent more female adolescents are the oldest child in the family compared to male adolescents. Approximately 40 percent of adolescents have no steady boy/girlfriend. For male adolescents, approximately 50 percent have no steady girlfriend (this would include same-sex couples). For female adolescents it is 15.7 percentage points less. Leisure time activities and sports yield marked differences for male and female adolescents. Approximately 18 percent of the adolescents watch TV or videos daily. 31 percent of the female adolescents read daily. For male adolescents, it is 10 percent less. Every week, roughly 12 percent of the adolescents do some voluntary work in their community. 23 percent of the female adolescents take paid music lessons. The value for male adolescents is 10 percent lower. More male adolescents than female adolescents participate in hobby/leisure time sport and club sport.

Table 1: Summary Statistics			
	Total Sample	Male	Female
Number of subjects	749	372	377
Number of observations	1748	874	874
Age	20.1	20.1	20.1
Female (percent)	50.3	-	-
Residence			
Own Room (percent)	91.7	90.8	92.6
Living in East Germany (percent)	25.5	25.1	25.8
Jobs and Money			
Own income (percent)	47.3	45.6	49.0
Siblings			
Only child (percent)	9.0	9.3	8.7
Oldest child (percent)	37.9	36.0	39.8
Youngest child (percent)	38.4	38.4	38.3
Relationships			
No steady boy/girlfriend (percent)	40.5	48.5	32.8

Table 1: Summary Statistics			
	Total Sample	Male	Female
Leisure Time and Sport			
TV, Video (percent)	17.7	16.8	18.5
Reading (percent)	25.7	20.3	30.9
Voluntary activities (percent)	12.0	12.4	11.5
Paid music lessons (percent)	18.0	12.7	23.1
Hobby/leisure time sport or club sport (percent)	29.9	36.1	24.0
School			
Attendance at a private school (percent)	5.6	3.0	8.0
Class representative (percent)	31.3	30.3	32.3
School sport (percent)	24.4	26.5	22.4
No extracurricular activities (percent)	35.3	38.8	31.9
Recommended for Gymnasium (percent)	44.5	42.4	46.5
Advanced course in German (percent)	5.8	3.5	8.0
Advanced course in mathematics (percent)	7.5	8.8	6.2
Advanced course first foreign language (percent)	7.1	4.6	9.6
Paid extra lessons (percent)	28.5	26.6	30.3
Mother helps with homework (percent)	25.3	26.2	24.4
Father helps with homework (percent)	3.7	4.6	2.8
The majority of classmates are foreign (percent)	3.7	4.3	3.2
Education and career plans			
Advanced technical college (percent)	17.4	17.9	16.8
University (percent)	31.4	30.4	32.4
Desired age for financial independence (17-25) (percent)	80.7	78.4	82.9
Already financially independent (percent)	0.7	0.5	0.8
Characteristics of parents			
Father does not work (percent)	14.4	14.8	14.0

Table 1: Summary Statistics			
	Total Sample	Male	Female
Mother does not work (percent)	23.6	22.5	24.7
Net salary, father	2004.9	1945.6	2062.8
Net salary, mother	690.0	689.0	691.0
Grades of father 1 or 2 at school (percent)	11.9	14.6	9.3
Grades of mother 1 or 2 at school (percent)	22.4	24.7	20.2
Characteristics of grandparents			
Grandparents have matriculation standard (percent)	3.0	2.2	3.8
Grandparents are deceased (percent)	6.8	7.5	6.1
Source: Own calculations using GSOEP data.			

Considering school variables, we find a higher share of female adolescents than male adolescents attending a private school. The share is 8 percent for female and 3 percent for male adolescents. With respect to school activities, being the class representative, participating in school sport and doing no extracurricular activities, are considered. Approximately 31 percent are class representatives. 27 percent of male adolescents are active at school sport and 22 percent of females. More male adolescents than female adolescents do not participate in extracurricular activities. Roughly 40 percent of male adolescents do not participate in extracurricular activities. For female adolescents, the value is 7 percent lower.

Attending high school after elementary school is recommended by teachers to approximately 45 percent of pupils. The value is slightly higher for female adolescents. More female adolescents than male adolescents choose an advanced course in German or in their first foreign language. An advanced mathematics course is chosen by more male than female adolescents. When grades at school are not sufficient from parent perspective, 29 percent of parents pay a tutor in an attempt to improve the performance of their children at school. Approximately 30 percent of females receive lessons from a private tutor. For male adolescents, this value is 4 percent lower. The share of adolescents receiving help with homework from their mother is higher than the share of adolescents receiving help from their father. 25 percent of teenagers receive help from their mother and only 4 percent from their

father. More male adolescents than female adolescents receive help with their homework from both their father and mother. Around 4 percent of adolescents are in a class in which most of the pupils are foreign.

According to their educational and career plans, about 17 percent (31 percent) of adolescents wish to attend an advanced technical college (the German Fachhochschule) after graduation. We further include a variable indicating the desired age of being financially independent, between 17 and 25 years of age. Approximately 80 percent belong to this group. 1 percent of the adolescents are already financially independent.

Furthermore, we include parental characteristics. Integration into the labor market is markedly different for men and women. 14.4 percent of male parents are not employed, while this applies to 23.6 percent of the female parents. Because the share of part time workers is noticeably different for the mother and father, the average net salary of the father is roughly €1310 higher than that of the mother. This difference can be explained by a higher share of full time working fathers. 12 percent of the fathers have grades 1 or 2 (equivalent to A or B) in mathematics, German and the first foreign language at school when they were 15 years old. For male adolescents, this value is about 5 percent higher compared than for female adolescents. The share of mothers with grades of 1 or 2 (equivalent to A or B) in the main subjects at school is 22 percent. This value is 5 percent points higher for male adolescents than for female adolescents.

Finally, we include characteristics of the grandparents. 3 percent of at least one parent of the father and one parent of the mother of the adolescents have at least a high school diploma. Both grandparents of approximately 7 percent of the adolescents are deceased.

EMPIRICAL RESULTS

We use the Cox proportional hazard model specified in equation (1) to estimate the likelihood of successful graduation from high school, depending on the age of the adolescents. We conducted regressions for the total sample and subsamples of men and women. Our endogenous variable is a dummy variable that takes the value 1 in the year the pupil graduates at high school, 0 otherwise. The average age of high school graduation is 21.54 years of age in the total sample, 21.63 for males and 21.45 for females.

Our specification includes fixed and time dependent covariates. We grouped the exogenous variables according to the grouping of the summary statistics. Except

for the interaction of being employed part time or full time and the net salary of the father and mother, all variables are dummy variables.

In order to gain an first impression of the time dimension of graduation from high school, we plot the smoothed hazard function for the total sample and the two subsamples in Figure 1. The hazard indicates the instantaneous rate of high school graduation and can take values from zero (meaning no high school graduation at all) to infinity (meaning certainty of high school graduation). Thus, the hazard is the probability that graduation from high school occurs within a given interval, conditional upon pupils still being at school to the beginning of that interval, divided by the width of the interval. The hazard function of male pupils increases until the maximum at the age of 22.2. Being older than 22.2, reduces the hazard of graduating from high school for males. For female pupils the maximum of the hazard function is 21.4. Before the age of 21.4, the hazard function increases and then decreases subsequently. For males, the hazard curve is at a higher level compared to females and therefore, the probability of graduating at high school is higher for males at every age of the observation period. Since the hazard curve begins to decrease at an earlier age for females, females are less likely to graduate at a higher age, compared to males. For the total sample, the value of the maximum of the hazard curve and the age at this point are between the values of the two subsamples.

Table 2 displays the regression results. The results in the first column refer to the total sample, and the next two columns for males and females, respectively. According to equation (1), we estimate the coefficients β. Exponentiating the estimated coefficient leaves us the hazard ratio displayed in Table 2. This expoentiated individual coefficient yields the hazard ratio. For example, if the coefficient on the dummy variable *own income* is 0.352, then a change in the status of the dummy variable from 0 to 1 increases the hazard by 42.2 percent, because exp(0.352)=1.422. If the coefficient of the dummy variable indicating living in East Germany for males is -0.347, then a change in the status of the dummy variable decreases the hazard by 29, percent because exp(-0.347)=0.707. Therefore, hazard ratios lower than one indicate a negative impact of the considered variable on the hazard of graduating from high school, while hazard ratios above one indicate the opposite.

Figure 1: Smoothed hazard functions
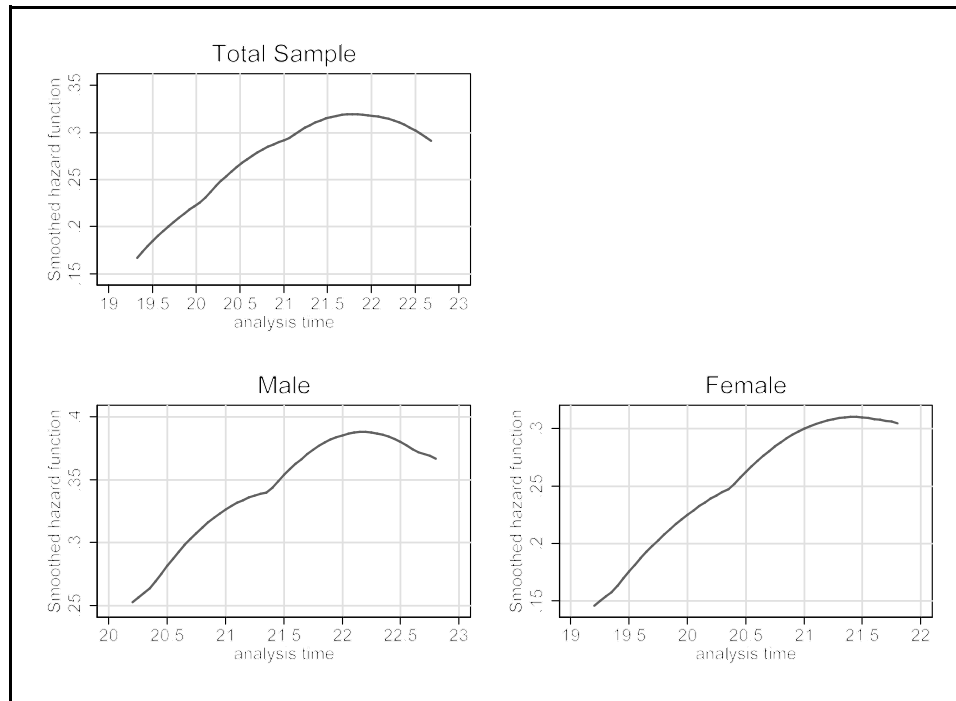
Source: Own calculations using GSOEP data.

For males and females, we did not detect a statistically significant difference. Living their own room at home raises the likelihood of graduating from high school insignificantly. Due to inferior economic standards in East Germany compared to West Germany, we assume lower probabilities of graduation for adolescents living in East Germany. However, a significant negative effect of 29 percent is only revealed for *male* adolescents.

A strong positive and highly significant effect is found for pupils who work part time in addition to their regular full time formal education. This applies especially to females, who have almost a 68 percent higher likelihood of graduating from high school than their non-working counterparts. Male adolescents who work part time also are more likely to graduate, but the effect is not significant. Since own income or part time work has no direct influence on school performance from a

theoretical point of view, the estimated effect could be an indirect measure of personal ability. Since more highly skilled adolescents are able to work part time while in full time education, it is not surprising that working adolescents more often complete their high school exam.

A look at siblings reveals ambiguous findings. Being the only child has a strong and significantly positive effect on the likelihood of graduation for male adolescents, whereas females are less likely graduate. The results indicate large differences for males and females. It seems that males my benefit substantially from increased status. On the other hand, females probably perform better at school if they have siblings. In families with more than one child, with respect to the graduation likelihood of the individual child, it does not matter whether it is the youngest or the oldest of the siblings.

Table 2: Cox Model Estimation Results						
	Total Sample		Male		Female	
	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.
Sex	0.9786	(0.104)	-	-	-	-
Residence						
Own Room	1.273	(0.277)	1.199	(0.279)	1.558	(0.647)
Living in East Germany	0.844	(0.121)	0.707	(0.148)*	0.940	(0.201)
Jobs and Money						
Own income	1.422	(0.152)***	1.273	(0.199)	1.677	(0.273)***
Siblings						
Only child	0.987	(0.264)	1.902	(0.666)*	0.568	(0.231)
Oldest child	1.026	(0.174)	0.931	(0.221)	0.950	(0.230)
Youngest child	0.949	(0.167)	1.121	(0.275)	0.681	(0.177)
Relationships						
No steady boy/girlfriend	1.216	(0.130)	1.120	(0.165)	1.229	(0.223)
Free time and Sport						

Table 2: Cox Model Estimation Results					
	Total Sample		Male		Female	
	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.
TV, Video	0.909	(0.121)	1.235	(0.244)	0.719	(0.149)
Reading	1.223	(0.143)*	1.073	(0.206)	1.143	(0.209)
Voluntary activities	1.223	(0.172)	1.116	(0.223)	1.132	(0.252)
Paid music lessons	1.041	(0.141)	0.877	(0.206)	1.019	(0.190)
Hobby/leisure time sport or club sport	1.056	(0.118)	0.923	(0.151)	0.989	(0.203)
School						
Attendance in a Private School	1.077	(0.220)	1.502	(0.581)	0.968	(0.276)
Class representative	1.053	(0.138)	1.601	(0.314)**	0.658	(0.121)**
School sport	1.138	(0.148)	0.985	(0.205)	1.415	(0.281)*
No extracurricular activities	1.012	(0.146)	1.361	(0.286)	0.671	(0.154)*
Recommended for Gymnasium	1.372	(0.164)***	1.596	(0.288)***	1.178	(0.193)
Advanced course in German	1.403	(0.369)	0.936	(0.403)	1.616	(0.524)
Advanced course in mathematics	1.156	(0.214)	1.648	(0.332)**	0.874	(0.354)
Advanced course first foreign language	1.035	(0.256)	1.667	(0.564)	0.966	(0.379)
Paid extra lessons	1.048	(0.130)	1.264	(0.220)	0.924	(0.172)

Table 2: Cox Model Estimation Results					
	Total Sample		Male		Female	
	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.
Mother helps with homework	1.037	(0.122)	0.837	(0.143)	1.203	(0.206)
Father helps with homework	0.627	(0.200)	0.586	(0.183)*	0.534	(0.433)
The majority of classmates are foreign	0.975	(0.318)	0.572	(0.256)	1.309	(0.557)
Education and Career plans						
Advanced technical college	1.158	(0.154)	1.488	(0.244)**	0.924	(0.199)
University	1.105	(0.155)	1.266	(0.239)	1.208	(0.271)
Desired age for financial independence (17-25)	1.016	(0.133)	1.031	(0.210)	0.941	(0.185)
Already financially independent	5.293	(2.868)***	3.405	(1.507)***	20.266	(9.188)***
Characteristics of the parents						
Father does not work	0.698	(0.146)*	0.336	(0.111)***	1.238	(0.389)
Mother does not work	0.851	(0.136)	1.021	(0.219)	0.537	(0.141)**
Net salary, father	1.000	(0.000)**	1.000	(0.000)***	1.000	(0.000)
Net salary, mother	1.000	(0.000)	1.000	(0.000)	1.000	(0.000)

Table 2: Cox Model Estimation Results					
	Total Sample		Male		Female	
	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.	Hazard Ratio	Std. Err.
Grades of father 1 or 2 at school	1.161	(0.179)	1.478	(0.346)*	0.957	(0.233)
Grades of mother 1 or 2 at school	1.271	(0.171)*	0.949	(0.185)	1.565	(0.296)**
Characteristics of the grandparents						
Grandparents have matriculation standard	1.756	(0.512)**	1.187	(0.444)	2.775	(1.057)***
Grandparents are deceased	1.213	(0.254)	1.276	(0.366)	1.431	(0.479)
number of observations	1748		874		874	
number of subjects	749		372		377	
number of failures	281		148		133	
log likelihood	-1529.88		-685.74		-628.90	
LR Chi2	124.51 ***		202.26 ***		245.70 ***	

Note. - * significant at 10%; ** significant at 5%; * significant at 1%. In order to test the proportional hazard assumption, we performed the link test. According to the link test, the squared linear predictor is insignificant, so that the model is specified correctly. To check the proportional hazard assumptions for the global model and for each covariate we used the Schoenfeld residual test, based on a generalization by Grambsch and Therneau (1994). The global model and each covariate included in the estimation results fulfils the proportional hazard assumption. We also plotted the Nelson-Aalen cumulative hazard measure compared to the partial Cox-Snell residuals. Since the Nelson-Aalen cumulative hazard lies very close to the 45° line, the fit of our model is good. For the dummy variables, we plotted the –ln[-ln(survival)] curve for each category versus ln (analysis time). The curves are parallel. Therefore, the proportional hazard assumption is not violated.

Source: Own calculations using GSOEP data.

Adolescents with no steady boy/girlfriend have a significantly higher hazard ratio in the total sample. The effect is also positive, but insignificant in the subsamples for males and females. A plausible explanation for this finding could be the limited time for studying, which is reduced further when a boy/girlfriend appears on the scene.

Leisure time activities may correlate with school performance, if a particular activity directly influences human capital maturation or is an indicator of ability. A frequently mentioned variable in this context is time spent watching television. We do not find any significant effect for adolescents who watch TV every day. Interestingly, there are large differences in the hazard ratios for males and females. The effect of daily TV watching is positive for males, but negative for females. Daily reading increases the likelihood of graduating by 22 percent. Separated by gender, the effect is positive, but insignificant. Doing voluntary work in the community, taking paid music lessons or participating in hobby/leisure time sport or club sport increases the likelihood of graduating insignificantly. This also holds for both subsamples.[5]

A look at the school category does not reveal a significant influence of private school attendance. Being a class representative enhances the likelihood of graduation for males by 60 percent, whereas, surprisingly, females are 34 percent less likely graduate. It seems that male class representatives are positively selected from the pupil population and females negatively. The influence of doing school sport or doing no such activity at all is significant for females, but insignificant for males. Females doing school sport are 42 percent more likely to graduate from high school. Doing no extracurricular activities reduces the likelihood by 33 percent for females. Extracurricular activities seem to be an indicator of overall positive motivation at school. This impacts positively on school performance. After elementary school, teachers recommend a secondary school track for each pupil, based on their view about the pupil's ability. This recommendation is not binding for parents, but high schools can easily reject pupils who have been recommended for a lower school track. When a recommendation for high school truly reflects higher ability on the part of pupils, the likelihood of graduating should increase. This is confirmed by the total sample. For males, the likelihood increases by 60 percent. For females, the influence is also positive, but insignificant. We further investigate the influence of attending an advanced course in one of the main subjects – German, maths and first foreign language. Only attending an advanced math course positively affects the likelihood of graduating by 65 percent for males.[6] Paid private coaching does not enhance the likelihood of graduation. If parents helps

children to do their homework properly, and the effect is significantly negative only when a father helps his son. This could be due to opposing effects. Because of negative selection, more often pupils with low ability will need assistance in private learning. However, assistance by itself should enhance performance. The share of foreign classmates has no significant effect on the likelihood of graduating.[7]

The aim of attending an advanced technical college or university after successful high school graduation should increase the likelihood of graduating. Only males who wish to attend an advanced technical college in the future graduate more often. Pupils who with to be financially independent even at the age of 17-25, do not graduate more often. Being already financially independent before graduation increases the likelihood of graduating markedly. However, this result must be interpreted with caution, because of the small sample size.

Considering parental characteristics yields different findings for both males and females. Male adolescents tend to be influenced by their father, while the graduation likelihood of females tends to be affected more by their mother. The father unemployed has only a negative impact on the likelihood of a son graduating. Daughters graduate less often when their mother is not employed.[8] The net salaries of the parents have no or only a negligible influence on graduation. When the father performed well at school in his main subjects, his son will have a 48 percent higher likelihood of graduating. The same holds for daughters, when their mothers had been good performers at school. They have a 57 percent higher likelihood of graduating.[9]

We further analyze influence of grandparent characteristics on the likelihood of their grandchildren graduating successfully. If at least one parent of the father and one of the mother of the adolescents has at least a high school diploma, the likelihood of granddaughters graduating is increased by 176 percent. There is no significant effect for males. The death of grandparents has no significant effect on the likelihood of graduating.

CONCLUSION

Since the demand for highly skilled workers will probably continue to rise over the coming decades, due to globalization and skill-biased technical change, it is becoming more and more important to graduate successfully from high school and obtain access to tertiary education. Thus, analyzing the determinants of successful high school graduation is extremely important. That proportion of the population with educational attainments of at least high school level, is not only better

integrated into the labor market, but exerts a positive impact on societal development in a broader sense. The determinants of successful graduation are markedly different in terms of gender. According to the smoothed hazard function, the probability of successful graduation is higher for males than for females. The maximum of the hazard function is reached at the age of 21.4 for females and at 22.2 for males. Being older than 21.4 years old reduces the probability of graduating from high school for females. For males, the decrease begins at the later age of 22.2. Male adolescents are less likely graduate when they live in East Germany, when their fathers help them with their homework and when their fathers are unemployed. Having no siblings, being the class representative, being recommended for high school, attending an advanced mathematics course, wanting to attend a technical college after graduation, being already financially independent while at school and having a father who himself earned good grades at school, all increase the likelihood of graduating successfully.

Successful graduation is less likely for females when they are class representatives, do not participate in any voluntary school activities and do not have a mother who is employed. In contrast, they benefit by earning their own income, by voluntarily participating in school sport, being financially independent, having a mother who earned high grades at school and having grandparents with a matriculation standard of education.

Surprisingly, we find no effect of leisure time activities on graduation. Furthermore, the results indicate that the variables relating to the parents have the following impact: fathers' impact on sons and mothers on daughters. Especially the integration of parents into the labor market is crucial for successful graduation at high school. If the father is unemployed, the likelihood of graduating is markedly reduced for male adolescents. Surprisingly, this is not the case for female adolescents. A strong positive influence of grandparents on school graduation was only evident for females. Since this is the first study to incorporate three generations, interdependencies between generations could be studied in more detail.

ENDNOTES

[1] In Germany, there is also the comprehensive school which combines all three types in one school, but within these schools, there is also a separation between the three main types.

[2]   In some federal states like Bavaria, the recommendation of the teacher is binding. In this case, parents can influence the recommendation indirectly by communicating with the teacher before he makes the decision.

[3]   For an overview of the literature on the returns to education in Germany, see Flossmann and Pohlmeier (2006).

[4]   See Klein and Moeschberger (1998) for a detailed specification of the partial likelihood function. We use the Breslow method to deal with tied failures.

[5]   Since leisure time variables are measured in categories, we could only use dummy variables in our estimation. Further information on free time activities could yield a significant influence on high school graduation.

[6]   We also have information on grades in German, maths and the first foreign language. Because grades and graduation are influenced positively by unobserved ability, we do not include grades as an exogenous variable.

[7]   We also included a dummy variable indicating if the pupil has repeated a school year. The effect on the likelihood to graduate was significantly negative for male and female. Because this dummy variable does not fulfil the proportionality assumption of the Cox model we dropped it.

[8]   Instead of the employment status we used the skill level of the parents. Being unskilled reduces the hazard ratio insignificantly. Alternatively being skilled increases the hazard ratio, but insignificantly. The results of the other variable are robust to these changes. We do not use both the skill level and the employment status, because of multicollinearity. In another specification we used a dummy variable identifying the father being a blue collar worker for employment status. This reduces the likelihood to graduate by 30 percent. An interaction of blue collar worker and being unskilled decreases the likelihood to graduate by 50 percent. These results are comparable to the findings of the OECD (2007), p. 116.

[9]   We also included dummy variables indicating foreign nationality of the mother and father. Neither exerts a significant or negative influence on the likelihood of graduating. The dummy variables are not included in our final specification, because they do not fulfil the proportionality assumption.

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AUTHORS' NOTES

ECONOMICS ARTICLES