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The Demand for Higher Education in Germany*

By Monika Merz** and Axel Schimmelpfennig***

Summary

This paper explores the economic determinants affecting high school graduates' demand for higher education in Germany. Higher education is defined as formal training received at universities or comparable institutions. Human capital theory is used to deduce a qualitative response model, which is then estimated with a logit estimator. The estimation results show that high school graduates' decisions about higher education are at least partially determined by economic considerations. Other major determinants are parental level of education, age at the time of Abitur, and marital status.

1. Introduction

Obtaining a university degree continues to be viewed as highly desirable in most countries. A university diploma supposedly opens the door to economic and social success. In this paper we explore the economic determinants affecting high school graduates' demand for higher education in Germany from 1985 to 1993 using data from the German Socio-Economic Panel. We define higher education as formal training received at universities or comparable degree-awarding institutions.[1]

Higher education constitutes a major element in the set of possible alternatives faced by upper-level secondary students (*Abiturienten*) after graduation. They can also do an apprenticeship, take on a job, become unemployed, or leave the labor force. Our analysis is based on ideas from human capital theory as applied to education by Becker (1962, 1964), Ben-Porath (1967), and Mincer (1974). We consider individual factors as well as aggregate labor market conditions as explanatory variables, because they are likely to affect students' expectations about their lifetime income. Our paper represents one of the first attempts to use microeconomic evidence from Germany to perform an economic analysis of high school graduates' choices regarding higher education.[2]

2. The Theory of Human Capital

Human capital theory, which is based on the assumption that life time earnings are an increasing function of schooling, is the starting point for our empirical analysis. Education is viewed as an investment, which rational actors pursue to the point where the marginal private internal rate of return equals the rate of interest. Furthermore, the labor market operates competitively and pays workers their marginal product.

The individual decision problem can be formulated as follows. An individual faces the option each year of either working, enjoying leisure, or going to school full time and investing in human capital. When deciding how much schooling to demand, individuals weigh current time, resources, and foregone earnings against future increases in productivity and pay. By assumption, individual earnings increase with the stock of previously accumulated human capital and with the amount of schooling received. Attending school full time implies that the individual receives no labor income while at school, but his stock of human capital increases. Human capital theory predicts that the marginal productivity of education, which determines an individual's pay, increases *ceteris paribus* with an individual's ability, or talent. More able students are likely to learn more from a given amount of education, which raises their marginal productivity of education and ultimately their earnings.

Attending school comes at a cost, which increases with the amount of schooling received. These opportunity costs include foregone leisure time as well as foregone earnings. The costs of schooling also capture the ease with which individuals have access to funds. When individuals finance their own education, these costs measure foregone interest that could have been earned from investing those funds into a comparably risky project. Typically, the costs of funds are higher for those who have to borrow than for those who can self-finance their schooling.

The human capital model is particularly suitable for studying the economic determinants of the demand for higher education. Individuals facing higher education decisions typically are young adults who are in the process of making career choices. They have not yet invested much in specific human capital and therefore are particularly likely to respond to economic incentives in making economic decisions.

Thus, human capital theory suggests several determinants of an individual's decision to pursue higher education. Individual factors include ability and access to financial funds, while macroeconomic factors are the wage premium for a university education and skill-specific employment opportunities.

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[1] In Germany, degrees of higher education are awarded by universities (*Universitäten*), polytechnics (*Fachhochschule*), seminaries (*Theologische Hochschule*), art academies (*Kunsthochschule*), and Gesamthochschulen, which are umbrella organizations combining any of these three types of institutions.

[2] Empirical applications of human capital theory for other countries are among others provided by Freeman (1975), Pissarides (1982), and Cameron and Heckman (1998).

3. Empirical Results

To study the factors influencing the decision to demand higher education, we use data from the German Socio-Economic Panel (GSOEP). We consider all individuals who have graduated from a *Gymnasium* or a *Fachschule* with a high school diploma — *Abitur* hereafter — between 1985 and 1993. In order to determine whether these individuals have decided to continue into higher education, we sample only those who stayed in the GSOEP for three more waves after reporting they had received the *Abitur*. Males face a mandatory military or social service that can delay higher education by up to two years. Some individuals choose to do an apprenticeship which lasts for another two years, e.g., banking before entering university. Thus, a three-year period allows for events that often postpone but do not preclude higher education. This leaves us with a sample of 419 respondents who received an *Abitur* and were eligible to pursue higher education during this time period. If an individual enrolled at a university or *Fachhochschule,* he is considered as having decided to continue into higher education.

The individual determinants of the demand for higher education can be inferred directly from the GSOEP. We record an individual's sex, nationality, marital status and age when the individual receives the *Abitur*. Age can be regarded as an indicator for ability, as less able students might have had to repeat one or more years of school. Age can also be regarded as an indicator for determination, as individuals who attend night school while working (*zweiter Bildungsweg*) or who continue school despite difficulties have set their mind on continuing into higher education.

For the family background, we construct two variables. First, we construct a dummy for the educational achievement of the parents. It takes on the value one if either parent holds an *Abitur* or an advanced professional degree, or if the father works in a higher job position. Second, we take the per capita family income at the time of the *Abitur.* The number of observations is reduced by 35 cases due to missing information on the parents' level of skill or the per capita family income.

The influence of labor market conditions would ideally be captured by a degree-specific wage differential and unemployment rate. This would imply that we need to follow the individuals from the time they receive their *Abitur* up to the potential time of finishing higher education. Due to sample size restrictions this is not feasible. Instead, we use skill-specific wage differentials and unemployment rates at the time of *Abitur* for two reasons. First, the individual will actually base his decision on the labor market conditions at the time of receiving the *Abitur.* Second, the indicators used are simply proxies for the actual factors discussed above.

We use the ratio of the median gross hourly wage, including benefits, for high-skilled to medium-skilled workers as a measure of the wage differential. The wage is

Table 1

Descriptive Statistics for Individual and Macroeconomic Factors Related to the Demand for Higher Education

	Share in Percent / Mean	
	Demand	No Demand
Percent of Sample[a)]	63.48	36.52
Male[a)]	62.78	47.06
Parents with advanced level of skill[a)]	61.65	49.01
Unmarried[a)]	96.99	94.77
German nationality[a)]	85.71	82.35
Female and child[a)]	0.00	0.65
Age at *Abitur*[b)]	21.49 (2.58)	20.86 (2.68)
Per capita household income at Abitur[b)]	1,163.85 (958.12)	1,009.53 (385.33)
Wage differential high/medium skilled[b)]	1.75 (0.13)	1.77 (0.14)
Unemployment rate medium-skilled[b)]	5.11 (2.28)	5.70 (2.28)
Unemployment rate high-skilled[b)]	2.74 (1.46)	3.18 (1.47)

a) Discrete variable: Share in percent. — b) Continuous variable: Mean and standard deviation.
Source: Authors' calculations using GSOEP, 1997.

constructed from the information on income in the month preceding the interview, actual hours worked in that month, and information on benefits and side payments.[3] We define high-skilled as having a university degree or equivalent and medium-skilled as having an *Abitur* or an advanced occupational degree.

We calculate the within-group unemployment rates for high-skilled and medium-skilled individuals.[4] The unemployment rate equals the number of individuals registered as unemployed divided by the civilian labor force (percent). Since the interviews are conducted in different months, we use information on the month of October in the year preceding the interview.

The macroeconomic determinants are computed by sex for each of the 9 years in which one of our sample members completed the *Abitur.* To increase the variation in the variables, we would prefer to have them computed at the regional level, but we were unable to do this due to sample size restrictions.

Of the 419 individuals holding an *Abitur,* 63.48 percent went on to higher education within the next three years. The share exhibits considerable variation from year to year, with a peak in 1989.[5] Table 1 shows some descriptive statistics of the potential determinants of the schooling decision. The individual characteristics are in line with the implications of human capital theory. Namely, individuals who went on to further schooling were from families with higher incomes and with more educated parents. Of the macroeconomic determinants only the skill-specific unemployment rates correspond with human capital theory.

The hypotheses derived from human capital theory are tested using a logistic regression approach. We estimate the model,

$$P(B = 1) = \frac{\exp(d + X'\beta)}{1 + \exp(d + X'\beta)}$$

where B is the schooling decision. B takes the value one if an individual demands higher education and zero otherwise. α is an intercept term, X is the regression matrix, and β is the coefficient vector.

Ideally, we should have included a measure of ability in the regressor matrix; the *Abitur* grade point average (*Abiturnote*) would have been one possible candidate. Unfortunately, no such measure could be retrieved from the GSOEP. The omission of this relevant variable will lower the overall explanatory power of our model.

Table 2 presents the results for four specifications which we have estimated. The parameters are jointly significant in all four specifications.[6] Model 1 includes all measured determinants of the decision to demand higher education. Of the individual-specific determinants, sex, German nationality, parents' level of skill and per capita household income are insignificant. The log of age at the time of *Abitur* is significant and carries a positive sign. This suggests that age is an implicit measure of determination rather than ability. Of the macroeconomic determinants, the two within-group unemployment rates carry the expected sign, but they are both insignificant. The wage differential is significant, but it carries an unexpected sign: the negative influence would imply that individuals with an *Abitur* are more inclined to demand higher education, if the respective return falls.

To investigate the influence of the wage differential more closely, model 2 contains the interaction between sex and the wage differential. The insignificant variables nationality and per capita household income are eliminated from this model as well. While the interaction has a positive influence, it is not significant. Model 3 contains a linear trend that could capture any trend toward a higher demand for higher education over the period from 1985 to 1993; the estimated coefficient is positive and significant.

Finally, model 4 contains the significant individual determinants: age at *Abitur,* marital status, and parental level of skill; they all carry the expected sign. Of the macroeconomic determinants, only the wage differential is kept, because the unemployment rates were insignificant in all other specifications. In addition, model 4 contains the interaction between sex and wage differential as well as a linear trend.

Taken together, the presented results provide evidence for the determinants of the demand for higher education once an individual has received an upper secondary degree (*Abitur*). Neither sex nor the per capita household income at the age of *Abitur* appear to influence the decision to demand higher education. The latter result stands in contrast to findings for the United States, where parental income is a significant determinant of the schooling decision. In Germany, the financial constraints on the demand for higher education are insignificant.

Both the age at *Abitur* and marital status have a positive influence on demand for higher education. It appears that age is a measure of determination. Unmarried individuals are more likely to demand higher education, because they do not need to provide financial or other support for a family.

Skill-specific unemployment rates do not influence the schooling decision significantly, although the coefficient estimates carried the expected sign. The implications of

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[3] See Christensen and Schimmelpfennig (1998) for the construction of this variable.

[4] We do not use unemployment rates for *Abiturienten,* because many jobs that used to require less than an *Abitur* are nowadays filled only with *Abiturienten.*

[5] Figures not reported. The development is in line with aggregate university enrollment.

[6] Joint significance is not rejected by the likelihood-ratio (LR) tests of the deviance. Neither the log-likelihood, nor standard specification criteria, nor the McFadden pseudo-R strongly favor one of the specifications over the others (not reported).

Table 2

Individual and Macroeconomic Factors Affecting the Demand for Higher Education: Logistic Regression Coefficients[a)]

	Model 1	Model 2	Model 3	Model 4
Constant	−15.14 (0.93***)	−13.18 (9.05***)	−14.24 (10.57***)	−14.47 (11.19***)
Male	0.48 (2.03)	−1.73 (0.92)	0.39 (1.40)	–
Log age at *Abitur*	4.77 (11.76***)	4.59 (12.33***)	4.68 (12.68***)	4.76 (13.21***)
Not married	1.78 (6.28**)	1.68 (6.47**)	1.59 (5.66**)	1.62 (5.93**)
German nationality	−0.12 (0.11)	–	–	–
Parents with high level of skill	0.41 (2.44)	0.41 (3.53*)	0.40 (3.24*)	0.39 (3.25*)
Log per capita household income at *Abitur*	0.13 (0.30)	–	–	–
Log unemployment rate high-skilled	−0.52 (1.90)	−0.54 (2.23)	−0.27 (0.50)	–
Log unemployment rate medium-skilled	0.73 (1.30)	0.79 (1.67)	0.10 (0.02)	–
Log wage differential	−4.51 (4.85**)	−5.49 (6.51**)	−3.18 (2.50)	−3.56 (5.62**)
Interaction of sex and log wage differential	–	4.00 (1.66)	–	0.90 (5.60**)
Log of linear trend	–	–	0.36 (4.26**)	0.35 (5.60**)

[a)] t-values in parentheses. The estimators are $\chi^2(1)$ distributed. — [b)] The test statistic is $\chi^2(r)$ distributed, where r is the number of regressors. — * Significant at the 10 percent level. — ** Significant at the 5 percent level. — *** Significant at the 1 percent level.

Source: Authors' calculations using GSOEP, 1997.

human capital theory are not supported by this result. However, the insignificant influence of the skill-specific unemployment rates may also be due to limited variation in this measure. Therefore, we do not consider these results as an outright rejection of human capital theory.

To our surprise, the variable measuring skill-wage differentials has a significant negative impact on the decision to demand higher education. In our view, this result suggests that the demand for higher education has risen, despite the fact that the wage differential has fallen over the period under investigation. One reason for this might be that individuals still consider higher education as beneficial to one's future career regardless of the immediate wage differential. Also, the wage structure has not responded to market needs, as suggested by skill-specific unemployment rates (cf. Christensen and Schimmelpfennig 1998), so that it may be wise to ignore the relative return to skill. The coefficient of the interaction of sex and the wage differential points in another direction. Males seem to respond to the relative return on education more along the lines of human capital theory.

4. Summary

In our view, the decision to demand education is an economic decision and should therefore be influenced by economic factors. Human capital theory offers a price-theoretic framework to analyze the schooling decision. The theory is based on the assumption that income can be modeled as a function of schooling. The decision to demand education is then modeled as a human capital investment decision.

The implications of human capital theory are: the demand for education will increase with the return to education and employment opportunities and decrease with the costs of education- tuition and fees, living expenses, and opportunity costs. The availability of investment capital and ability will also have a positive impact on the demand for education.

Data from the German Socio-Economic Panel were used to test the implications of human capital theory. We constructed a sample of 419 individuals who graduated with an *Abitur* in the period from 1985 to 1993. Those who entered

a university within three years after receiving the *Abitur* were considered to have made a decision to demand higher education. Sixty-three percent of the *Abiturienten* made that decision.

We analyze the decision to demand higher education conditional on holding an *Abitur* as a logit model. Of the individual factors, sex and availability of funds turned out insignificant. Age at *Abitur*, being unmarried, and parents' level of skill have a positive, significant impact on the schooling decision. Of the macroeconomic factors, the skill-specific unemployment rates turned out insignificant, although they carried the expected sign. The relative return to higher education had an unexpected negative, but significant impact. However, an interaction term of sex and the relative return carried the expected positive sign and was significant.

These results shed light on the relevance of human capital theory. The insignificant impact of the skill-specific unemployment rates may be due to an omitted variable bias as well as low variation in the variables themselves. With respect to the return to education, it may well be that this is more important for males, if the traditional roles of the sexes still matter. Also, skill-specific wage differentials have evolved in a way that is not in accordance with actual labor market conditions in Germany. Hence, popular wisdom, not the real bottom line, may have guided decisions regarding investment in higher education. In a nutshell, our results are consistent with human capital theory when one keeps in mind that the constraints of imperfect information are essential to understanding the outcomes chosen by rational actors.

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