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Career Choices of German High School Graduates: Evidence from the German Socio-Economic Panel♣

by Monika Merz* and Axel Schimmelpfennig**

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Abstract

There has been a secular move towards more and better education in Germany as well as in other industrialized countries since the 1970s. In particular, the fraction of high school graduates continuing on to university has steadily risen. This paper explores the economic determinants affecting high school graduates' career choices in Germany. A qualitative response model is deduced from the theory of human capital and estimated with data from the German Socio-economic Panel from 1985 through 1994, using the multinomial logit approach. The estimation results show that high school graduates' career decisions are at least partially determined by economic considerations. Other major determinants are the parental skill-level, and age at the time of Abitur.

JEL-Classification: I21, J24

Key Words: Educational Choices, Qualitative Response Model, Human Capital Theory

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1 Introduction

Deciding which type of education to acquire is crucial for an individual's future earnings and employment opportunities. In Germany, like in many other European countries, the wage differential between skilled and unskilled workers has remained remarkably stable over the past thirty years, while the unemployment rate of the skilled has risen less strongly than that of the unskilled. This development has left the skilled with comparatevely better employment prospects. During the same period there has been a secular move towards more education in the form of formal schooling or vocational training. The fraction of adults aged eighteen to twenty-one holding a university-entrance certificate – so-called *Abitur* – has risen from four percent in the early 1970s to almost twelve percent in 1994. The share of these *Abiturienten* who continue on to tertiary education has reached an all-time high of 96 percent in 1993. These facts are nicely illustrated in Figures A1 and A2 in the appendix.

These observations raise the question whether educational choices made by *Abiturienten* are driven by economic considerations, and if so to what extent. The answer to this question has important implications for the labor market. For example, if the career choice of young adults – and therefore ultimately the supply of skilled labor – reacts to economic factors such as skill-specific unemployment rates, total unemployment will be lower than otherwise. If this choice reacts to financial constraints, public policies aimed at influencing the educational behavior can help alleviate such constraints, thereby raising the educational level and reducing unemployment.

In this paper we explore the extent to which the career choice of *Abiturienten* in Germany is determined by economic considerations. Our analysis is based on ideas from human capital theory as applied to education by Becker (1964), Ben-Porath (1967), and Mincer (1974). According to this theory, educational choices

amount to a decision about investing in ones human capital. The outcome of such a decision is crucially affected by the expected return on the investment. The human capital model seems particularly suitable for studying the economic determinants of the career choices made by *Abiturienten*. These individuals typically are young adults who have not yet invested much in specific human capital and therefore seem particularly prone to responding with their decision to changes in economic incentives. We explicitly derive a qualitative response model from human capital theory. We estimate our model with a multinomial logit approach using microeconomic evidence from the German Socio-economic Panel from 1985 through 1994.

Our estimation results suggest that human capital theory performs reasonably well in explaining high school graduates' career choices. The theory correctly predicts the choices vocational training, and tertiary education to vary positively with the expected lifetime income associated with the respective path. These choices also positively vary with the graduates' level of ability which is proxied by the age at *Abitur* and parental skill level. Financial constraints only play a minor role for career decisions of German high school graduates. Also, the human capital model better explains the career choice of males than of females.

The rest of this paper is organized as follows. Section 2 briefly reviews the related literature. Section 3 deduces a qualitative response model for the career decision of German high school graduates from human capital theory. Section 4 describes the data generated from the German Socio-economic Panel. Section 5 presents our estimation results. And, section 6 summarizes the main findings.

2 Related Literature

The implications of human capital theory can be tested by estimating the return to schooling from individual data. However, such estimates are subject to a potential bias in the return to schooling, when both the schooling decision and the wage equation are influenced by an unobserved variable like work ethic or talent. If the impact of the unobserved variable is positive in both equations, the return to schooling is biased upwards. If it is negative, the bias is downwards (Griliches 1977).

Data sets for twins have recently become popular, because they are thought to avoid the bias in the estimate of the return to schooling (e.g. Ashenfelter and Zimmermann 1997, Ashenfelter and Rouse 1998). The underlying assumption being that twins should be similar with respect to the unobserved variable that causes the bias. If twins differ in the amount of schooling they have undergone, the observed wage difference should closely reflect the impact of additional schooling. Bound and Solon (1998) show that twin-based studies are in fact subject to the same problem than other studies.

A different approach to test the implications of human capital theory is to study which factors influence the schooling decision. Based on time-series evidence, Freeman (1975) finds that the relative earnings of male college graduates drove college enrollment in the United States during the 1960s and 1970s. Pissarides (1982), Topel (1997), and Fredrikksson (1997) confirm this result for the United Kingdom, the United States, and Sweden respectively.

Even though these time-series studies shed light on the role that aggregate variables play for educational choices, they typically cannot examine the role of individual-specific variables. Yet, existing studies from other countries have demonstrated the importance of individual-specific factors for educational decisions. Cameron and Heckman (1998) analyze the impact of family back-

ground and financial resources on the decision to continue education at different stages of the educational system. They find that these variables' influence declines as individuals move up the educational ladder. Dai (1998) estimates a discrete choice model for U.S. high school graduates' decision on which college to attend using microeconomic data. The availability of financial aid, tuition fees, and other costs, as well as family background positively affects the decision to attend a private rather than a public college.

3 A Qualitative Response Model Based On Human Capital Theory

Our empirical analysis builds upon the theory of human capital. This theory views education as an investment: individuals pursue the type of education — formal schooling as well as vocational training — which yields the highest internal rate of return. The theory is inherently linked to the work by Gary Becker. In fact, his book *Human Capital* is the first price-theoretic analysis of an individual's decision to invest in education. By assumption, decision-making individuals have rational expectations. The theory is supply-side oriented and concerned with the long-run.

We formulate the educational investment decision problem of German *Abiturienten* as follows. An *Abiturient* faces the option of either attending university (U), doing vocational training only (V), or attending university after having finished vocational training (VU). Hence, the set of educational choices, J, is given by $J=\{U,V,VU\}$.[1] We let schooling, S, represent any of the three elements in J. This setup is consistent with the definition provided by Train

[1] Of course, high school graduates could also choose to immediately join the labor force by either working or being unemployed, or to leave the labor force. Since none of these choices are empirically relevant, we ignore them in the following analysis.

(1986) which turns the choice situation into a qualitative choice situation: the set of possible alternatives is finite, and the alternatives are mutually exclusive and exhaustive.

Alternatively, one could argue that, rather than facing the choice between multiple alternatives at the time of graduation, *Abiturienten* actually face a sequential binary choice situation. According to this argument, *Abiturienten* can only choose between two alternatives at the time of graduation: attending university and undergoing vocational training. In case they decide in favor of vocational training, they can choose between undergoing or not undergoing tertiary education after having finished their training. However, this alternative view is inconsistent with evidence provided by Büchel (1996) that *Abiturienten* who undergo vocational training before engaging in tertiary education do so, because they view the training as insurance against an uncertain labor market outcome of tertiary education. This evidence supports our view that, already at the time of graduating from high school, *Abiturienten* consider the combination of vocational training and tertiary education as a serious alternative to going for one or the other alternative only.

Human capital theory assumes worker *i's* earnings, $Y(S_i)$, to increase in the stock of previously accumulated human capital. Similarly, schooling augments the stock of human capital, so that earnings increase in the amount of schooling undergone:

$$Y_i(S_i) = g(S_i) \tag{1}$$

The function $g(.)$ is concave.

When deciding which educational alternative to choose, high school graduates weigh the respective length of the educational period, t_S, future increases in

productivity and pay, $Y(S_i)$, and forgone earnings, forgone leisure, and opportunity costs, $\phi(S_i)$.

Becker's original model assumes perfect capital markets implying that all individuals can access funds for financing their education at the same cost. When this assumption is relaxed and capital market imperfections are introduced, the cost function $\phi(S_i)$ also captures the ease with which individuals have access to funds. In case individuals can self-finance their education, $\phi(S_i)$ measures forgone interests that could have been earned from investing those funds into a comparably risky project. Because of intrinsic capital market imperfections, the costs of funds are typically higher for those who have to borrow than the opportunity costs for those who can self-finance their schooling.

Human capital theory predicts the marginal productivity of education $g'(.)$, to determine an individual's pay. Of course, this marginal productivity *ceteris paribus* increases in an individual's ability, or talent. More able individuals are likely to learn more from a given amount of education, which raises their marginal productivity of education and ultimately their earnings. In fact, there is strong empirical evidence of a large variety in earnings among individuals who have undergone a similar amount of formal education.

For the sake of formalizing the educational decision problem and ultimately deriving a testable econometric model, we introduce individual i's momentary utility function $U[Y(S_i),S_i]$ and assume it to be additively separable in earnings and costs of schooling:

$$U\left[Y\left(S_{i,t}\right), S_{i,t}\right] = log\left(Y_{i,t}\right) - \phi\left(S_{i,t}\right) \tag{2}$$

When choosing among the three possible career paths, a high school graduate i performs the following calculation. In period zero, he determines the overall

lifetime value $W(S_i)$ accruing from each of the three alternatives and decide in favor of the one yielding the highest value. The lifetime value of career path S_i equals the present value of the expected future utility derived from the income path and costs associated with alternative S_i. Hence,

$$W(S_i) = E_0 \sum_{t=0}^{T} \beta^t \left[log\left(g\left(S_{i,t}\right)\right) - \phi\left(S_{,ti}\right)\right] \qquad \text{for } t_S < T \tag{3}$$

In general, the schooling period t_S is longest for alternative *VU* and shortest for alternative *V*. E_0 denotes expectations taken at time period zero when the career choice is made. The letter T denotes the expected length of the individual's working life, and β represents the discount rate — the inverse of the gross rate of time preference.[2] A high school graduate decides in favor of career path S if $W(S) > 0$ and $W(S) > W(S')$ for all $S,S' \in J$ and $S \neq S'$.

The individual decision problem summarized in equation (3) nicely illustrates the various components that high school graduates need to weigh against each other when choosing a career path. Attending university typically takes longer than undergoing vocational training and also involves higher costs, but it promises to yield a higher lifetime income by generating a higher wage and reducing the risk of unemployment.

To render our model testable, we distinguish an observable component and an unobservable component in the true lifetime value of career path S_i. The lifetime value of career path S_i then becomes

$$W\left(S_i\right) = X_i{}'\pi_S + \eta_{S_i} \tag{4}$$

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[2] The rate of time preference is to be distinguished from the internal rate of return to education. This return equals the interest rate, which sets the present discounted value of an individual's lifetime utility equal to zero.

where X_i are the observable individual-specific factors that influence the expected lifetime value of career path W. π_S are choice-specific parameters, and η_{Si} captures the part of true lifetime utility which is unobserved by anyone but the decisionmaker. the π_S parameters represent the relative importance of the expected increase in pay, or the costs related to choices.

The probability of individual i choosing alternative S equals the probability that the lifetime value of alternative S exceeds that of any other alternative S' for individual i:

$$P_{S,i} = Pr\left[W(S_i) \geq W(S_i'), \forall S_i, S_i' \in J, S_i \neq S_i'\right] \tag{5}$$

Using equation (4), this probability can be rewritten as

$$P_{S,i} = Pr\left[\eta_{S',i} - \eta_{S,i} < X_i'\pi_S - X_i'\pi_{S'}, \forall S_i, S_i' \in J, S_i \neq S_i'\right] \tag{6}$$

Since $\eta_{S',i}$ and $\eta_{S,i}$ are random variables, their difference is also a random variable. It follows that the right-hand side of equation (6) is a joint cumulative distribution function. The probability of individual i choosing alternative S equals the probability that the random variable $\eta_{S',i} - \eta_{S,i}$ is smaller than the difference $X_i'\pi_S - X_i'\pi_{S'}$ of the deterministic parts of the lifetime value of choice S relative to any other choice S'.

Assuming all $\eta_{S,}$ to be identically and independently Weibull distributed, the probability of choosing alternative S can be rewritten (Train 1986: 53) as

$$P_{S,i} = \frac{e^{X_i'\pi_S}}{\sum_{S \in J} e^{X_i'\pi_S}} \tag{7}$$

This is the multinomial logit, which is identified up to the parameters π for one possible choice category. Greene (1997) provides an introduction to this

econometric model. For estimation purposes, the multinomial logit is rewritten as

$$P_{S,i} = \frac{e^{X_i'\pi_S}}{1 + \sum_{S \in J, S \neq U} e^{X_i'\pi_S}} \qquad for\ S \neq U$$
$$P_{U,i} = \frac{1}{1 + \sum_{S \in J, S \neq U} e^{X_i'\pi_S}} \tag{8}$$

The vector X_i contains individual-specific characteristics related to the career choice. We sort these characteristics into three different groups. The first group contains characteristics that influence the career decision through their effect on the benefits associated with education such as talent, earnings potential, and employment opportunities. The second group contains characteristics that influence the career decision throught their effect on costs associated with education such as access to capital. The third group contains characteristics that control for individual heterogeneity.

The parameters π_S give the change in the probability of choosing alternative S relative to the probability of choosing the reference category U. Therefore, the coefficients cannot be interpreted in a direct way. Marginal effects can instead be computed according to the formula

$$\frac{\partial P_{S,i}}{\partial X_i} = P_{S,i}\left[\pi_S - \sum_{S \in J} P_{S,i}\pi_S\right] \tag{9}$$

4 The Data

We use data from the German Socio-economic Panel (GSOEP) to study the factors influencing the career decision of *Abiturienten*. The GSOEP is an annual household survey that starts in 1984, with the most recent wave referring to 1997. The GSOEP contains information on schooling, family background, and employment status, for example. Frick and Haisken-De New (1997) provide a detailed description of this survey.

Our sample consists of all individuals who have graduated with an *Abitur* from a Gymnasium or a Fachschule with an *Abitur* from 1985 to 1994. We exclude 1984 from the sample, because it is impossible to infer the year in which an individual has received the *Abitur* from the information available for 1984. We set the year of *Abitur* as the first wave in which graduation is reported.[3] In order to observe the career decision of these individuals, we require them to stay in the GSOEP for three more waves after reporting to have received the *Abitur*. This Requirement seems appropriate, because males face a mandatory military or social service that can delay tertiary education or vocational training by up to two years. Also, some individuals choose to undergo vocational training for two years before entering tertiary education. The data suggests that the requirement of remaining three more waves in the GSOEP is reasonably long for the decision to pursue tertiary education to show up in the interviews.[4]

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[3] Some individuals report actually receiving their *Abitur* in two or more consecutive waves. We assume the double reporting to be caused by a different interpretation of the interview question in the two consecutive years. In the first year, the individual bases her information on the twelve months preceding the interview. In the second year, the individual bases her information on the previous calendar year.

[4] The length of the mandatory staying time can bias our estimation results, because it affects the composition of the *Abiturienten* in the sample. Extending the mandatory staying time in the GSOEP one more year, leads to a relative decrease of the individuals who choose vocational training. Shortening the mandatory staying time leads to a relative decrease of

Based on our selection criteria, we identify 470 individuals who have received the *Abitur* between 1985 and 1994. We lack information on the career choice of five *Abiturienten*. We lose further observations due to missing information on some of the regressors. Therefore, the sample we use for the regression analysis is left with 423 observations.

In general, an *Abiturient* has five options when choosing his career path: (i) Not joining the labor force; (ii) Joining the labor force; (iii) Vocational training only; (iv) Vocational training followed by tertiary education; And (v) tertiary education only. For the year of *Abitur* and the following three years we determine the main activity in which an individual is engaged during each year.[5] We take these four main annual activities and combine them to determine each individual's actual career choice.[6]

For example, if an individual reports being in the military in the year of *Abitur* and the following year, and reports being enrolled at university in the second and third year after the *Abitur*, we set the career decision to 'tertiary education'. We allow for the individual to reconsider the career decision within the four-year window. For example, if an *Abiturient* starts vocational training in the first year and then enters tertiary education without completing vocational training,

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those individuals who choose tertiary education, because those choosing to work after graduation will become independent from their family faster than those who continue on to university. Being independent from home, the panel household, is likely to increase the probability of attrition. By setting the mandatory staying time to three additional years, we hope to correctly observe the carreer decision while not introducing a strong bias in the composition of our sample.

5 Some individuals report to be simultaneously engaged in several of the five career choice activities for a single year. We classify these people by assigning decreasing weights to tertiary education, vocational training, in the labor force, and out of the labor force, respectively. Thus, if an individual reports to be in the labor force and in tertiary education within a single year, we set his career choice to tertiary education for that year.

6 A table linking each permutation of the annual activities to the actual choice will be provided by the authors upon request.

we classify him as having pursuedtertiary education only. Similarly, if an *Abiturient* joins the labor force for one year before entering tertiary education his career choice is set to tertiary education. We gain the information on the main activity is gained from questions relating to the time of the interview and retrospective spell-data for the year preceding the interview.[7]

Our sample contains no individuals who drop out of the labor force or join the labor force immediately after graduating from high school. This evidence suggests that the *Abiturienten* in our sample consider vocational training or tertiary education as having a positive net present value. For our estimation analysis the effective career choice thus reduces to a choice between three options.

Our list of regressors comprises variables suggested by human capital theory, dummy variables to control for individual heterogeneity, and a linear trend. Except for the skill-specific unemployment rates we construct all variables from information contained in the GSOEP. Table 1 presents as descriptive statistics the mean and standard deviation — if applicable — of the variables entering our analysis.

[7] All SAS programs used to generate the variables and all Stata programs for estimation are available from the authors upon request.

Table 1 – Distribution of the Variables[a]

	Total	Vocational Training	Vocational Training and Tertiary Education	Tertiary Education	Obser-vations
Career Decision	100.00	40.65	18.49	40.86	
Age at *Abitur*	21.19 2.56	20.75 2.53	23.03 3.67	20.81 1.36	470
Parental Skill Level	57.69	49.21	50.59	70.37	468
Per-Capita Income at Abitur	1132.03 (787.53)	1023.62 (403.25)	1113.538 (556.42)	1253.95 (1117.09)	428
Wage Differential	1.75 (0.14)	1.77 (0.14)	1.75 (0.14)	1.73 (0.12)	470
Unemployment Rate High Skilled	4.56 (1.41)	4.75 (1.42)	4.77 (1.55)	4.28 (1.30)	470
Unemployment Rate Medium Skilled	6.20 (1.66)	6.50 (1.64)	5.95 (1.38)	5.97 (1.72)	470
Male	57.66	51.32	54.65	65.26	470
Single	97.02	96.30	95.35	98.95	470
German Nationality	83.40	83.07	82.56	84.74	470
Female with Child	0.21	0.53	0.00	0.00	470
Unemployed	5.81	6.35	11.63	2.63	465

[a]Percent of individuals with the respective attribute for the discrete regressors. Mean and standard deviation in parenthesis for the continuous regressors. –[b]Monthly income in deutschmarks. Year before *Abitur* is reported for the first time.

Source: GSOEP (1997); own calculations.

We cannot construct a direct measure of ability from the GSOEP, because it contains no variable comparable to a grade-point average (GPA), for example

we ability .[8] We proxy ability by age at *Abitur*, and parental skill-level instead. Age at *Abitur* can be thought of as proxy for ability, because less able students are likely to take more time for completing the *Abitur*, particularly if they have to repeat one or more grades. We compute age at *Abitur* as the difference between the year of *Abitur* and the year of birth. The parental skill level can also be thought of as a proxy for ability, because parents with a higher skill level are more likely than others to provide their children with an environment that is conducive to learning. However, there is the risk of highly skilled parents pushing their child into tertiary education Regardless of the child's ability.[9] We define the parental skill level as high if either parent holds an *Abitur*, an advanced professional degree, or if the father works in a higher job position.[10]

We approximate the influence of financial constraints on the career decision by per capita household income in the year preceding the *Abitur*. If financial constraints matter for the career decision, a higher per capita household income should increase the probability of choosing tertiary education. If financial constraints do not matter for the career decision, the variable's influence should be insignificant.[11]

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[8] Unlike in the binary logit, the omission of a relevant variable will bias the estimated coefficients of the included regressors in the multinomial case only if regressors are correlated with the omitted variable (Shabbir 1993).

[9] Siebert (1985) argues in a recursive model of ability, schooling, and earnings that a mother's IQ is a valid proxy for a child's ability; he summarizes empirical support from other studies for this hypothesis.

[10] There is no information on the mother's job position in the GSOEP.

[11] Ermisch (1996) analyzes the influence of parental income on their children's schooling behavior in a theoretical framework. In the absence of perfect capital markets with no information asymmetries, transfers by parents matter for schooling behavior. The hypothesis is supported by evidence from the British Household Panel Survey.

Ideally, we would capture the expected return to education by a degree-specific wage differential and unemployment rate. To do so would require us to follow the individuals from the time they receive their *Abitur* up to the potential time of finishing tertiary 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*. Two rationales can be put forth for this approach. (i) The individual will actually base his career decision on the labor market conditions at the time of receiving the *Abitur*.[12] (ii) The indicators used are proxies for the actual degree-specific employment situation after completing vocational training or tertiary education.

We use the ratio of the median gross hourly wages — including benefits — for high-skilled to medium-skilled workers as a measure for the wage differential. The wage is constructed from the information on income in the month preceding the interview, actual hours worked in that months, and information on benefits and side payments. We take this wage from Christensen and Schimmelpfennig (1998). The Authors provide a detailed description of how they construct it. We define high-skilled as owning a university or equivalent degree, and medium-skilled as owning an advanced occupational degree or an *Abitur*. We take the unemployment rates for the group of high-skilled workers and the group of medium-skilled workers from Reinberg (1997). High-skilled is defined as owning a university degree, and medium-skilled is defined as owning a vocational degree.

The macroeconomic determinants are available for each of the ten years of *Abitur* by sex. This results in twenty values for each variable. Data limitations

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[12] Such behavior implies static expectations of the *Abiturienten* in their career decision. The existence of excess supply and excess demand cycles for university graduates with particular majors actually lends support to the assumption of static expectations.

prevent us from adding a further dimension like region to increase the variation in the variables.

To control for individual heterogeneity, we include dummies for sex, marital status, German nationality, and having been unemployed for more than 3 months. For females, we also construct a dummy for being a mother.[13] All variables refer to the year of *Abitur*, unless indicated otherwise. A linear trend is included to test whether the career decision has changed over the sample period due to factors not included in our regressor list.

5 Estimation Results

The multinomial logit model for the career decision of *Abiturienten* is estimated according to equation (8). The overall fit of the model is satisfactory (Table 2); McFadden's R^2 is around 15 percent.[14] The deviance test of the full model against a model that includes only a constant rejects the null-hypothesis of all regressors being jointly insignificant. According to these statistics, the estimated model is able to explain the career decision taken by *Abiturienten*.

The model's explanatory power can also be judged from a cross-tabulation of the predicted choice and the actual choice (Table 3). On average, the estimated model correctly predicts 57 percent of all decisions. However, the estimated model performs much better in pridicting the two extreme choices vocational

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[13] It is not possible to construct a father-variable for males as well without running the risk of classifying some wrongly. However, this should be less of a problem, since childcare appears to still fall more into the responsibilities of females. Also, we end up not using the variable, because only one female individual did actually have a child at the age of receiving her *Abitur*.

[14] Veall and Zimmermann (1996) discuss different measures of fit for limited dependent variables. In the multinomial case, McFadden's Pseudo R^2 is suggested as one measure of fit.

training, and tertiary education than predicting the intermediate choice vocational training and tertiary education. This result may arise because individuals going for this intermediate choice are likely to share characteristics with individuals who choose vocational training and with those who choose tertiary education. Hence, the model may have difficulties explaing this halfway house vocational training and tertiary education.

Table 2 – Measures of Fit

Number of Observations	423
Log-Likelihood Full Model	–376.3585
Deviance	$\chi^2(28) = 129.59$
McFadden's R^2	0.15

Source: GSOEP (1997); own calculations.

Cramer (1998) has shown that in a binary logit, the predictive power is smaller for the less frequent outcome. Therefore, the low predictive power for the intermediate choice may also be due to the fact that it is the less frequent choice. Nevertheless, judging a model by its predictive power needs to be viewed with caution. Even a purely random predictor would lead to some choices being predicted correctly.

The multinomial logit model is based on the independence of irrelevant alternatives (IIA) property. For our estimation, the IIA property implies that the choice between two career paths is independent of whether or not the third career path is available. We test the IIA property with the Hausman test suggested by Hausman and McFadden (1984).[15] The choice between vocational training and tertiary education is independent of the choice vocational training and tertiary

[15] See Brooks et al. (1995) for a discussion of alternative tests.

education. The test statistic is $H = 0.05$ with a critical value of $\chi^2(14) = 23.69$ at the five percent level. For the other two possible partitions of the choice set the test statistic is negative. This finding suggests that the null hypothesis of IIA most likely would not be rejected by alternative tests (cf. Hausman and McFadden 1984, footnote 4). We conclude that the IIA property holds for our estimated model. In particular, the choice vocational training and tertiary education is a distinct choice of its own.

Table 3 – Predictive Power of the Estimated Model[a]

Predicted Career Choice / Actual Career Choice	Vocational Training	Vocational Training and Tertiary Education	Tertiary Education	Total
Vocational Training	112 (69.92)	8 (4.49)	58 (32.58)	178 (42.08)
Vocational Training and Tertiary Education	19 (24.36)	24 (30.77)	35 (44.87)	78 (18.44)
Tertiary Education	53 (31.74)	9 (5.39)	105 (62.87)	167 (39.48)
Total	184 (43.50)	41 (9.69)	198 (46.81)	423 (100.00)

[a]Frequencies. Percentage of predicted choice per actual choice in parenthesis.

Source: GSOEP (1997); own calculations.

Table 4 shows the marginal effects of the included regressors on the probability of choosing a particular career paths.[16] Although the estimated marginal effects were jointly significant, only some of them are also individually significant. In

[16] We also computed discrete effects for the dummy regressors. As the discrete effects are almost identical to the marginal effect, we do not report them due to space considerations.

particular, age at *Abitur*, the parental skill level, and the skill specific unemployment rates appear to be influential for all three possible career paths.

Age at *Abitur* is the dominant regressor. At first sight, the sign on the estimated marginal effect appears to contradict our interpretation of age at *Abitur* as proxy for ability. However, considering the joint impact of age at *Abitur* and age at *Abitur* squared lends support for our view. The probability of choosing vocational training increases up to an age at *Abitur* of 24, the probability of choosing vocational training and tertiary education increases up to an age of 40, and the probability of choosing tertiary education increases up to an age of 21. Thus a younger age at *Abitur* is more strongly associated with choosing tertiary education than with choosing vocational training. For the intermediate choice, the influence of age at *Abitur* has its maximum at a rather late age, because some individuals in this group have completed their *Abitur* after finishing vocational training, and probably while working on a job.

Having parents with an advanced skill level increases the probability of choosing tertiary education and lowers the probability of choosing vocational training. The marginal effect is only significant for the choice tertiary education. We can therefore interpret the parental skill level as another proxy for ability and conclude that the probability of a graduate going for tertiary education increases in the individual's ability.

Table 4 – The Estimated Marginal Effects from the Multinomial Logit[a]

	Vocational Training	Vocational Training and Tertiary Education	Tertiary Education
Log Age at Abitur	–37.37 (–3.01***)	8.59 (1.25)	28.78 (1.97**)
Log Age at Abitur Squared	5.87 (2.92***)	–1.16 (–1.06)	–4.71 (–1.98**)
Parental Skill Level	–0.10 (–1.56)	–0.07 (–1.54)	0.17 (2.67***)
Log per-capita Household Income at Abitur	–0.11 (–1.68*)	0.03 (0.66)	0.08 (1.33)
Wage Differential	0.67 (1.51)	–0.07 (–0.21)	–0.60 (–1.33)
Wage Differential * Sex	–1.60 (–1.64*)	–0.10 (–0.15)	1.70 (1.81*)
Log High-Skilled Unemployment Rate	0.42 (1.33)	0.46 (2.04**)	–0.88 (–2.88***)
Log Medium-Skilled Unemployment Rate	–0.08 (–0.29)	–0.40 (–2.40**)	0.47 (1.90*)
Male	1.02 (1.72*)	0.14 (0.34)	–1.16 (–2.05**)
Single	–0.30 (–1.24)	0.27 (1.94***)	0.03 (0.11)
German Nationality	0.08 (0.96)	0.00 (0.05)	–0.09 (–0.99)
Unemployed	0.12 (0.90)	0.14 (2.03)	–0.26 (–1.82*)
Time	–0.48 (–2.23**)	–0.13 (–0.90)	0.61 (2.81***)
Time Squared	0.23 (2.27**)	0.06 (0.96)	–0.29 (–2.94***)
Constant	59.61 (3.10***)	–15.91 (–1.47)	–43.71 (–1.94*)

[a]Marginal effects are evaluated at the sample mean. t-statistics in parantheses. The test statistic is asymptotically standard normal distributed. * denotes significance at the 10 percent level, ** denotes significance at the 5 percent level, and *** denotes significance at the 1 percent level.

Source: GSOEP (1997); own calculations.

Similarly, a higher per capita household income increases the probability of choosing tertiary education. It lowers the probability of choosing vocational training. This evidence lends some support to the view that financial considerations influence high school graduates' career decision. However, the impact is not strong, and only the estimate for the choice vocational training only is significant at the 10 percent level. This evidence stands in contrast to what we know from studies for the United States and the United Kingdom where financial constraints significantly affect young adults' career decision. There are several possible explanations for this discrepancy. First, the studies for the United States or the United Kingdom show that the influence of financial constraints weakens as young adults move up the educational ladder. Second, the majority of German universities and *Fachhochschulen* are public institutions which are free of tuition or any other charges. Third, there are publicly provided interest-free loans available that are designed to alleviating financial constraints for poor students.

The wage differential has a negative impact on the probability of choosing tertiary education and a positive impact on the probability of choosing vocational training; but the marginal effect is not statistically significant. When introducing an interaction term between the wage differential and the dummy for being male the variable becomes significant and carries the expected sign. This evidence shows that, for males, a higher wage differential increases the probability of choosing tertiary education and lowers the probability of choosing vocational training. Hence, human capital theory correctly predicts males' educational behavior with respect to the wage differential, but it fails to describe females' behavior. With respect to the wage differential, human capital theory appears to be able to describe the behavior of males, while it fails to describe the behavior of females. Looking at separate regressions for males and

females lends further support to the view that the determinants of the career choice differ between the sexes.

The skill-specific unemployment rates perform as predicted by human capital theory. A higher unemployment rate among the high-skilled reduces the probability of choosing tertiary education only and increases the probability of choosing vocational training. Similarly, a higher unemployment rate among the medium-skilled increases the probability of choosing tertiary education and lowers the probability of choosing vocational training. Both marginal effects are significant at the five percent level for the choice tertiary education and for the choice vocational training and tertiary education. They are insignificant for the choice vocational training only. This evidence is consistent with the common view that many *Abiturienten* undergo vocational training prior to engaging in tertiary education in an effort to insure against the possibility of becoming unemployed after graduating from university.

Human capital theory appears to be better suited to describe the career choice of male *Abiturienten* than to describe the career choice of female *Abiturientinnen*. However, this is not surprising. The career choice of females is influenced by other factors besides those put forth by human capital theory. And, females may weigh the determinants suggested by human capital theory differently from men. If women take on a larger share of family related work like raising children, wage differentials may actually matter less than employment and re-employment probabilities. Also, females may choose majors like liberal arts, or teaching that are less subject to macroeconomic influences.[17] In any case, these

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[17] See Figure A3. Montmarquette et al (1997) e.g. show that women respond less strongly to expected earnings differences when choosing a college major than men. The willingness of women to go into non-traditional careers is viewed as an explanation for this finding by the authors.

results highlight the importance of paying close attention to gender differences when analyzing economic behavior. Merely including a gender dummy may not be sufficient to fully control for these differences.

6 Summary

Human capital theory interprets high school graduates' decisions about their career path as an investment decision. When making their decision, graduates are assumed to compare the present value of the expected lifetime utility associated with each path and deciding in favor of the path yielding the highest value. Lifetime utility increases in the return to education — which itself is affected by individual talent —, and in employment opportunities. It decreases in the costs of education. Our empirical results based on a multinomial logit model using data from the German Socioeconomic Panel suggest that human capital theory explains important aspects of these decisions reasonably well. The results also suggest that our particular specification of human capital theory is better suited to describe the behavior of males than to describe the behavior of females.

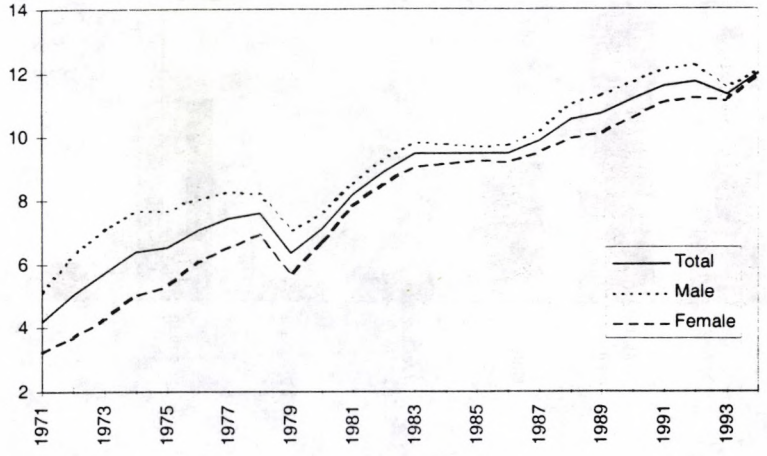
In accordance with the theory, male graduates react with their career choice to the expected return from a certain career path, where the return is approximated by a skill-specific wage differential. Males' choices also react in the expected fashion to skill-specific unemployment rates. These unemployment rates express skill-specific employment probabilities. Both findings together suggest that an individual's expected lifetime income from a certain career path positively affects the probability of choosing that path. Another major determinant of high school graduates' career choices is individual ability. In the absence of a direct measure of ability, we use age at *Abitur* and the parental skill-level as proxies. Both variables have a significant positive impact on the probability of choosing tertiary education only, and a significant negative

impact on the probability of choosing vocational training only. Finally, there is some empirical support of the view that financial constraints affect the career choice of qualified young adults.

The fact that high school graduates do react with their career choice to economic stimuli means good news for the German labor market. The unemployment rate for academics tends to be lower than that for non-academics. By positively reacting with their educational behavior to relative changes in the skill-specific employment probability, for example, *Abiturienten* help reduce overall unemployment. The same holds true for their reaction to financial constraints. If introducing *BAFöG* in 1977 indeed eliminated financial constraints for a large number of high school graduates, thereby encouraging them to undergo tertiary education, this educational behavior has helped mitigate the rise in German unemployment. Investigating the extent to which adjustments in the educational level may have affected the path of the unemployment rate along the lines of Summers' (1986) analysis for the United States will be one natural next step of our analysis. Doing so requires time series evidence on unemployment by level of education. We will leave it as topic for future research.

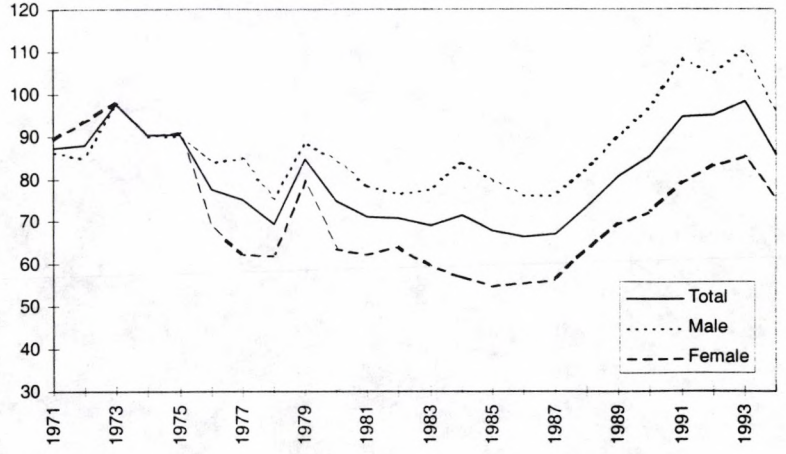
Appendix – Figures

Figure A1 – Share of *Abiturienten* in Population 18–21 Years in West-Germany (percent)



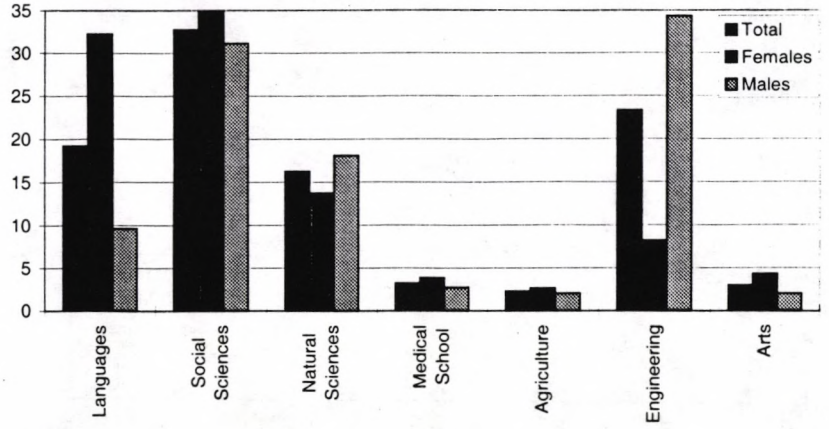
Source: Statistisches Bundesamt (1997).

Figure A2 – Share of University Enrollment in Population 18–21 Years in West-Germany (percent)



Source: Statistisches Bundesamt (1997).

Figure A3 – University Enrollment by Subject and Sex in 1992 (percent)



Source: Statistisches Bundesamt (1997).

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