Career Choices of German High School Graduates:

Evidence from the GSOEP[♣]

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November 1998

PRELIMINARY DRAFT – PLEASE DO NOT QUOTE

Abstract

This paper explores the economic determinants affecting high-school graduates' career choice in Germany. A qualitative-response model is deduced from the theory of human capital and estimated 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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♣ This research was started while Merz visited the Kiel Institute of World Economics. It was continued while she visited the European University Institute in Florence. She thanks both institutions for their hospitality. We gratefully acknowledge helpful comments from participants at the GSOEP 1998 conference and participants at the Tübingen Economic Workshop. We also thank Gerd Ronning, Christian Dustmann and Andrea Ichino for valuable suggestions, as well as Björn Christensen and Katrin Eckert for research assistance. All remaining errors are our own.

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1 Introduction

Deciding which type of education to acquire is crucial for 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, leaving the skilled with comparatively better employment prospects. At the same time, 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. Of these *Abiturienten*, the share continuing to tertiary education has reached an all-time high of 96 percent in 1993. These facts are nicely illustrated in Figures A1 and A2.

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 socioeconomic panel from 1985 through 1994.

Our estimation results suggest that at least some of the high school graduates' career choices can be explained reasonably well by economic factors. Moreover, age at *Abitur* and the parental skill-level play a significant role for the choices 'tertiary education' and 'vocational training'.

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 from human capital theory. Section 4 presents estimation results for German *Abiturienten* with data from the German Socio-economic Panel. Section 5 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 Fredrikkson (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 background 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.

In the case of German *Abiturienten*, the educational investment decision problem can be formulated 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 $J=\{U,V,VU\}$.[2] We let schooling, S, represent any of the three elements in J. This setup is consistent with the definition provided by Train (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.

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:

$$Y\left(S_i\right) = g\left(S_i\right) \tag{1}$$

The function $g(.)$ is concave.

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2 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.

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.

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:

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

When choosing among the three possible career paths, high school graduates perform the following calculation. They determine the overall lifetime value $W(S)$ 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 expected present discounted future utility derived from the income path and costs associated with alternative S_i. Hence,

$$W\left(S_i\right) = E_0 \sum_{t=t_s}^{T} \beta^t \left[log\left(g\left(S_i\right)\right) - \phi\left(S_i\right)\right] \tag{3}$$

In general, t_S is largest 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.[3] A high school graduate decides in favor of career path S if $W(S) > 0$ and $W(S) \geq W(S')$ for all $S,S' \in J$ and $S \neq S'$.

[3] 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.

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

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

where X_i are the 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 parameters η_{Si} represent the relative importance of the expected increase in pay, or the costs related for the choice S.

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:

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

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

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

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 is that probability that the random variable $\eta_{S',i} - \eta_{S,i}$ is smaller than the difference $X_i\text{'}\pi_S - X_i\text{'}\pi_{S'}$ of the deterministic parts of the lifetime value of choice S relative 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)

$$P_{S,i} = \frac{e^{X_i\text{'}\pi_W}}{\sum\limits_{S \in J} e^{X_i\text{'}\pi_W}} \tag{7}$$

This is the multinomial logit, which is identified up to the parameters π for one possible choice category.[4] Hence, for estimation, the multinomial logit is rewritten as

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

The vector X_i contains individual-specific characteristics related to the career choice. These characteristics can be subdivided into three groups. First, characteristics that influence the career decision through their effect on the benefits associated with education like talent, earnings potential, and employment opportunities. Second, characteristics that influence the career decision throught their effect on costs associated with education like access to capital. And, third, 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. Thus, the coefficients cannot be interpreted in a direct way. Instead, marginal effects can be computed according to the formula

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

[4] See e.g. Greene (1997) for an introduction to the multinomial logit.

4 Empirical Results

4.1 The Data

To study the factors influencing the career decision of *Abiturienten*, we use data from the German Socio-economic Panel (GSOEP). The GSOEP is an annual household survey that starts in 1984, with the most recent wave referring to 1997.[5] The GSOEP contains information, for example, on schooling, family background, and employment status.

The sample consists of all individuals who have graduated from a Gymnasium or a Fachschule with a university entrance certificate – *Abitur* hereafter – from 1985 to 1994.[6] The year of *Abitur* is set as the first wave, in which graduation is reported.[7] In order to observe the career decision of these individuals, they are required to stay in the GSOEP for three more waves after reporting to have received the *Abitur*. Males face a mandatory military or social service that can delay tertiary education or vocational training by up to two years. Some individuals choose to do an apprenticeship before entering tertiary education which lasts another two years. 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.[8]

Based on our selection criteria, we identify 470 individuals who have received the *Abitur* from 1985 to 1994. There is no information on the career choice for five *Abiturienten*. In addition,

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5 See Frick and Haisken-De New (1997) for a detailed description of the GSOEP

6 It is not possible from the information in 1984 to infer the year in which an individual has received the *Abitur*.

7 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.

8 Extending the mandatory staying time in the GSOEP one more wave, leads to a relative decrease of the individuals do not choose tertiary education. Shortnening the mandatory staying time leads to a relative decrease of those individuals who we can observe to choose tertiary education for the sake of a larger sample. 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. Introducing a mandatory staying time will therefore bias our sample towards those who choose tertiary education. However, since we cannot follow the whole life of every individual in our sample, there is also a bias towards those who do not choose tertiary education, because we do not observe this decision for some individuals. As both of these biases work in the opposite direction, the net effect will be smaller than either of the individual effects. While we do not know which way the net effect works, we can hope that it will be small.

we lose further observations due to missing information for some of the regressors. For the regression analysis, our sample is therefore reduced to 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 an individual is engaged in during each year.[9] Next, we take these four main annual activities and combine them to determine the actual career choice of each individual.[10]

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, we consider her as having made the career choice 'tertiary education'. Similarly, if an *Abiturient* joins the labor force for one year before entering tertiary education, her career choice is also set to 'tertiary education'. 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.[11]

There are no individuals who drop out of the labor force, and there is no individual who joins the labor force right away in our sample. Hence, for the actual estimation, the career choice between five options reduces to a choice between three options. The fact that there are no individuals who choose to join the labor force right away after the *Abitur* implies that the investment in vocational training or tertiary education is considered as having a positive net present value by the individuals in our sample.

The list of regressors comprises those suggested by human capital theory, dummy variables to control for individual heterogeneity, and a linear trend. Except for the skill-specific

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[9] Some individuals report to be engaged in several of the five career choice activities for a single year. We classify these people by putting the most weight on tertiary education, and less weight on vocational training, in the labor force, or 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, his career choice is set to tertiary education for this year.

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

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

unemployment rates, all variables were constructed from information in the GSOEP. Table 1 shows descriptive statistics of the variables used.

A direct measure of ability like GPA (*Abiturnote*) could not be constructed from the GSOEP.[12] We tried to instrument ability by age at *Abitur*, and parental skill-level. Age at *Abitur* can be thought of as an instrument for ability, because less able students are likely to take more time for the completion of the *Abitur*, e.g. if they have to repeat one or more grades. Age at *Abitur* was computed as the difference between the year of *Abitur* and the year of birth. Parental skill level can also be thought of as an instrument for ability, because parents with a higher skill level may provide an environment that is more conducive to learning. However, parents with a higher skill level can also push their child into tertiary education.[13] The parental skill level is defined as high, if the either parent holds an *Abitur*, an advanced professional degree, or if the father works in a higher job position.[14]

The influence of financial constraints on the career decision is approximated by per-capita household income in the year preceeding 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.[15]

The expected return to education 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 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

[12] 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).

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

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

[15] Ermisch (1996) anylzes 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 substantiated with evidence from the British Household Panel Survey.

conditions at the time of receiving the *Abitur*.[16] (ii) The indicators used are instruments for the actual degree-specific employment situation after completing vocational training or tertiary education.

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.

As a measure for the wage differential, we use the ratio of the median gross hourly wages including benefits for high-skilled to medium-skilled workers. The wage is constructed from the information on income in the month preceding the interview, actual hours worked in that months, and information on benefit and side payments.[17] We define high-skilled as owning a

[16] 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.

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

university or equivalent degree, and medium-skilled as owning an advanced occupational degree or an *Abitur*.

The unemployment rates for the group of high-skilled individuals and the group of medium-skilled individuals are taken from Reinberg (1997). High-skilled is defined as owning a university degree. Medium-skilled is defined as owning a vocational degree.

The macroeconomic determinants are available for each of the nine years of *Abitur* by sex. This results in 20 values for each variable. Data limitations 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.[18] 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.

4.2 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.[19] 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 by looking at a cross-tabulation of the predicted choice and the actual choice (Table 3). On average, the estimated model predicts 57 percent of all decions correctly. The two extreme choices 'vocational training' and 'tertiary education' are predicted better by the estimated model than the intermediate choice 'vocational training and tertiary education'. Individuals going for this intermediate choice are likely to share characteristics with individuals who choose vocational training and with those who

[18] 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*.

[19] 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.

choose tertiary education. Hence, the model may have difficulties explaing this halfway house 'vocational training and tertiary education'.[20]

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.

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.[21] Although the estimated marginal effects were jointly significant, only some of them are also individually significant. In 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 an instrument for ability.

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[20] 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 be due to the fact that it is the less frequent choice. Also, judging a model by its predictive power needs to be viewed with caution, because even a purely random predictor would lead to some choices being predicted correctly.

[21] 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.

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 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 their vocational training and probably while working.

Having parents with an advanced skill level in the year preceding the *Abitur* 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'. The parental skill level could therefore be interpreted as another instrument for ability.

A higher per capita household income increases the probability of choosing 'tertiary education', and it lowers the probability of choosing 'vocational training'. Financial considerations appear to be relevant to the career decision. However, the impact is not strong and the estimates are only significant at the 10 percent level.

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'; the marginal effect is not significant, though. An interaction term between the wage differential and the dummy for being male, however, is significant and carries the expected sign. Therefore, for males, a higher wage differential increases the probability of choosing 'tertiary education' and lowers the probability of choosing 'vocational training'. 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.[22]

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[22] For males, the results are very similar to the ones presented here. For females, the estimated model contradicts the implications of human capital theory. The results are available from the authors upon request.

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.

The skill-specific unemployment rates perform as expected. A lower unemployment rate among the high-skilled increases the probability of choosing 'tertiary education' and lowers the probability of choosing 'vocational training'. 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'.

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.[23] In any case, these 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.

5 Summary

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 career decision. The theory is based on the assumption that income can be modelled as a function of schooling. The decision on the type of education is thus an investment decision, that compares the expected lifetime utilities for different career paths. The demand for education increases in individual talent, the return to education and employment opportunities. It decreases in the opportunity costs of education.

German data from the Socio-economic Panel was used to test the implications of human capital theory. We constructed a sample of 470 individuals who graduated with an *Abitur* in the period from 1985 to 1994. Of these *Abiturienten*, 41 percent chose to enter vocational training, 18 percent chose to complete a vocational training and continue on to tertiary

[23] 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.

education, and 41 percent chose to enter tertiary education. We analyze the decision to demand higher education conditional on holding an *Abitur* as a multinomial logit model.

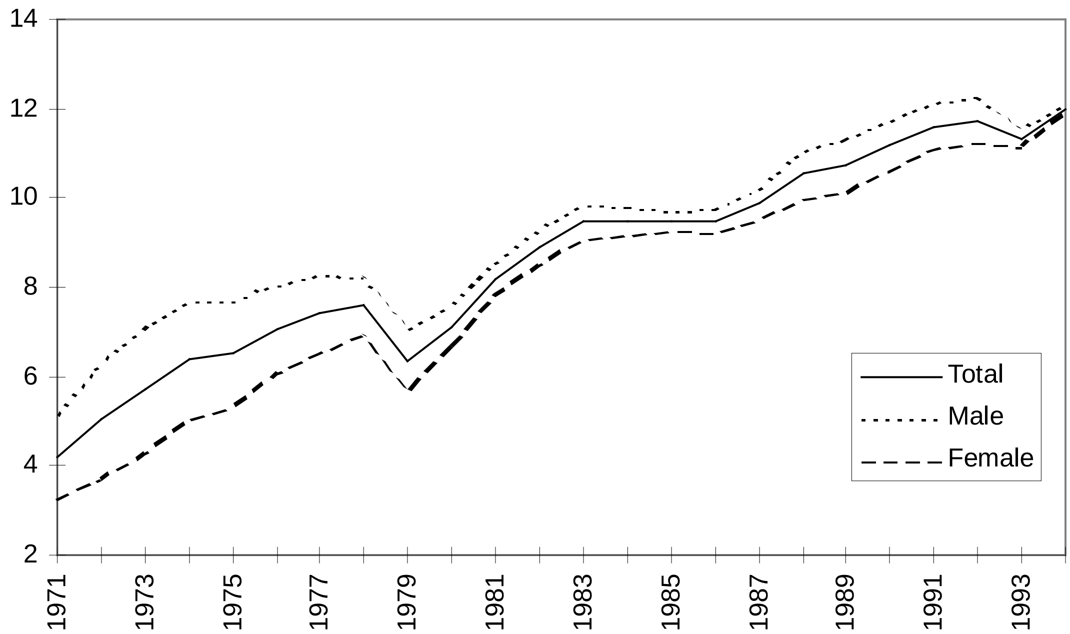
The estimated model fits the data well. The choices 'vocational training' and 'tertiary education' are predicted satisfactorily. The choice 'vocational training and tertiary education' is predicted less satisfactorily. We argue that individuals choosing the intermediate career path 'vocational training and tertiary education' exhibit characteristics that are associated both with those individuals who choose just vocational training or those individuals who choose just tertiary education. The multinomial logit may therefore have difficulties at picking up separate effects for the intermediate choice.

The regressors derived from human capital theory have the expected influence on the career decision. Age at *Abitur*, and the parental skill-level have a significant positive impact on the probability to choose tertiary education and a significant negative impact on the probability to choose vocational training. We interpret these variables as instruments for talent. The wage differential had the expected positive effect on the probability of choosing tertiary education and the expected negative effect on the probability of choosing vocational training for males only. The skill-specific unemployment rates had the expected effect for both sexes.

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. There is evidence in our data that the career decision taken by *Abiturienten* is at least partly based on economic motives. These results suggest that labor supply adjusts to changes in labor demand at least in the long run.

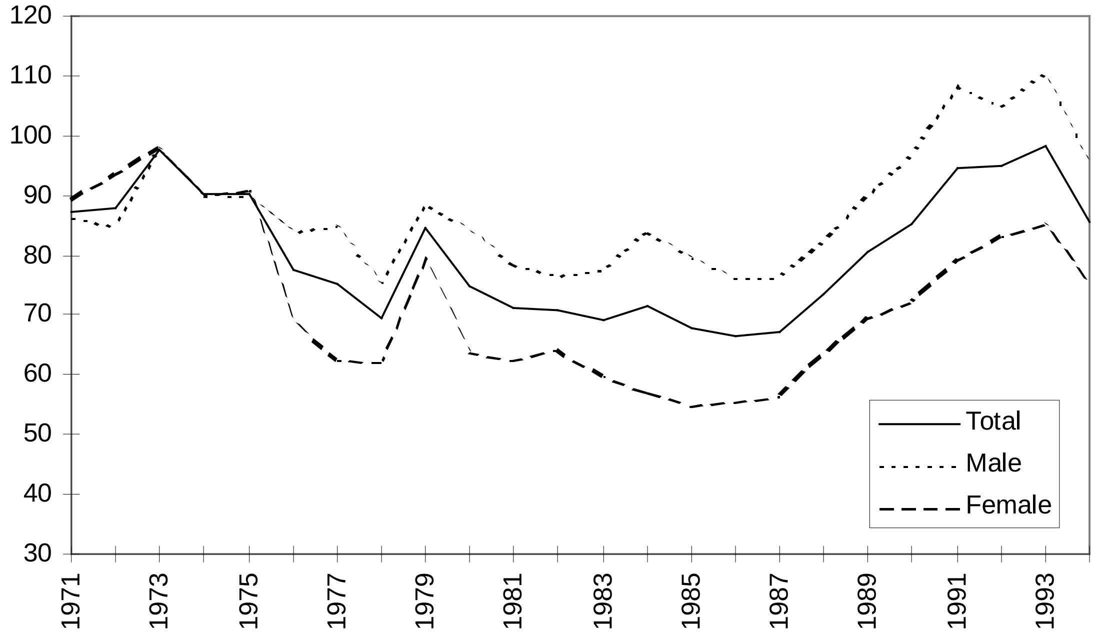
Appendix – Figures

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



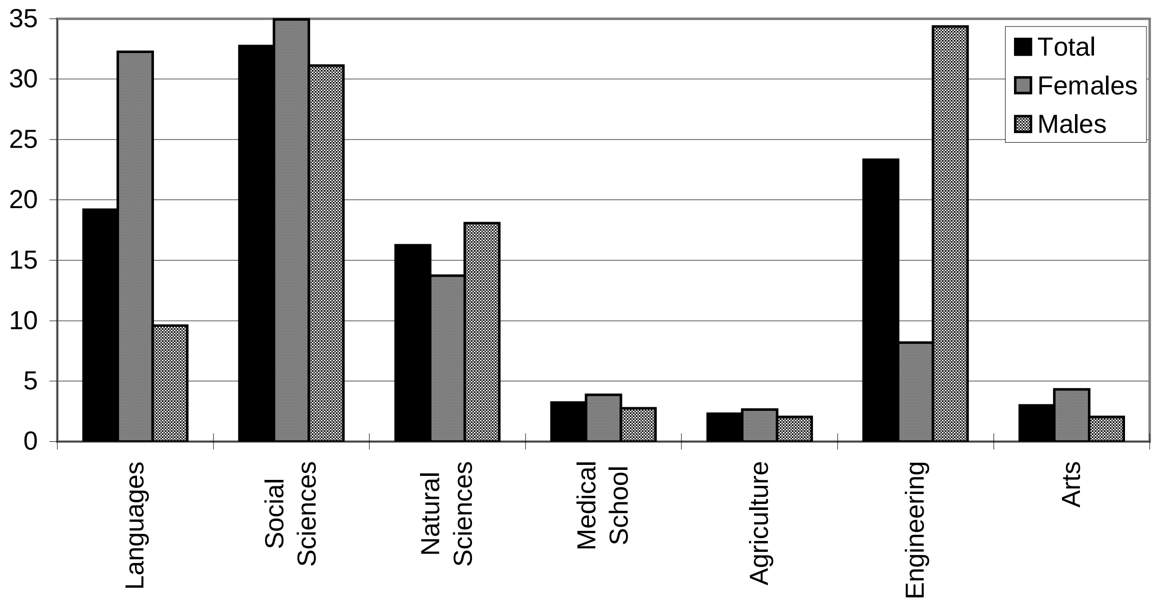
Source: Statistisches Bundesamt (1997).

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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