

Entry wages, wage progression and employer learning - Empirical evidence for university graduates ¹

Katja Görlitz

RWI Essen

Barbara S. Winter

RWI Essen

February 2009

Preliminary version - Please do not quote!

Abstract. Little is known about the transition from university to the labor market, in particular about the determinants of a successful labor market entry and career development. This paper estimates the determinants of log monthly wages in the first job and compares it with the determinants of wages five years later. Considering a variety of control variables, i.e. socio-demographic factors, course of study, job and firm characteristics, work experience, tenure, job mobility and participation in continuous training, we show that sign and significance of study characteristics and ability proxies differ with labor market experience. These findings provide evidence that employer learning also occurs for college graduates that have the same educational background.

JEL classification: I23, J24, J31

Keywords: employer learning, entry wage, university graduates

1 Introduction

Little is known so far on what determines a successful entry, career development and high wage growth for labor market entrants. This information might be of importance because successfully starting one's working life might determine future labor market outcomes, e.g. if wages are path dependent or if first job characteristics are a stigma for future employers. In addition, there is still no conclusive evidence on how (entry) wages are generated and what determines their growth, i.e. whether the accumulation of human capital is responsible (Becker, 1964) or whether education signals innate ability (Spence, 1973). The literature on employer learning suggests that employers initially discriminate upon education but they reward ability later on when the employees' time within labor markets reveals this information (Farber and Gibbons, 1996; Altonji and Pierret, 1996, 2001).

In this paper, we estimate the determinants of entry wages of German university graduates and their change over time by comparing the determinants of the entry wages with the determinants after five years using individual panel data. We introduce a variety of variables on

¹All correspondence to Katja Görlitz or Barbara S. Winter, Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI Essen), Hohenzollernstraße 1-3, D-45128 Essen, Germany. Fax: +49-201-8149-200. Email: goerlitz@rwi-essen.de or winter@rwi-essen.de. All remaining errors are our own.

socio-demographics, course of study, college achievement as well as firm and job characteristics. After five years, there is also information on previous career development (e.g. job mobility, unemployment, tenure, and attendance at further training). Unfortunately, there is no information on a formal ability tests available in our data. Therefore, we use some other proxies for ability, in particular fathers' and mothers' education (see Altonji and Pierret (2001); Bauer and Haisken-DeNew (2001) for an application) and the high school grade of the graduates. Furthermore, we are able to proxy motivation and career ambition.

We contribute to the previous literature by providing determinants of entry wages, career development, and wage growth for Germany. We are only aware of two studies providing similar evidence for Germany. Braakmann (2008) who uses the same data set as we use finds that gender wage differentials are mainly caused by gender differences in choosing a field of study. The interpretation and discussion of the covariates in the wage equation remains a sight aspect in his paper. Bauer and Haisken-DeNew (2001) test the employer learning theory for Germany and find no support for it using data from the German Socio-Economic Panel Study. In addition, comparing determinants in the first job and after five years allows us to contribute to the employer learning literature. For this application, we allow that employers do not only discriminate upon education but also discriminate upon other factors when hiring individuals that acquired the same educational degree.

Using data from the "HIS panel survey of graduates 1997", we find that sign and significance of labor market characteristics differ to a large extent between the first year and after five years. Especially for the coefficients of the course of study we find large differences. In the first year, work experience before or during study leads to higher entry wage which could indicate that these graduates have a higher marginal productivity or know which firms pay high entry wages . After five years, only a weak effect of work experience is left but there are statistical significant results on university grade, length of study, international experience and on one of our ability measures high school grade. Although we are aware that our ability measure might not cover all aspects of ability, we still interpret our results as evidence that employer learning also occurs rapidly within the five years of experience for the homogeneous group of university graduates.

The remainder of the paper is organized as follows. The next section provides a theoretical background and introduces the previous literature. The third section presents the data and summary statistics and the empirical specification. Afterwards, regression results are illustrated and the last section concludes.

2 Theory and Previous Literature

Yet, relatively little work is done on what determines wages of first labor market entrants and how these factors change with labor market experience, especially for European countries. In

the US, a recent literature finds evidence that labor market outcomes are associated with college quality (e.g. Brewer et al., 1999; Dale and Krueger, 2002; Black and Smith, 2004; Light and Strayer, 2004; Long, 2008), college degrees (e.g. Kane and Rouse, 1995, 1999; Jaeger and Page, 1996), changing the college (e.g. Light and Strayer, 2004), time to obtain the degree (e.g. Brodaty et al., 2008) and majors (e.g. Arcidiacono, 2004). In contrast, whether there is a relation between grades and wages is not clear. While Wise (1975) and Carvajal et al. (2000) find significant effects for college graduates in the US, Weiss (1995) deems this link to be rather unimportant at least for high school grades. Whether these associations hold also true for other countries, especially European countries, is not investigated yet. In line with the results for the US, Holmlund and Regnér (2008) find a relation between college changing and wages for Swedish graduates. There is also some evidence of the relation between college quality and wages available for Italy (e.g. Di Pietro and Cuttillo, 2006; Brunello and Cappellari, 2008) and some evidence of a relation between grades and wages for the Swiss (Schweri, 2004). To our knowledge, there is no evidence taking the whole bunch of relevant variables into account. In our data set we are able to observe a large set of relevant variables and hence we can control for a lot of relevant factors.

Furthermore, there is also no conclusive evidence on how (entry) wages are generated and what determines their growth, i.e. whether the accumulation of human capital is responsible (Becker, 1964) or whether education signals innate ability (Spence, 1973). Following the human capital theory, changes in wages arise due to differences in human capital. Assuming that changes in wages reflect changes in productivity, accumulation of human capital requires to increase productivity, and thus wages. Hence human capital can be acquired through education or experience, more educated and more experienced workers earn higher wages. In contrast, signaling theory suggests that investments in education only serve as a signal for underlying ability. Assuming that investments in education are only worthwhile for persons with higher ability, it helps sorting workers into groups regarding their ability. This enables education to serve as a signal for employers, helping them to distinguish between more and less able workers. Whether the former or the latter theory holds true is not clear.

There is evidence that wage differentials between labor market entrants with different educational backgrounds are initially large but decrease with labor market experience. By contrast, the impact of ability on wages is initially low and increases over time (Farber and Gibbons, 1996). Furthermore, it could be shown that employers discriminate labor market entrants based on their educational attainment (Altonji and Pierret, 2001). These findings represent that employer learning exists in the labor market, i.e. that there are information asymmetries and that employers initially are unable to observe workers' productive capability or ability but that it is revealed gradually by the workers with experience. In general, knowledge obtained through the learning process seems to be 'public' because all employers achieve the same information; except for college graduates where learning seems to be asymmetric (Schönberg, 2007). Furthermore,

employers learn rapidly about workers' skills (Lange, 2007).

3 Data and methods

Data

For the analysis, we use the scientific use file of the "HIS panel survey of graduates 1997" that is a representative survey among German students obtained their grade between September 1996 and September 1997 from a German university.² The survey was conducted by the HIS Hochschul-Informationen-System GmbH. College graduates and graduates from universities of applied science (*Fachhochschulen*) were interviewed the first time shortly after graduation (1 to 2 years) in 1998. In 2003, they were interviewed again to cover wage and job developments. In the first wave the graduates were asked about their course of study (e.g. field of study, length of study, final grade, type and number of degrees obtained, student employment), the transition from university to the labor market, and about social demographic factors and background (e.g. gender, age, marital status, parental educational background). The survey in the year 2003 concentrates on the employment biography (e.g. job changes, unemployment durations), the participation in further training (e.g. formal/ informal training, the frequency of training, cost sharing between employers and employees), some characteristics of the current job (e.g. firm size, industry, share of workers with university degree, full-time employment, employment in civil service) and the actual family situation.

The sampling design was a clustered sampling where the clusters were defined by field of study, type of degree and college. The graduates from East German universities are oversampled. To account for this sampling structure we use the weights derived by the HIS.

In our analysis we exclude all teachers because the process for the labor market entry is different to that one of the other kind of degrees. The same holds true for graduates of medicine and health science. The graduates of law are excluded because the information of the final university grade are measured in a different way and could not be transformed in an adequate way. The reason is that the distribution of final grades in the study of law is totally different from that of the other fields of study. Furthermore we exclude all those persons which are self employed, and which obtained their high school degree in the former German Democratic Republic (GDR). For all persons with more than one employment at the time of the second interview, we could not match the income information to the job characteristics appropriately. Therefore we exclude these persons, too. To minimize possible bias we only include in our estimation persons with information for all relevant variables for both years.

²The scientific use file and its documentation (Fabian and Minks, 2006) is distributed by the GESIS-ZA Central Archive for Empirical Social Science (GESIS-ZA Zentralarchiv für empirische Sozialforschung).

Methods

In order to investigate the determinants of entry wages and their development over time we estimate in a first step a mincer wage equation for each survey year with wage as dependent variable on a set of controls that comprises variables of e.g. socio-demographics, course of study, college achievement, and firm and job characteristics. The second step consists of the estimation of a wage growth equation. Additionally, we run the estimation separately for graduates who changed their firm at least once since graduation (mover) and for graduates who did not change the firm (stayer). Regarding the theory of employer learning, the time the employer can learn about the productivity of the worker differs between movers and stayers. In addition, the process of wage building as well as of wage growth can be assumed to be different, e.g. increasing numbers of job changes can serve as a stigma to the employer. Applying a chow test to the data, these assumptions can be confirmed by significant differences in the results for movers and stayers.

To model the process of building the labor market entry wage we estimate a modified mincer wage equation including as dependent variable the log of the monthly gross labor income, measured at the time when first entering the labor market and as controls variables for the social background, ability, motivation, course of study, the work experience before and during study, the quality of the university, and firm and job characteristics.³ We do not include schooling because our sample only comprises graduates from colleges. The first equation is

$$W_{1i} = \beta_0 + \beta_1 A_i + \beta_2 M_i + \beta_3 STUDY_i + \beta_4 PEXP_i + \beta_5 UNI_i + \beta_6 FIRM_{1i} + \beta_7 X_{1i} + \epsilon_{1i} \quad (1)$$

where W_{1i} is the log monthly gross income at the time of the first labor market entry and ϵ_{1i} is the error term which is assumed to be unrelated to the other variables in the model.

To control for unobservable heterogeneity we include firstly the vector A_{1i} that comprises some ability measures. Because ability is not directly observable it need to be approximated by other variables. We control for ability in our model by including on the one hand the final grade at high school and on the other hand the parents' educational background. The latter is used often in literature (see Altonji and Pierret (2001); Bauer and Haisken-DeNew (2001) for an application) and there is widespread evidence that there is a relation between parents' and children's schooling. However, it is not clear whether this due to nurture or due to nature. The final high school grade is measured by a dummy variable indicating a low final grade, meaning the grade 3 (*befriedigend*) or the grade 4 (*ausreichend*).⁴ We could not include the grade as a continuous variable because for some people obtaining their high school degree in East Germany

³We also used the log hourly gross wages but the results does not change. Because of data loss when using the hourly wages we use the log monthly gross income in the further.

⁴The German scale of grades goes usually from 1.0 up to 4.0, measures in 0.1 steps where 1.0 is best and 4.0 is the worst grade.

after reunification the final grade is only measured in a categorical variable instead of in a continuous one. In order to control for parents' schooling we define for each parent a dummy variable whether it has a tertiary degree or not.

Secondly we include the vector M_i to control for further unobserved characteristics. M_i comprise some variables that control for motivation. We include a variable whether the labor market played a high relevance for the study's choice of the graduate, whether the graduates has a high relevance for carrier for future, and whether the graduates had visited additional qualifications during the study.

All our graduates has a completed tertiary educational degree. Therefore they all have nearly the same amount of human capital, measured in years of schooling. The course of the study gives the employer some information about the quality of the schooling and hence possibly about the productivity of the graduate. In order to control for it we add the vector $STUDY_i$. This vector comprises the field of the study, whether the person graduated at an university or an university of applied science, whether the graduate obtained more than one degree, the final grade of the study measured in a scale form 1.0 to 4.0, the length of the study measured in subject-related semesters, and whether the person has changes the field of study or the university since the first university enrollment.

Additionally we include variables for work experience while study ($PEXP_i$). On the one hand work during study can increase the time-to-degree and interfere with learning and therefore have a negative impact on the achievement and on wages. On the other hand it may have a positive influence on the wage after graduation because of the acquired work experience. Work experience, especially in the area of study, may complete the mainly theoretical skills acquired at university. In the literature there seems to be a consensus that student employment while enrollment has a negative effect on the achievement (e.g. Ehrenberg and Sherman, 1987; Stinebricker and Stinebricker, 2003). However, it seems to have also a positive effect on subsequent labor market outcomes (e.g. Light, 2001; Hotz et al., 2002; Häkkinen, 2006). We control for student employment by defining three variables for the extent a student worked and one variable whether he has worked in the area of study. Additionally we control for whether he has international experience and whether he has a completes vocational training.

The vector UNI_i contains some variables that measure the quality of the university the graduated had attended. As mentioned above there is evidence that the quality of the college has a positive effect on wages (e.g. Black and Smith, 2004; Black et al., 2005; Brewer et al., 1999; Dale and Krueger, 2002). In our data set we can not distinguish between different universities. Therefore we have to construct a measure from the graduates' answers. We build two different measures to control for the quality. The first variable measures whether the graduate thinks that the university has a good technical equipment, and the second whether there are good course offerings. We assume that a good technical equipment correlates with a good capital endowment

and good course offerings with a widespread variety of possibilities to accumulate human capital.

$FIRM_{1i}$ captures several controls for the firm and job characteristics of the first job. We include four dummies for industries, four dummies for firm size, and two dummies for the share of workers with university degree in the firm. Furthermore, we include whether the graduate is employed in civil service, whether he is employed in West Germany, and whether it is a full time job.

In X_{1i} we include some socio-economic characteristics. These are whether the graduate is married, whether he/she has children, the gender and the age at the time of the first survey.

The second survey was conducted five to six year after graduation. We expand our estimation in order to account for actual work experience and the attendance of further training. Our second model is

$$W_{2i} = \beta_0 + \beta_1 A_i + \beta_2 M_i + \beta_3 STUDY_i + \beta_4 PEXP_i + \beta_5 UNI_i + \beta_6 FIRM_{2i} + \beta_7 X_{2i} + \beta_8 TRAIN_{2i} + \beta_9 EXP_{2i} + \epsilon_{2i} \quad (2)$$

The left hand variable is the log monthly gross income at the time of the second survey (five to six years after graduation) and like in the first model ϵ_{2i} is the error term which is assumed to be unrelated to the other variables in the model. The vectors A_i , M_i , $STUDY_i$, $PEXP_i$, and UNI_i , include the same variables as in the first model because they did not change over time. According to the first equation, vector $FIRM_{2i}$ comprises firm and job characteristics and vector X_{2i} socio-economic characteristics but at the time of the second survey. The experience after graduation is captured by vector EXP_{2i} which comprises variables with information about actual work experience, duration of unemployment, tenure, whether the graduate has work experience abroad, and the number of job changes since graduation, measured with a dummy for none job changes, one job change and two or more job changes. To control for further training we only include an indicator whether the person itself, the firm or the person and somebody else (e.g. the job center (*Arbeitsagentur*)) has paid the cost of the further training ($TRAIN_{2i}$). We do not need to include a dummy for attendance because all persons of our final sample attended further training.

Additionally we include the log monthly income from the first survey and a variable that measure the time between graduation and the second survey. The latter is of importance because the time period between graduation and second survey goes from 57 up to 88 months. For the summary statistics of both estimations see table 2 in the appendix.

As mentioned above we estimate the equations (1) and (2) separately for movers and stayers. For this purpose we divide our sample with respect to the frequency of job changes. The mover-sample included all persons that change their job at least once. In the stayer-sample are all those graduates that did not change their job since graduation.

4 Results

In table 1 the results for the whole sample are shown. We find a positive effect for men on the log monthly gross income at the time of the first labor market entry. Men earn about 5% more than women, holding all other variables constant. This wage gap at the beginning can on the one hand be explained by gender discrimination and on the other hand by differences in the job characteristics we can not observe in our data. There is evidence that women and men tend to work in different occupations. This wage gap increases over time and has more than doubled five to six years after graduation. An explanation could be that men could acquire more and other skills than women especially because of their higher relevance of labor market participation. For age we find, as expected, a positive and with rising age decreasing impact on first wages. Over time this impact decreases.

Looking at the measures for ability we find the expected pattern for a low high school mark. At the first entry on the labor market the high school grade is negative but insignificant. Five to six years after the first labor market entry the effect became significant negative. A low high school grade has a negative impact about -4.3% on wages. This fits to the human capital literature where the effect of ability rises with increasing work experience. When trying to control directly for ability by including parents' education as used in Altonji and Pierret (2001) and Bauer and Haisken-DeNew (2001), there is no correlation on either fathers' or mothers' education. As we have already suggested that ability is likely to matter for labor productivity, parental education does not seem to be proper ability measure for the homogeneous group of workers. Our measures for motivation show the results we expected. If the labor market played an important role for the choice of the field of study the wage at the labor market entry is about 4% significantly higher, but after five to six years this effect becomes insignificant. However, a high relevance of career for the future has in both points of time a significant positive impact on the wage which decreases over time, though. If somebody has obtained additional qualifications during study this has a positive but insignificant effect on the first wage. After five to six years this effect becomes significant and having obtained additional qualifications leads to a wage gain of 3.5%. For this reason, additional qualifications do not seem to be relevant for the first labor market entry but become more important over time. This seems to underline the assumption that the human capital acquired by this additional qualifications need to be recognized by the employer.

When looking at the course of study only the change of the field of study seems to have an impact on the first wage. Having changed the field of study causes a significant 6% negative effect on the wage which indeed diminishes over time. Hence, changing the field of study seems to work as a (negative) signal for the potential employer. Having more than one degree does not have a significant impact on wages neither at the first entry to the labor market nor after five to

six year. It seems that additional degrees rather be supplements than complements and generate no wage gain for the graduate.

Surprising is that the finale grade does not seem to have an influence on the first wage but have an effect on the wage after five to six years. The only exception are student that graduated in the field of "maths/science/forestry". For them the effect of the final grade at university on the first wage is significant and positive. That means that a grade step from 1.0 to 2.0 gives you a wage gain about 12%. This counterintuitive pattern can also be found in the raw data when depicting the mean wage at each grade by filed of study (see figure 1). After five to six years for all fields of study the expected pattern is found and a worse grade has a significant and negative effect on wages between 0.9% for "Engineering/agricultural science" up to 11% for "humanities/sports/arts/landscape planning". Having graduated at an university instead at an university of applied science does not have an impact on starting wage but on the wage after five to six years. Graduates of universities earn about 11% more than comparable graduates from universities of applied science. This effect can be explained by the differences in the way of learning between these two types of universities. While universities focus more on theoretical learning, universities of applied science focus more on the practical way of learning. Therefore the graduates from universities of applied science are directly ready for working while the others have to learn on-the-job first but then they have a higher wage path. A similar pattern is found for the length of the study. At the first labor market entry the potential employer does not penalize a longer length of study while he does after five to six years even if the wage loss is very small (0.8% less wage for one more semester).

Looking at the work experience while study, having worked little or not at all during enrolment has a significant and negative impact on the entry wage as well as on the later wage compared to graduates that have worked much. It decreases the first wage by 7.6%, holding all other factors constant. This negative effect diminishes over time and after five to six years it is only almost half as much. Having worked in the area of study while enrollment increases the entry wage about 3.7%. Over the time this effect disappeared and becomes insignificant. This two findings both fits to the findings that over time the actual work experience become more relevant for the potential employer (e.g. Häkkinen, 2006). The same holds true for completed vocational training before study. Graduates with a completed vocational training have a wage gain of 4.9% at the time of the first labor market entry compared to similar graduates having not a completed vocational training. But this advantage disappeared over the time and became insignificant. In contrast, international experience, including having studied abroad, does not seem to have an effect on entry wages. After five to six years graduates that allocated international experiences before graduation have a wage gain of 6.0%.

Regarding the quality of the university, only a good technical equipment at university has a significant effect on wages. Having good technical equipment at university gives you a wage

gain at the first entry on the labor market after graduation about 8.1%. Over time this effect disappears and becomes insignificant. It can be expected that universities with a better technical equipment have also a better capital endowment and are presumably universities with a better reputation. Reputation works as a signal and hence is rewarded by the potential employer by a higher wage. Regarding firm characteristics almost all variables have a significant and relatively high effect on both wages, the wage at the first entry and the wage after five to six years after graduation. Full time employment increases the wage by 68.3% at the first entry and over times this effect decreased up to 49.3%. The same holds true for being employed in West Germany. The positive effect on the first wage is higher (13.0%) and decreased over time (8.8%). Being employed in civil services has a negative effect on wages but this effect is only significant for the wage after five to six years. Persons employed in civil service earn 11.7% less holding all other variables fixed. A low share of workers with a university degree in a firm has a significantly negative impact on the wages, compared with firms with a higher share. If only 15 to 50% of the worker share a university degree the wage is about 10.1% lower at the beginning and about 3.2% after five to six years compared to firm with a share over 50%, controlling for all the other factors. If the share is below 15% the negative impact is greater with 17.4% and 4.4%, respectively. For the firm size we observe the expected pattern that the bigger the firm is the higher the wage is.

Looking at the effect of further training on wages after five to six years we find a positive but insignificant effect for all three variables. Nevertheless including this variables in our model is of vitally importance because further training is a important factor following the human capital theory (see Becker, 1964). Additionally, for the wage five to six years after graduation we can observe work experience. Actual experience, measured in months, has a positive but insignificant impact on wages. The same holds true for tenure. As expected, the duration of unemployment has a significant and negative effect on wages that increases slightly with increasing duration of unemployment. One month of unemployment reduces the wage by 1.4%. Having worked abroad generates a wage gain of 6.6%, holding all other controls fixed. Job mobility, measured by changing the job once or changing the job at least two times compared to having not changed the job at all, does not have a significant effect on wages. This result can be explained by the fact that we only observe few persons that change their job more than three times. Therefore we can not observe the effect of many job changes in our data.

Looking at the determinants of wage growth for the whole sample of graduates as well as looking at the determinants of entry wages and wage growth separately for movers and stayers is planned in the next step.

5 Conclusion

This paper describes the determinants of log monthly wages in the first job with those after five years. A variety of control variables is considered such as socio-demographic factors, course of

Table 1: Results

	(1)	(2)	(3)
	Log wage (€) at first labor market entry	Log wage (€) 5-6 years after entry	Log wage (€) growth
SOCIO-DEMOGRAPHICS			
Male	0.0517 **	0.1307 ***	0.1508 ***
Age	0.0781 **	0.0503 *	
Age, squared	-0.0011 **	-0.0005	
Married	0.0436	0.0102	
Has Children	-0.0555	-0.0270	
ABILITY			
Low high school degree	-0.0207	-0.0432 ***	0.0009
Father has higher education	-0.0253	0.0101	0.0170
Mother has higher education	-0.0054	0.0210	0.0408
MOTIVATION			
High relevance of labor market for study's choice	0.0405 **	0.0210	-0.0014
High relevance of carrier for future	0.0882 ***	0.0601 ***	-0.0145
Obtained additional qualifications during study	0.0159	0.0353 ***	0.0495 **
COURSE OF STUDY			
University	0.0244	0.1091 ***	0.1110 ***
More than 1 degree	0.0694	0.0438	-0.0799
Field of study - 2	0.1262	0.0296	-0.1870
Field of study - 3	-0.0808	-0.0493	0.0696
Field of study - 5	0.3075 ***	-0.1272 *	-0.4993 ***
Final grade university	-0.0022	-0.0109 ***	-0.0104
Final grade university X Field of study - 2	0.0023	0.0072 *	0.0071
Final grade university X Field of study - 3	0.0141 **	0.0097 **	-0.0047
Final grade university X Field of study - 5	-0.0045	0.0119 ***	0.0181 **
Length of studies (subject-related semester)	-0.0013	-0.0079 **	-0.0031
Change of field of study	-0.0634 **	0.0083	0.0325
WORK EXPERIENCE BEFORE OR WHILE STUDY			
Worked during study (partial)	-0.0245	-0.0153	-0.0041
Worked during study (little, not at all)	-0.0755 ***	-0.0432 **	0.0253
Worked in area of study during study	0.0372 *	0.0169	-0.0243
International experience	0.0037	0.0601 ***	0.0667 **
Completed Vocational Training	0.0478 **	-0.0253	-0.0845 ***
QUALITY OF UNIVERSITY			
Good technical equipment at university	0.0812 ***	0.0003	-0.0647 **
Good course offerings at university	0.0240	0.0232	-0.0264
FIRM CHARACTERISTICS			
Full time employment	0.6830 ***	0.4927 ***	
Employed in civil service	-0.0270	-0.1168 ***	
Employed in West Germany	0.1303 ***	0.0874 ***	
Share worker with university degree (15-50 %)	-0.1009 ***	-0.0321 **	
Share worker with university degree (<15 %)	-0.1744 ***	-0.0443 **	
FURTHER TRAINING			
Plant bore costs of further training		0.0341	-0.0830 **
Individual bore costs of further training		-0.0003	0.0076
Individual & somebody else bore costs of further training		0.0101	-0.0600
WORK EXPERIENCE			
Actual experience (months)		0.0049	-0.0001
Actual experience, squared (months)		-0.0000	0.0000
Duration unemployment (months)		-0.0143 ***	-0.0174 **
Duration unemployment, squared (months)		0.0004 **	0.0005
Tenure current job (months)		0.0017	0.0097 ***
Tenure current job, squared (months)		-0.0000	-0.0001 ***
Worked abroad		0.0663 ***	0.0947 **
One job change		0.0164	0.0620 **
Two or more job changes		0.0099	0.1237 ***
Log monthly gross labor income 1997 (€)		0.0870 ***	
Constant	5.4900 ***	5.8850 ***	1.0506 ***
R-squared	0.476	0.551	0.093
N	2093	2093	2093
F	47.29746	47.58346	6.64358

Notes: In all our regressions we included dummies for industries and firm size and we control for time between graduation and second survey. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: HIS panel of survey graduates 1997.

study (length and field of study, grade, work during study, change of field of study) and firm characteristics. For the regression after five years, we also include additional characteristics on work and unemployment experience, tenure, job mobility and on participation in continuous training.

We show that sign and significance of study characteristics differ with labor market experience. In the first job, wages are only slightly related to students' achievement. We only find a positive effect of work during study especially for work related to the field of study and of completing an apprenticeship before studying. Other variables indicating study performance such as final grade, time to obtain the degree, international experience are insignificant. After five years of potential experience, many of these variables become statistically significant. For instance, obtaining additional qualifications during study, international experience and a good grade are positively associated with log wages.

The result that work experience matters during labor market entry could represent that these workers have a higher initial productivity if wages reflect marginal productivity. This could be because they can perform working tasks immediately without a long period of instructions or trainings. Other reasons such as bargaining power or a better ex ante knowledge about firms and labor markets could be suggested as well.

The finding that differences in study characteristics are not responsible for entry wage differentials but seem to be related to higher wages and wage growth afterwards could be explained by many reasons. First, unobservable characteristics such as ability could cause our results if these characteristics are positively correlated with college performance and are not adequately taken into account in the regression. This would be in line with the employer learning literature where firms gradually learn about workers' ability over time and reward it accordingly. Second, it could also be that these characteristics reflect differences in human capital, i.e. labor market entrants with a better grade might have learned more during study and are thus more productive. Unfortunately, it is not possible to distinguish ability from human capital explanations because of data limitations. However, we conclude that the ability explanation does account to some extent for our results (which does not mean that human capital does not!) because all graduates acquired similar human capital by visiting similar courses and passing similar exams. It is also not possible to rule out that there is an interaction between both factors, i.e. students with higher ability might be able to translate their knowledge to a larger extent into work productivity compared to their lower able counterparts.

Furthermore, we also find that performing poorly at high school is initially insignificant but becomes negatively statistically significant after five years. This finding could also be explained by productivity differences that might be due to different endowments with ability or human capital. These initially unobserved factors might be observed and rewarded by employers when time passes by.

Our findings raise some questions for future research as one might ask if the course of study and the high school degree signals productivity (regardless whether this is through ability or human capital), why do firms initially not discriminate upon these factors? One reason might be that high ability graduates already selected themselves into firms offering higher wage growth.

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Appendix

Table 2: Summary statistics, whole sample

Variable	Labor market entry (1997)				5-6 years after entry (2003)			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Log monthly gross labor income 1997 (€)	7.508	0.55	4.404	8.84	7.508	0.55	4.404	8.84
Log monthly gross labor income 2003 (€)					8.115	0.432	5.704	9.741
SOCIO-DEMOGRAPHICS								
Male	0.654	0.476	0	1	0.654	0.476	0	1
Age	28.794	2.877	23	49	33.794	2.877	28	54
Age, squared	837.369	181.266	529	2401	1150.31	209.896	784	2916
Married	0.159	0.366	0	1	0.451	0.498	0	1
Has Children	0.095	0.293	0	1	0.344	0.475	0	1
ABILITY								
Very good high school degree	0.104	0.306	0	1	0.104	0.306	0	1
Good high school degree	0.505	0.5	0	1	0.505	0.5	0	1
Low high school degree	0.391	0.488	0	1	0.391	0.488	0	1
Father has higher education	0.365	0.482	0	1	0.365	0.482	0	1
Father has no higher education	0.635	0.482	0	1	0.635	0.482	0	1
Mother has higher education	0.161	0.368	0	1	0.161	0.368	0	1
Mother has no higher education	0.839	0.368	0	1	0.839	0.368	0	1
MOTIVATION								
High relevance of labor market for study's choice	0.296	0.457	0	1	0.296	0.457	0	1
High relevance of carrier for future	0.559	0.497	0	1	0.559	0.497	0	1
COURSE OF STUDY								
University	0.581	0.494	0	1	0.581	0.494	0	1
More than 1 degree	0.045	0.206	0	1	0.045	0.206	0	1
Field of study - 1	0.123	0.329	0	1	0.123	0.329	0	1
Field of study - 2	0.317	0.465	0	1	0.317	0.465	0	1
Field of study - 3	0.191	0.393	0	1	0.191	0.393	0	1
Field of study - 5	0.37	0.483	0	1	0.37	0.483	0	1
Final grade university	19.307	5.761	10	38	19.307	5.761	10	38
Final grade university X Field of study - 1	2.062	5.787	0	34	2.062	5.787	0	34
Final grade university X Field of study - 2	6.773	10.425	0	37	6.773	10.425	0	37
Final grade university X Field of study - 3	3.164	6.947	0	35	3.164	6.947	0	35
Final grade university X Field of study - 5	7.309	10.104	0	38	7.309	10.104	0	38
Length of studies (semester)	10.945	2.69	5	26	10.945	2.69	5	26
Change of field of study	0.17	0.376	0	1	0.17	0.376	0	1
WORK EXPERIENCE BEFORE OR WHILE STUDY								
Worked during study (much)	0.376	0.484	0	1	0.376	0.484	0	1
Worked during study (partial)	0.337	0.473	0	1	0.337	0.473	0	1
Worked during study (little, not at all)	0.287	0.453	0	1	0.287	0.453	0	1
Worked in area of study during study	0.697	0.46	0	1	0.697	0.46	0	1
Obtained additional qualifications during study	0.578	0.494	0	1	0.578	0.494	0	1
International experience	0.307	0.461	0	1	0.307	0.461	0	1
Completed Vocational Training	0.445	0.497	0	1	0.445	0.497	0	1
QUALITY OF THE UNIVERSITY								
Good technical equipment at university	0.443	0.497	0	1	0.443	0.497	0	1
Good course offerings at university	0.653	0.476	0	1	0.653	0.476	0	1
FIRM CHARACTERISTICS								
Industry - 1	0.308	0.462	0	1	0.339	0.473	0	1
Industry - Services	0.467	0.499	0	1	0.472	0.499	0	1
Industry - Educational Service, 3	0.171	0.376	0	1	0.095	0.294	0	1
Industry - Non profit, public administration	0.054	0.227	0	1	0.094	0.292	0	1
Full time employment	0.787	0.41	0	1	0.884	0.321	0	1
Employed in civil service	0.297	0.457	0	1	0.252	0.434	0	1
Employed in West Germany	0.907	0.29	0	1	0.899	0.301	0	1
Firm Size (> 1000)	0.266	0.442	0	1	0.382	0.486	0	1
Firm Size (500-1000)	0.092	0.289	0	1	0.09	0.286	0	1
Firm Size (100-500)	0.192	0.394	0	1	0.182	0.386	0	1
Firm Size (20-100)	0.209	0.406	0	1	0.194	0.396	0	1
Firm Size (5-20)	0.179	0.383	0	1	0.112	0.316	0	1

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... table 2 continued

Variable	Labor market entry (1997)				5-6 years after entry (2003)			
	Mean		Std. Dev.		Mean		Std. Dev.	
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Firm Size (< 5)	0.062	0.242	0	1	0.039	0.195	0	1
Share worker with university degree (> 75 %)	0.314	0.464	0	1	0.23	0.421	0	1
Share worker with university degree (50-75 %)	0.18	0.385	0	1	0.206	0.405	0	1
Share worker with university degree (15-50 %)	0.262	0.44	0	1	0.355	0.479	0	1
Share worker with university degree (< 15 %)	0.243	0.429	0	1	0.209	0.406	0	1
WORK EXPERIENCE								
Actual experience (months)					63.675	10.573	5	85
Actual experience, squared (months)					4166.27	1131.385	25	7225
Duration unemployment (months)					1.771	3.757	0	37
Duration unemployment, squared (months)					17.247	69.754	0	1369
Tenure current job (months)					34.113	22.054	1	85
Tenure current job, squared (months)					1649.891	1701.852	1	7225
Worked abroad					0.114	0.318	0	1
No job change					0.381	0.486	0	1
One job change					0.364	0.481	0	1
Two or more job changes					0.254	0.436	0	1
FURTHER TRAINING								
Plant bore costs of further training					0.518	0.5	0	1
Individual bore costs of further training					0.062	0.241	0	1
Individual & somebody else bore costs of further training					0.31	0.463	0	1
Time between graduation and second interview (month)					69.986	4.329	57	88
No. of observations	2093		2093		2093		2093	

Source: HIS panel of survey graduates 1997.

Figure 1: Final grade at university and first wage, by field of study

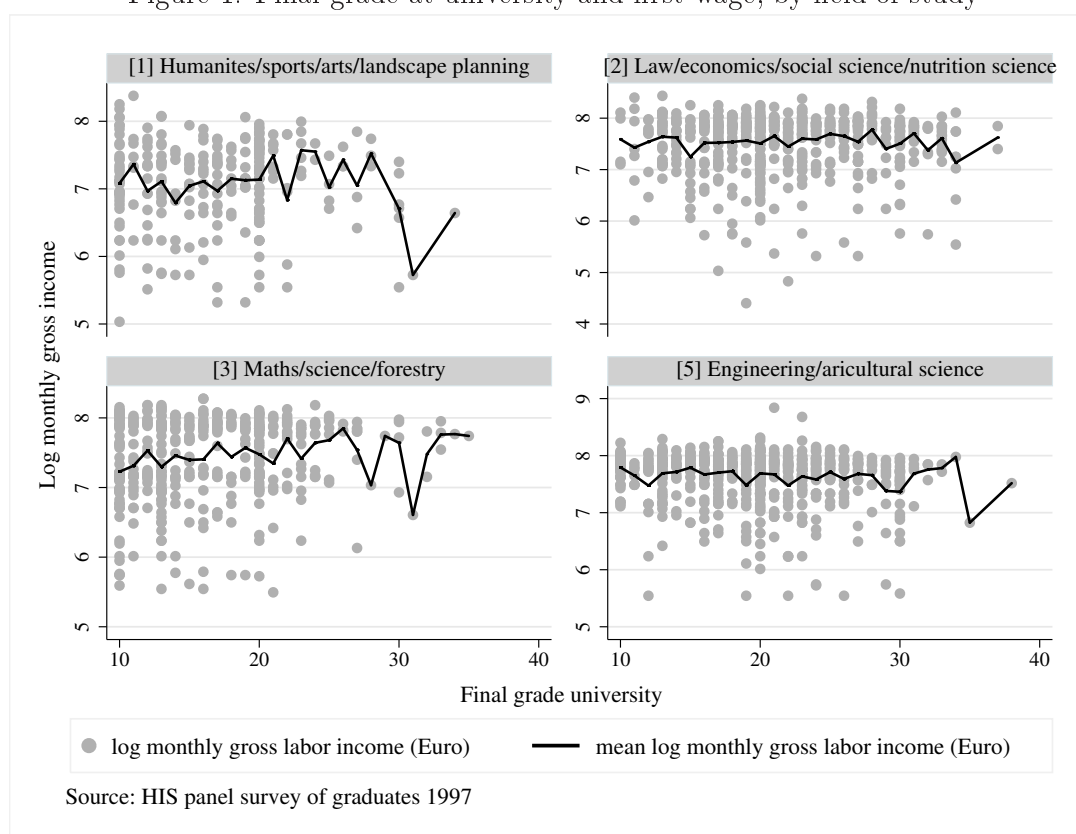


Figure 2: Final grade at university and wage after five to six years, by field of study

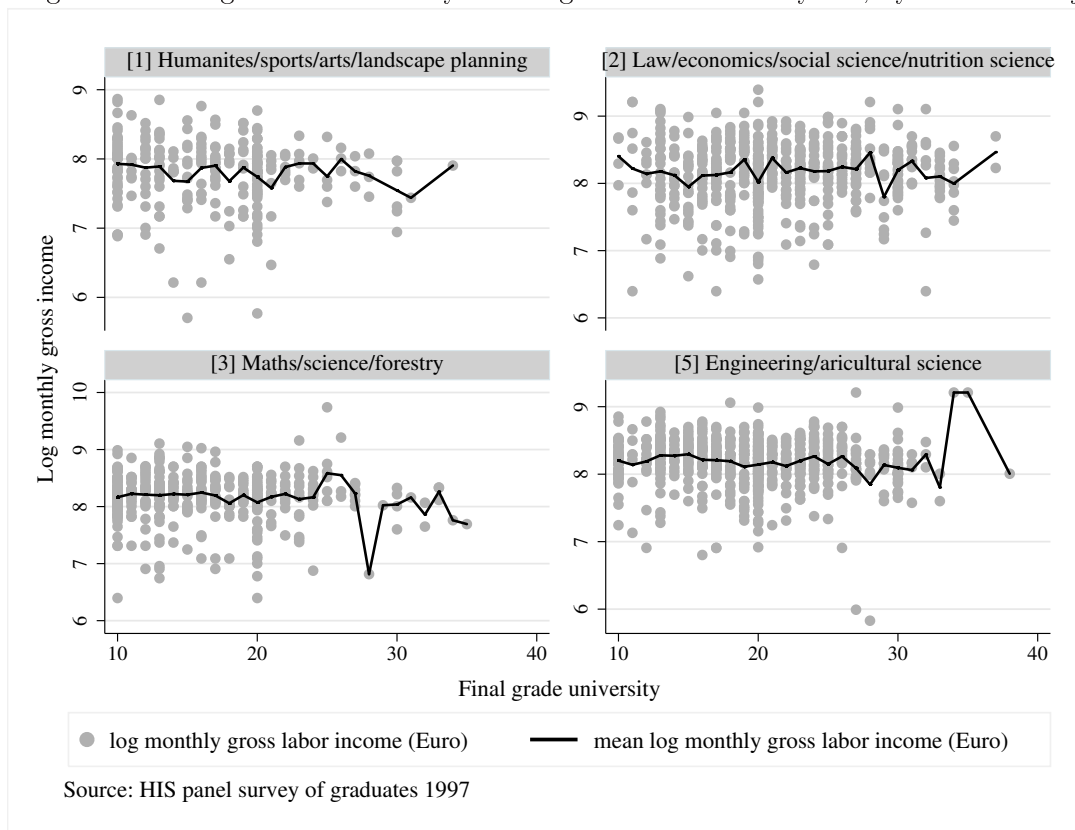


Figure 3: Kernel Density of log monthly gross labor income (€) 5-6 years after first entry

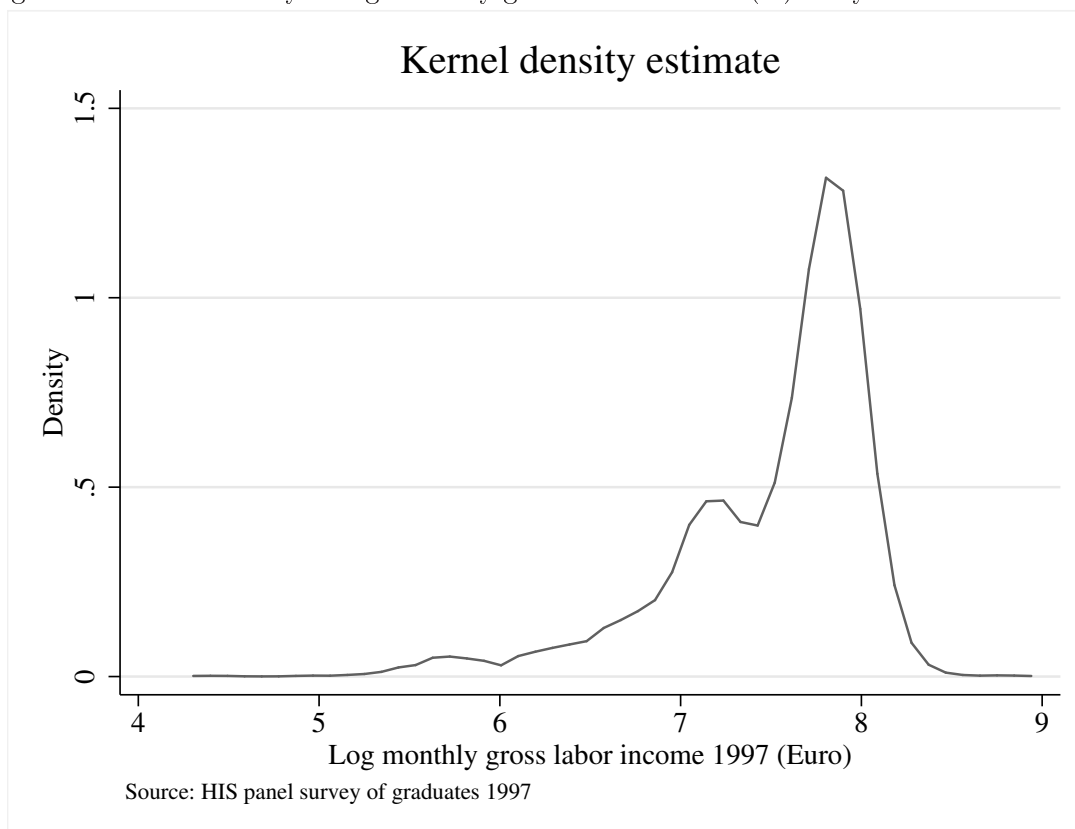


Figure 4: Kernel Density of log monthly gross labor income (€) 5-6 years after first entry

