Does it pay to be a good student? Results from the Swiss graduate labour market

Juerg Schweri

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Universität Bern
Volkswirtschaftliches Institut
Gesellschaftstrasse 49
3012 Bern, Switzerland
Tel: 41 (0)31 631 45 06
Web: www.vwi.unibe.ch

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Juerg Schweri

Centre for Research on Economics of Education

Department of Economics, University of Berne

and Swiss Institute for Vocational Education (SIBP), Zollikofen

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Abstract

Surprisingly little is known about the relation between grades and wages. This relation is analysed using a sample of ca. 1'700 individuals that graduated in Swiss universities in 1998. Testing different operationalisations of the grade variable, we find a significant and robust effect of grades on the annual wage one year after graduation. When wage is specified as wage per actual hour of work, instead of formal hours of work, the effect becomes insignificant. Four years after graduation, however, grades have a higher and significant effect on wages based on formal working time as well as on wages based on actual working time. We conclude that people with higher grades get jobs with better career prospects when entering the labour market. Thus, the wage effect of university graduates' final grades is non-transitory and increasing over time. This finding calls for further research in the role that grades play in labour markets.

1. Introduction

The majority of research concerning the link between educational attainment and earnings has focussed on years of education as a - quantitative - measure for educational attainment. Less attention has been paid to quality indicators of education. This imbalance is partly due to the overwhelming success of the standard Mincer equation allowing for easy rates of return estimations, partly due to the existence of numerous data sets including the variables years of education and wage. These data sets allow for a wide range of model specifications and robustness checks in order to establish secure knowledge about the link between years of education and labour market outcome.

This focus on years of education comes at the cost of neglecting potentially important aspects of this link, which may in turn lead to an incomplete picture, at best, or to a biased one in the worse case.

One qualitative variable that is readily available for employers when making employment decisions are grades. In most European countries it is common that job applicants include a copy of their highest attained educational certificate with their CV, so employers have full and credible information about the final grade the applicant received.
The aim of this paper is to investigate whether Swiss university students' final grade has a significant effect on their wages one and four years after graduation, i.e. whether grades are used as a relevant information by employers in the employment decision.

Grades might have an effect on first wages no matter whether one analyses this question from the point of view of human capital theory or sorting (signalling, screening) theories. If education raises worker productivity, grades might be a measure for the extent to which an individual has actually acquired the knowledge that has been taught in the educational process. Two individuals that have followed the same education and received the same degrees might differ in their actual educational attainment and, thus, in their productivity, which is reflected by grades. From a signalling theory point of view, on the other hand, grades might serve as a signal containing additional information compared to years of education. If grades are correlated with desirable individual characteristics such as intelligence, motivation, perseverance and alike, employers will use the information contained in grades when building expectations about the productivity of future employees. So human capital and signalling theory both predict an effect of grades on wages, provided they contain additional information on workers' productivity not available through other observable characteristics.[1]

It has, of course, early been acknowledged that quantitative measures of educational attainment alone are insufficient. Behrman and Birdsall (1983) expressed this in an article's title: "The Quality of Schooling: Quantity alone is misleading". They concentrated on the effect of school quality on rates of

return, where quality itself depends on public resources allocated to schools. There exists a still growing body of literature on this issue.[2]
Another branch of literature, starting with Griliches (1976), is concerned with IQ or aptitude test scores in wage regression models. These measures are likely to be correlated with grades. A fundamental difference lies in the non-observability of IQ and test scores as opposed to grades for employers.[3] Therefore, an influence of the latter on (starting) wages is more likely than in the case of the former.

Grades have been used in various respects in the empirical literature. Firstly, they are used as outcome measure in educational production functions. Dolton et al. (2003) estimate a stochastic frontier production function for students of a university in Spain taking examination performance as output measure. Stinebrickner and Stinebrickner (2003) analyse the effect of working during school on academic performance measured by the grade point average. Both papers implicitly assume that student's grades contain information about the quality of schooling that is relevant to labour markets.

Secondly, grades have also been used as explanatory variables in different models. Büchel and Pollmann-Schult (2001) show that higher secondary school grades reduce the risk of being overeducated. This result holds for pupils that achieved an intermediate leaving certificate, whereas grades do not explain the probability of overeducation neither for pupils with a lower nor with a higher leaving certificate. This finding suggests that the informational content of grades depends on the composition of the reference group.
Furthermore, there exist some studies that consider the effect of grades on earnings. Wise (1975) used data pertaining to individuals working in a large US manufacturing corporation and demonstrated significant effects of

[1] Therefore, we will use the language of the human capital theory in the remainder of the paper. This does, however, not exclude signalling explanations of the discussed phenomena.
[2] On the effect of public resources on schools see, e.g., Card and Krueger (1992), Hanushek (2003), Krueger (2003).
[3] Of course, employers could conduct own IQ or aptitude tests for applicants. The results of these tests will, however, typically deviate from the test scores that are usually observed by econometricians in data sets. This is probably one reason why IQ and test scores have often been used as proxy or IV variable rather than as explanatory variable.

undergraduate as well as graduate grades on starting salaries.
Weiss (1995: 141), however, in his review of human capital and signalling explanations of wages concludes:

> *"Researchers have also looked at possible effects of secondary school grades and class rank on wages (...). In some regressions, small results are found some of the time. But the main message from studies on course work, test scores, and grades is that learning in high school does not seem to be a significant factor in explaining the correlation between secondary schooling and wages."*

Carvajal et al. (2000) use earnings reported by 219 college (Business) graduates and earnings expectations reported by 248 college seniors in Florida to assess the inter-gender differential. They control for grade point average and find significant effects of grades on both, earnings expectations and earnings itself. The expected influence of grades is, however, overestimated by the college seniors compared to the true effect observed for college graduates.
The abovementioned findings on the link between grades and earnings reveal a mixed picture. Whereas Weiss (1995) deems this link to be rather unimportant at least for high school grades, Wise (1975) and Carjaval et al. (2000) find significant effects for college graduates. Their data sets are, however, small and far from representative. To date, there exist no detailed analyses on the link between wages and grades using recent, representative data. This paper tries to fill this gap for the case of Swiss university graduates and their wages one and four years after graduation.

The structure of the paper is as follows:
Section 2 discusses under which conditions an influence of grades on earnings should be expected, and which model specifications can be derived from these considerations. Section 3 presents the data set used for the analyses in section 4, section 5 concludes.

2. Theoretical and model specification issues

It has been argued above that grades should influence earnings in a human capital as well as in a signalling framework. This will hold true as long as grades contain some information on the productivity of workers. Two cases of interest can be distinguished:

(0) $E(P_i \mid G_i) = P_0$

(I) $E(P_i \mid G_i) = P_0 + h(P_i, G_i, G_0) \qquad with \ \frac{\partial h}{\partial G_i} > 0$

$P_i : productivity\ of\ individual\ i, P_0 : mean\ productivity, G : grade$

Case (0) means that grades have no informational content relevant for labor markets, case (I) states there is such an informational content of grades.
This content depends on the way grades are assigned by universities. Case (0) holds trivially if universities assign grades randomly. One might, however, expect that universities try to attract high-achieving (i.e., higher ability and/or more diligent) students and want to limit entry of low-achieving students. In this case, universities will use grades as a selection device: It is more costly for low-ability students to obtain passing grades and thus, university graduates are positively selected from the population. If universities succeed in designing exams that test learning ability and/or learning effort of students, then it is also very likely that success in these exams is positively correlated with the labor market productivity of students.
Up to this point, the arguments substantiate the claim that university graduates as such should earn higher starting salaries than workers with less education, but the arguments are not yet sufficient to ensure that case (I) holds. In order to select between high- and low-achieving students, universities could assign only two grades: pass and fail. Then there are students who drop out, but for the graduating individuals there is no variance in grades. For case (I) to hold, passing grades must show some variance which is, in addition, to be correlated with knowledge and/or ability.

In this paper, we basically want to test the hypothesis characterized by equation (I) against the null hypothesis described by equation (0). To recapitulate: for (I) to hold,

1. universities have to use grades as a selection mechanism by assigning grades using a scale with more than one passing grade,
2. these grades have to be increasing in knowledge and/or ability in the mean,
3. knowledge and/or ability, in turn, have to be correlated with productivity.

Only if these conditions hold, employers can use the information in grades about the productivity of workers. Given this and given that the labor market rewards good grades, students have an incentive to work harder to achieve better grades (see Dolton et al. 2001 for an analysis of the time use of students). Their learning effort does not only reduce the risk of failing; even if they are sure to pass, there is a return to higher grades through higher wages. This provides an incentive if students expect that their grades will have an effect on wages. For a sample of students from two large Swiss universities, Wolter and Zbinden (2002) showed that students believing to be better performers also expect to have positive financial effects associated with their academic superiority.

Of course, students might differ in their opportunity cost of learning for other reasons than differences in learning ability or in preferences for education. There might be a (individual) trade-off between working during one's studies and getting higher grades, for instance (Stinebrickner and Stinebrickner 2003). As working could enhance wages after graduation, too, an empirical model should take working during studying into account. The same holds true for study length, as a short study length might be a signal of its own for high productivity, but at the same time study duration is likely to positively influence grades, *ceteris paribus*. There are more variables that might interfere in the relation between grades and earnings. Graduates with higher grades might be prone to accumulate even more human capital after graduation. Then they are likely to become university assistants or look for jobs which provide high amounts of on-the-job-training. From the theory of on-the-job training we would expect that this training is paid for at least partially by workers, namely by reduced wages (Becker 1964, Hashimoto 1981). In short, there exist a lot

of education-related variables like study length, work during study or on-the-job training, that should be held constant when analysing grades and earnings.

There is another theoretical question that merits comment. We assume that employers can observe the grades of applicants, but are they also informed about the relevant grade distribution, i.e. the grades of the applicant's fellow students? Grades are an ordinal measure; therefore, their informational content depends crucially on the distribution of grades, at least on its mean and variance. It is not clear whether employers have enough information about the grade distribution. If the distribution differs between subjects, universities or graduation year, employers need full information on the relevant distribution in order to exploit the full informational content of grades. If not, they might use the grades of the different applicants they observe to form a belief about the relevant grade distribution, which will probably be skewed compared to the true one. Different employers may also have different knowledge about grades in certain subjects or universities.

Our empirical analyses will address the different specification issues raised before by including education-related variables, on the one hand, and by using different variants of grade variables that account for grade distributions, on the other hand.

3. The Swiss university system and the data

Only 18.4% of a cohort receive a university entrance diploma (*Maturität*) in Switzerland (FSO 2003). This low value can be explained by the importance of the vocational education system, which also provides vocational tertiary educations, like the universities of applied science. These are not included in our data, we restrict attention to normal universities.

There exist eleven[4] public universities in Switzerland and no comparable private ones. Their quality standards are usually regarded as broadly equivalent, i.e. contrary to the situation in the US or UK, quality differences have not been a major issue to date.

For each subject, study plans define a regular study length of usually four years. The mean of study length in our sample is, however, considerably higher (5.5 years). This is due to the fact that most universities and most subjects do not have fixed curricula but offer a lot of leeway for students to choose lectures and, consequently, also study length. Many students profit from this liberty by working part-time besides studying.

Since 1977, the Swiss Federal Statistical Office (FSO) has surveyed every second cohort of university graduates. For the first time, the cohort 1998 has not only been surveyed in 1999, but also in 2002, i.e. four years after graduation.[5] We use this data set that contains information on 6750 individuals (response rate 59.2%). Of these, we only use graduates who earned a *Lizentiat* or *Diplom* degree and exclude state examinations (with the exception of medical exams), teacher licence (*Patent*) and doctorates, which leaves 5228 cases[6]. For the wage regressions, we drop people not working at the time of the survey and people who were employed for less than 80%. Finally, we only include cases with information about wage, grade[7], age and study length. For the remaining 2067 cases[8], missing values in other independent dummy variables were assigned to a separate dummy which was included in regression models.

This data set is well suited to analyse the problem at hand as it is a

[4] The university of Lucerne and the Università della Svizzera Italiana are new and offer only few subjects. Due to the small N in our data set, they do not appear in the tables of the paper.
[5] For further details concerning the data set see Schmidlin (2003).
[6] This means especially that we excluded state examinations for lawyers (bar exam). Furthermore, we excluded theology completely, as this study leads to a state examination for the majority of students.
[7] Grade questions were included only in the second wave survey in 2002. In the second wave, only people that had participated in the first wave were interviewed. 68% of these responded. Thus, 38.2% of the population of Swiss university graduates of the year 1998 responded in both waves (Schmidlin 2003).

representative, recent survey. The limitation to university graduates has the advantage of netting out sheepskin effects. It is, however, not possible to analyse the effect of including grades on the coefficient of years of schooling. The data set encompassing data about two time points enables us to check whether the results of the starting wage regression can be confirmed for wages four years after graduation. Thus, the data provide a better understanding of the mid-career development of graduates. The second innovation in the 1998 survey is that, for the first time, graduates have been asked to indicate their final grade.

The wage and grade variables will now be discussed in more detail.

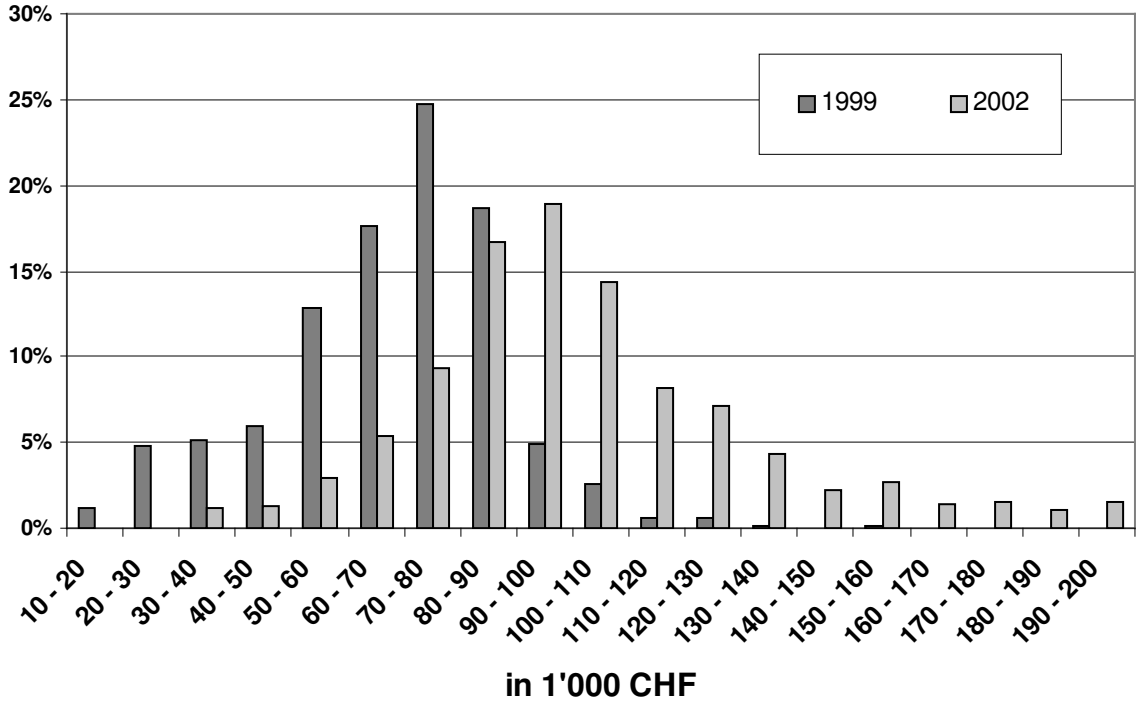
wage variables

The questionnaire of each survey wave (1999 and 2002) contained questions on annual wage for the respective main occupation, the formal degree of employment and actual weekly working hours. From this information, two different variables for 1999 and 2002 have been computed: Annual wage standardized for fulltime (i.e., 100%) employment and actual hourly wage. The latter variable uses the information on actual weekly working hours, the former the information on the formal degree of employment. The wage variables relating to the year 1999 have been transformed to express real values with base year 2002[9]. Thus, wages of 1999 and 2002 are directly comparable. All wage variables have been logarithmised for semi-log regressions. Graph 1 shows the (unlogarithmised) distribution of annual wages in 1999 and 2002 with base year 2002 (N_{99}=1'716, N_{02}=1'704)[10]. Within 3 years, not only the mean wage increases, but variance increases, too.

[8] Due to the different operationalisations of the wage as well as the grade variable, some cases can only be used for certain operationalisations. For this reason, the N of the regressions is usually around 1700.

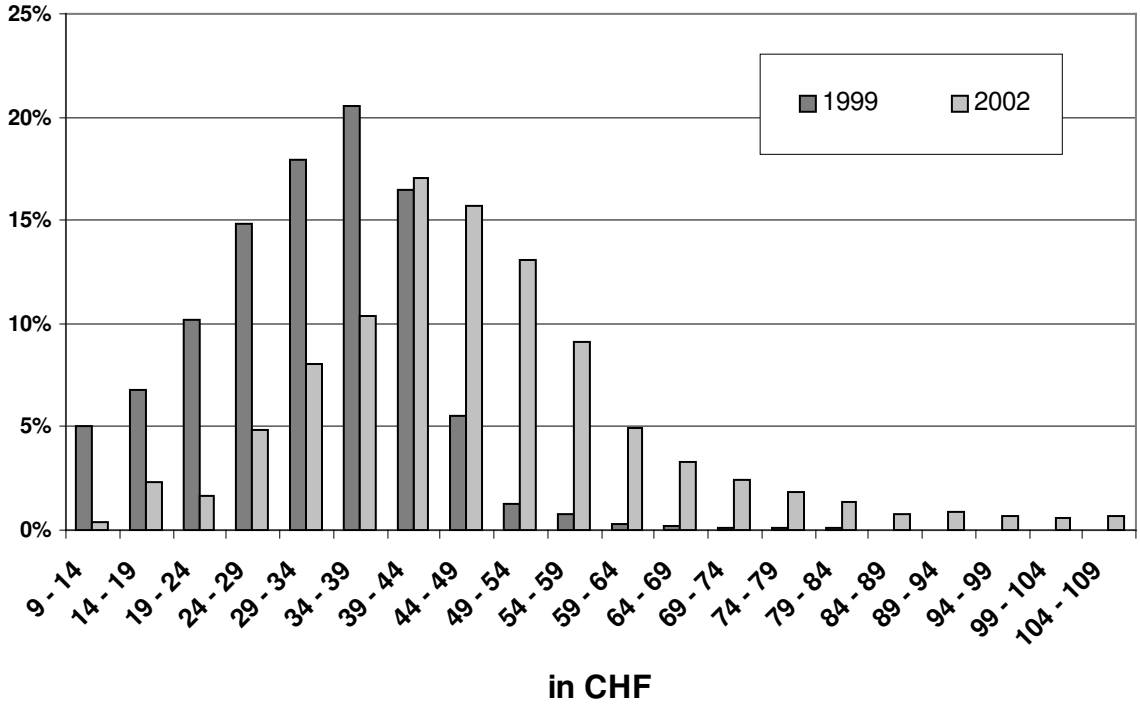
[9] See the appendix for details.

[10] All reported figures concern only the cases that will also be used in the analyses of section 4, even if the data set contains more valid observations for the variable under consideration.



Graph 1: Annual fulltime wages 1 and 4 years after graduation (base year 2002)

Graph 2 depicts the distribution of hourly wages in 1999 and 2002 (N_{99}=1'722, N_{02}=1'696). The sample size has slightly changed because of deviations in the outlier deletion which are due to the actual weekly working hours variable which was not used for annual wages.



Graph 2: Hourly wages for actual working time, 1 and 4 years after graduation (base year 2002)

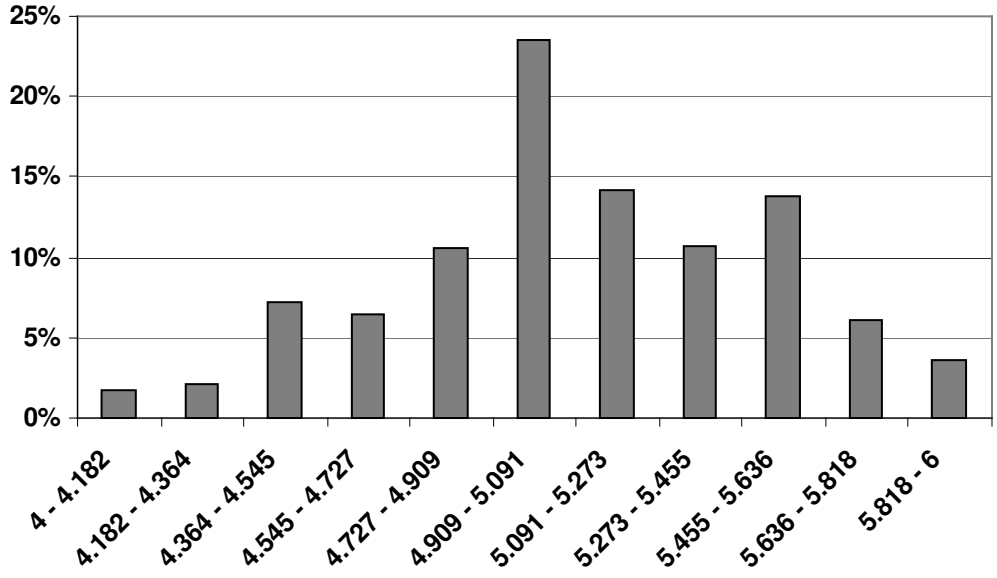
grade variables

The grade variable cannot be used directly as it appears in the raw data set since there exists or existed a variety of different grade scales at Swiss universities. The most usual grade scale goes from 6 (best grade) to 1 (worst grade) with 4 being the minimal passing grade. There exist, however, also the scales 10/1, 8/1, 5/1, 4/1 and 1/4. Therefore, grades had to be made comparable. This was done in the following manner:

$$G_i = \frac{g_i - g_{pass}}{g_{\max} - g_{pass}}$$

This transformation results in a grade variable ranging from 0 (minimal passing grade) to 1 (maximum grade). In order to execute this computation, information on the relevant $g_{\max}$ and g_{pass} for each observation was necessary. The questionnaire asked for the scale endpoints ($g_{\max}$ and $g_{\min}$).

These data were often missing or implausible. Thus, the scale variables ($g_{\max}$ and $g_{\min}$) were carefully edited, whereas the actual grade variable remained unchanged.[11] Furthermore, information from university deaneries has been collected about the minimal passing grade (g_{pass}) belonging to certain scales. Graph 3 shows the distribution of the transformed, i.e. comparable grade variable in the sample on a scale from 4 to 6 instead of 0 to 1 (N=2'067)[12].



Graph 3: Grade distribution (4: lowest passing grade, 6: maximum grade)

The distribution does not look normal as one might have expected. Very low grades are seldom, and there is a tendency of clusters at 4.5, 5 and 5.5.[13]
A problem of the grade variable is that this item has only been asked in the second wave of the survey. This entails two problems. First, data quality might be poor because people do not remember their grade accurately any more. Second, attrition in the second wave might be non-random and introduce endogeneity in the grade variable. The first problem seems to be limited as

[11] The appendix gives more information on the editing rules that have been applied.
[12] In the graph, all cases were included that appear in the annual wage regression for 1999 or in the annual wage regression for 2002.
[13] For subjects with one or few final examinations, grade average is likely to have such a value. In subjects where the final grade is an average of many exams passed throughout study time, the clustering does not happen.

item non-response is low[14]. The second problem, potential endogeneity, will be adressed in section 4.

Tables of summary statistics for all variables that will be used in the analyses can be found in the appendix, along with more technical detail on various variables.

4. Results

Wage regressions 1999

Table 1 shows results of annual log-wage-regressions with different specifications. It contains four blocks of independent variables (besides grade and the constant): 1. university dummies (reference category: University of Zurich), 2. subject dummies (reference category: business & economics), 3. individual characteristics and 4. job characteristics. As pointed out in section 2, we are able to take into account variables that are relevant from a theoretical point of view, such as training, study length or jobbing during study. Grades are significant[15] in all models, with the coefficient and its significance rising when controlling for subjects. Model (4) indicates that an individual switching from the minimal passing grade to a maximum grade earns about 9.6% more one year after graduation.

[14] The non-response rate for the grade item is 8.0% (for the full sample of graduates who earned a *Lizentiat*, a *Diplom* degree or passed the medical state examinations and participated in the survey 2002).

[15] Significance levels based on t-values rely on central limit theorems which assume an infinite population. We use significance levels although the whole population of 1998 graduates has received a questionnaire. We are interested in the effects not only for the cohort of 1998 but for generally valid results. I.e., we regard the cohort of 1998 graduates as the realisation of an infinite population of graduates. Therefore, we apply no finite population correction and use the standard 5% significance level.

OLS:	(1)		(2)		(3)		(4)	
ln annual wage 99	**b**	**t**[16]	**b**	**t**	**b**	**t**	**b**	**t**
grade	*0.0854*	3.04	*0.0802*	2.75	*0.1010*	3.46	*0.0957*	3.12
Univ. Basel			-0.0305	-1.08			-0.0488	-1.74
Univ. Berne			-0.0229	-0.93			-0.0226	-0.93
Univ. Fribourg			-0.0234	-0.86			-0.0119	-0.43
Univ. Geneva			-0.0489	-1.35			-0.0387	-1.08
Univ. Lausanne			0.0030	0.09			0.0009	0.03
Swiss Fed. Inst. of Technology Lausanne (EPFL)			-0.0299	-0.95			0.0332	0.86
Univ. Neuchâtel			-0.0324	-0.70			-0.0240	-0.52
Univ. St. Gall (HSG)			0.0161	0.49			0.0104	0.31
Swiss Fed. Inst. of Technology Zurich (ETHZ)			*-0.0418*	-2.06			0.0199	0.69
Arts & Humanities, Social Sciences					*-0.0632*	-3.12	*-0.0624*	-2.87
Law					*-0.0721*	-3.42	*-0.0717*	-3.38
Science					*-0.0410*	-2.05	*-0.0498*	-2.16
Medicine, Pharmacy					*0.1700*	3.17	*0.1747*	3.20
Technical Sciences					*-0.0637*	-3.03	*-0.0951*	-2.87
Other subjects					*-0.0824*	-2.64	*-0.1069*	-2.67
Age	*0.0070*	2.54	*0.0067*	2.45	*0.0085*	3.20	*0.0085*	3.19
Male	*0.0549*	4.64	*0.0566*	4.68	*0.0542*	4.47	*0.0536*	4.38
Foreigner	-0.0043	-0.27	-0.0045	-0.29	-0.0014	-0.09	-0.0017	-0.11
No. of Children	*0.0513*	2.96	*0.0511*	2.96	*0.0458*	2.71	*0.0448*	2.62
Study length (no. of semesters)	0.0026	1.09	0.0024	0.95	0.0022	0.91	0.0024	0.95
Jobbed during study: relation to study	*0.0474*	3.49	*0.0467*	3.38	*0.0435*	3.17	*0.0453*	3.27
Jobbed during study: no relation to study	0.0056	0.43	0.0039	0.29	0.0152	1.16	0.0179	1.36

[16] All OLS regressions in this paper are computed using Eicker-White heteroskedasticity robust standard errors.

Potential Experience	0.0084	1.6	0.0089	1.7	0.0101	1.92	0.0101	1.94
Potential Experience^2	-0.0003	-1.29	-0.0003	-1.28	-0.0003	-1.28	-0.0003	-1.28
Dummies for earlier educational certificates	yes		yes		yes		yes	
Dummies for Type of School Leaving Examination	yes		yes		yes		yes	
Region of residence fixed effects	yes		yes		yes		yes	
Part-time Work	0.0210	1.13	0.0202	1.08	*0.0370*	2.07	0.0349	1.95
Internship	*-0.4463*	-15.09	*-0.4448*	-14.98	*-0.4208*	-15.01	*-0.4185*	-14.88
Assistant at University	*-0.0661*	-2.16	*-0.0640*	-2.07	*-0.0731*	-2.32	*-0.0750*	-2.36
External Doctorand	*-0.1015*	-2.13	*-0.0999*	-2.11	*-0.0990*	-2.22	*-0.0967*	-2.13
Public Service	*0.2053*	7.48	*0.2025*	7.3	*0.2128*	7.92	*0.2128*	7.84
Private Firm, 10 - 49 employees	*0.0928*	3.54	*0.0929*	3.55	*0.0930*	3.59	*0.0942*	3.62
Private Firm, 50 - 99 employees	*0.1817*	5.51	*0.1815*	5.47	*0.1795*	5.46	*0.1828*	5.54
Private Firm, 100 - 499 employees	*0.1721*	7.39	*0.1679*	7.19	*0.1675*	7.47	*0.1679*	7.4
Private Firm, 500+ employees	*0.2046*	9.89	*0.2021*	9.68	*0.2002*	9.69	*0.2028*	9.73
Training >6 month completed	0.0218	0.79	0.0211	0.75	0.0249	0.91	0.0218	0.79
Training >6 month started	0.0766	1.61	0.0784	1.7	0.0812	1.79	0.0831	1.83
Job Temporary: <1 year	*-0.2452*	-9.5	*-0.2471*	-9.55	*-0.2504*	-9.92	*-0.2497*	-9.79
Job Temporary: 1-2 year	*-0.0849*	-4.17	*-0.0861*	-4.19	*-0.0924*	-4.54	*-0.0925*	-4.5
Job Temporary: 2-3 year	*-0.1088*	-3.54	*-0.1096*	-3.56	*-0.1119*	-3.72	*-0.1136*	-3.76
Job Temporary: >3 year	*-0.1509*	-4.39	*-0.1517*	-4.43	*-0.1543*	-4.38	*-0.1539*	-4.32
Economic sector fixed effects	yes		yes		yes		yes	
Constant	*10.5988*	118.57	*10.62898*	114.16	*10.56419*	118.44	*10.56707*	113.89
adj. R^2	0.644		0.644		0.655		.654	
F	*39.37*		*34.74*		*38.39*		*34.10*	
N	1716		1716		1716		1716	

Table 1: OLS-Regression, dependent variable: ln annual wage 1999; Reference category: University of Zurich, Business & Economics, Female, Swiss, did not job during studying, worked fulltime in a private firm with 1 - 9 employees, followed no training and occupies a permanent job. Note: Regression models contain also further independent variables listed in table 9 in the appendix.

With the possible exception of the university of Basel, universities do not seem to matter. Does this finding support the opinion that quality differences between Swiss universities are minor? Franzen (2002) found significant differences between universities for several cross section regressions, including the 1999 FSO-survey, i.e. using the same data as we use. Our table 1 is based on a smaller N as it contains the grade variable which has been asked only in the second survey. If we perform, however, the same regression without the grade variable and an N of 2692 cases, neither of the university dummies becomes significant on the 5% level, and coefficients are substantially lower (in absolute terms) than in Franzen (2002). This is probably due to the omission of relevant variables in Franzen's regressions. It is known that wages differ between regions in Switzerland.[17] As the place of study is obviously correlated with the working region one year after graduation (due to the relatively low mobility of students workers in Switzerland), it is important to control for working regions to separate the effects of study place and working region. We do not have data about the working region, but about the region of residence, which is likely to be highly correlated with the working region. The mere exclusion of the region of residence dummies in model (4) results in highly significant differences between wages of graduates from different universities - which cannot be considered as a causal effect, since a important part of the effect stems from working region differences.[18]

Subjects[19] have a very significant impact on starting wages. Medical graduates earn most[20], followed by business & economics graduates and science graduates.

There are several other significant variables, of which jobbing during study

[17] Wages differ between Cantons, but also between the language regions.

[18] This statement is true if working region (or region of residence, in our case) and place of study are not highly collinear. This is not a problem, as there are 23 Cantons but only 9 universities and mobility is high enough. Between language regions, however, mobility is more limited. 11% of the people that graduated at the universities of Geneva, Lausanne or Neuchâtel live in a non-frenchspeaking region one year after. This rate should still be sufficient to allow for a separation of the university and the working region effect.

[19] We are able to subdivide study subjects into more dummies. The grade variable is, however, hardly affected by different specifications of the subject variable.

[20] This result should not be overrated. Many medicine graduates occupy a position as medical assistant in a hospital. A lot of these characterised themselves as holding a temporary and/or internship position, Since the dummies controlling for this are highly negative, the medicine dummy might just counterbalance their effect. We do not further analyse this question because we are primarily interested in the grade variable.

deserves comment. This rises starting wage significantly if the job was related to the study subject, but only slightly (and insignificantly) if this was not the case. Study length does not matter for starting wages.

A first objection against the result concerning grades might be that grades could have a non-linear effect on wages. In order to test this, we subdivided the grade scale into 5 equally wide intervals and created 5 dummies. As can be seen in table 2, this dummy structure exhibits a roughly linear pattern: the positive coefficients rise for each dummy. There is a moderate jump when changing from dummy 4 to dummy 5, so grades in the upper 20% of the scale are possibly rewarded superproportionally.
A second possible critique pertains to our absolute definition of grades. As discussed in section 2, grades are an ordinal measure. Thus, their informational content depends on the grade distribution of the peers, and if employers have information about this distribution, they will take into account relative rather than absolute grades. Table 2 contains three different specifications of relative grades. First, we built quintiles for all grade distributions in 10 universities and 7 subjects, i.e., for 70 distributions or strata. The quintile dummies are the relative counterpart to the absolute grade dummies discussed above. Then, we standardized grades:

$$G_{i,h}^{s} = \frac{G_{i,h} - \overline{G_h}}{\sigma_h}$$

where *h* denotes a certain stratum. The variable “grade standardized 1” was built using the same 70 strata as for the quintile dummies. “Grade standardized 2” neglects universities and takes 17 different subjects as strata.

OLS:	**(5)**		**(6)**		**(7)**		**(8)**	
ln annual wage 99	**b**	**t**	**b**	**t**	**b**	**t**	**b**	**t**
grade dummy: 0.2 - 0.4	0.0360	1.30						
grade dummy: 0.4 - 0.6	*0.0514*	1.96						
grade dummy: 0.6 - 0.8	*0.0634*	2.30						
grade dummy: 0.8 - 1	*0.0947*	2.92						
grade 2nd quintile			-0.0031	-0.23				
grade 3rd quintile			-0.0034	-0.28				
grade 4th quintile			0.0130	1.02				
grade 5th quintile			*0.0376*	2.57				
grade standardized 1					*0.0203*	3.54		
grade standardized 2							*0.0160*	2.77
Arts & Humanities, Social Sciences	*-0.0594*	-2.73	*-0.0530*	-2.5	*-0.0461*	-2.24	*-0.0478*	-2.32
Law	*-0.0722*	-3.41	*-0.0739*	-3.45	*-0.0721*	-3.39	*-0.0742*	-3.49
Science	*-0.0485*	-2.09	-0.0371	-1.64	-0.0320	-1.42	-0.0328	-1.46
Medicine, Pharmacy	*0.1756*	3.20	*0.1820*	3.33	*0.1852*	3.41	*0.1874*	3.42
Technical Sciences	*-0.0921*	-2.77	*-0.0896*	-2.73	*-0.0853*	-2.61	*-0.0827*	-2.53
Other Subjects	*-0.1042*	-2.59	*-0.0969*	-2.47	*-0.0928*	-2.38	*-0.0933*	-2.37
Study length (no. of semesters)	0.0023	0.90	0.0024	0.93	0.0026	1.00	0.0025	0.99
Jobbed during study: relation to study	*0.0458*	3.29	*0.0460*	3.29	*0.0452*	3.26	*0.0454*	3.27
Jobbed during study: no relation to study	0.0178	1.35	0.0192	1.45	0.0184	1.40	0.0180	1.36
Constant	*10.567*	113.90	*10.606*	118.55	*10.603*	118.30	*10.610*	118.17
adj. R^2	0.655		0.654		0.655		0.654	
F	*33.02*		*33.05*		*34.16*		*34.03*	
N	1716		1715		1715		1716	

Table 2: OLS-Regression, dependent variable: ln annual wage 1999; Reference category: for grade dummy variables the first category, respectively, for all other dummies as in table 1; Note: Regressions contain also the independent variables listed in table 9 in the appendix.

Neither of these relative specifications of grades changes the result that grades have a significant impact on annual starting wages. The quintile dummies are less significant than the absolute grade dummies, which might indicate that employers do not have information about the relevant distribution. Standardized grades, however, are as significant as the absolute grade variable in table 1.

Finally, it could be the case that there are significant effects of grades in certain subjects which mask the lack of effects in other subjects. Table 4 uses various interaction effects to test for this possibility.
Indeed, we now find a significant effect only for law graduates. The other coefficients are positive (with the exception of medicine and pharmacy with a very small negative coefficient), but insignificant. It is the “aggregation” of these rather small positive effects in most subjects and the very marked effect for law graduates in a single grade variable that leads to the overall significant effect of grades in table 1.
Why is the effect so much stronger for law graduates? First, law is a subject with many students: In 1998, 15.8% of all graduates at Swiss universities were law graduates (FSO 1999). As law prepares for a wide variety of jobs, it is plausible that students are very heterogenous. Second, law study curricula are very strict as opposed to many other study curricula. E.g., law can usually not be studied along with a minor subject. Furthermore, students have very limited choice between different courses. Whereas students in most subjects can specialize by choosing a very individual portfolio of major subject, minor subject and even choosing the courses attended within these, law students have a highly standardized education. Combining these two factors, law graduates are very heterogenous in their ability-composition, but very homogenous in their education. In this situation, grades might be a very effective signal: both because there is an important variance in the ability distribution and because grades between different graduates are really comparable since they concern the same courses.

OLS: **ln annual wage 99**	**(9)**	
	b	**t**
grade X (Arts & Humanities, Social Sciences)	0.0558	0.83
grade X (Business, Economics)	0.0797	1.32
grade X Law	*0.2904*	3.22
grade X Science	0.0107	0.16
grade X (Medicine, Pharmacy)	-0.0097	-0.14
grade X Technical Sciences	0.1055	1.77
grade X Other Subjects	0.3218	1.57
Univ. Basel	-0.0501	-1.76
Univ. Berne	-0.0252	-1.03
Univ. Fribourg	-0.0126	-0.46
Univ. Geneva	-0.0484	-1.33
Univ. Lausanne	-0.0057	-0.18
Swiss Fed. Inst. of Technology Lausanne (EPFL)	0.0306	0.78
Univ. Neuchâtel	-0.0383	-0.82
Univ. St. Gall (HSG)	0.0097	0.29
Swiss Fed. Inst. of Technology Zurich (ETHZ)	0.0140	0.49
Arts & Humanities, Social Sciences	-0.0449	-0.88
Law	*-0.1649*	-3.28
Science	-0.0020	-0.04
Medicine, Pharmacy	*0.2356*	3.42
Technical Sciences	*-0.1050*	-2.01
Other Subjects	-0.2493	-1.86
Study length (no. of semesters)	0.0022	0.87
Jobbed during study: relation to study	*0.0463*	3.33
Jobbed during study: no relation to study	0.0193	1.46
Constant	10.571	110.61
adj. R^2	.655	
F	32.36	
N	1716	

Table 3: OLS-Regression, dependent variable: ln annual wage 1999; Reference category: as in table 1; Note: Regressions contain also the independent variables listed in table 9 in the appendix.

After analysing different specifications of grades, we now turn to a different specification of the wage variable. The annual wage variable has been built using formal working time and standardizing wages to a 100% fulltime job. Now we use hourly wages where not formal working time has been used, but actual weekly working time as reported by graduates.

Table 5 shows the result for hourly starting wages. Now the coefficient for grades drops by one third and is no more significant. The standardized (i.e., relative) grade variable is significant at the 10% level of significance, but the coefficient has dropped, too. Interaction effects show that grades remain important for law graduates, but for some other subjects the sign has turned negative (but remains clearly insignificant). Overall, the case for grades having an impact on first wages has become weak.[21]

This change can be explained as follows[22]: People with higher grades work more hours per week in jobs that entail the same *formal* working time. It seems that people who work harder in university (and thus get higher grades) also work harder later on.

One might ask which operationalisation of wages is the "right" one, using formal or actual working time? From the point of view of the students, the right one is the one on which they base their study-related decisions. It is possible that they prefer a higher annual wage even when their wage per actually worked hour remains the same. We would have to specify a labour supply function to determine this. Another hypothesis might be that students look at formal wages ignoring the fact that a higher wage entails more work, i.e., students would behave irrationally and suffer from "wage illusion". From the point of view of employers, the right wage variable is the one that is closest related to actual productivity. If those people that work more are proportionally more productive, wage per actual working time is relevant.[23]

We are not able to decide on which wage variable is better than the other and prefer to explain where the correlation of grades and working time accrues from. We will propose two hypotheses which we call the intrinsic and the extrinsic motivation hypothesis, respectively. These will provide the base for the analyses of the second wave results.

[21] For the 1999 regressions, this pattern basically holds also for regressions run separately for females and males (see appendix C).

[22] The differing result does not depend on the differing N: Running the annual wage regression only with cases for which there is a hourly wage, too, gives a significant grade coefficient, and vice versa.

[23] From the point of view of data quality, finally, we prefer the annual wage variable as the formal working time variable seems more reliable than the variable about actual working time which contains more outliers.

OLS:	**(10)**		**(11)**		**(12)**	
ln hourly wage 99	**b**	**t**	**b**	**t**	**b**	**t**
grade	0.0561	1.53				
grade standardized 1			0.0128	1.88		
grade X (Arts & Humanities, Social Sciences)					0.0869	1.07
grade X (Business, Economics)					-0.0515	-0.72
grade X Law					*0.2663*	2.75
grade X Science					-0.0131	-0.15
grade X (Medicine, Pharmacy)					-0.0350	-0.38
grade X Technical Sciences					0.0530	0.75
grade X Other Subjects					-0.0160	-0.05
Arts & Humanities, Social Sciences	-0.0276	-1.13	-0.0176	-0.77	-0.0909	-1.47
Law	*-0.0643*	-2.65	*-0.0643*	-2.65	*-0.2046*	-3.69
Science	*-0.0543*	-1.96	-0.0438	-1.61	-0.0557	-0.85
Medicine, Pharmacy	*0.0943*	1.94	*0.1009*	2.09	0.1042	1.3
Technical Sciences	*-0.1328*	-3.51	*-0.1272*	-3.39	*-0.1746*	-2.85
Other Subjects	-0.0713	-1.42	-0.0636	-1.29	-0.0699	-0.3
Study length (no. of semesters)	0.0012	0.40	0.0013	0.42	0.0006	0.21
Jobbed during study: relation to study	*0.0458*	2.93	*0.0456*	2.91	*0.0466*	2.98
Jobbed during study: no relation to study	0.0227	1.50	0.0230	1.52	0.0228	1.51
Constant	*2.984*	28.47	*3.003*	29.59	*3.030*	27.48
adj. R^2	0.548		0.548		0.550	
F	*22.29*		*22.31*		*21.16*	
N	1722		1721		1722	

Table 4: OLS-Regression, dependent variable: ln hourly wage 1999, based on actual (instead of formal) working time; Reference category: as in table 1; Note: Regressions contain also the independent variables listed in table 9 in the appendix.

Endogeneity

Before turning to these hypotheses, we have to deal with the problem of potential endogeneity of grades.

$$\ln(w99) = X_1\beta_1 + \alpha_1 G + \varepsilon_1 \qquad (1)$$
$$G = X\beta_2 + \varepsilon_2 \qquad (2)$$
$$I = 1(X\beta_3 + \varepsilon_3 > 0) \qquad (3)$$

Equation (1) is the population equation of interest where the grade variable is assumed to be exogenous. The grade variable is described by the linear projection of equation (2). It can, however, only be observed if the indicator variable *I* is 1. The estimated equation is:

$$\ln(w99_s) = X_{1,s}\beta_{1,s} + \alpha_{1,s} G_s + \varepsilon_{1,s} \qquad (4)$$

where s denotes the subsample of people that responded in the second wave. If, for instance, ability is correlated with grades (equation 2) as well as with the decision to participate in the second wave (equation 3), then grades will not be exogenous in equation 4, i.e. $\hat{\alpha}_{1,s} \longrightarrow \alpha_1$ will not hold.

How can this problem be overcome? A standard selection model does not help as these are designed for cases with censored or truncated *dependent* variables, not missing *independent* variables. We can, however, use a selection model to impute the missing observations in grades, taking into account possible selection effects. This method provides us with consistent estimates of the missing grades (provided the identification assumption holds) and we can use the imputed variable to estimate equation (1) with the full sample.[24]

A two-step Heckman estimation is used to impute the grade variable. The first step probit includes the weekly time for sports the person invested in 1999,

[24] Wooldridge (2002: 567ff.) proposes another method where only the observed subsample is used for the wage regression. In order to account for endogeneity, the grade variable is to be instrumented, and the inverse mills ratio of a probit (dependent variable: observed/not observed) should be included. This method needs two instruments and, accordingly, two identifying assumptions. The reason why we need only one is that we use the observed wage data for the cases where grades are not observed.

which is not included in the grade regression. This exclusion restriction can be motivated as follows: It is assumed that the more sports a person practises, the less time it has to fill in the questionnaire of the 2002 survey. As sports often entails regular trainings, typically weekly or several times a week, it is likely that sportive persons do not abstain from training to spare time for the questionnaire and are less likely to complete it. Further, we assume that the time someone invests in sport is not correlated with grades. This means, we believe that sportive persons are neither more intelligent nor more able than non-sportive people, and vice versa.

Table 5 shows the two-step Heckman model used to impute 911 missing values in the grade variable. The selection term is not significant, so grades of 2nd wave participants and non-participants do not differ.

Heckman 2step: grade	**1. Selection (Probit)**		**2. grade regression**	
	b	**t**	**b**	**t**
weekly time for sports	*-0.0232*	-2.99		
Univ. Basel	-0.0477	-0.31	0.0398	1.57
Univ. Berne	-0.1353	-1.1	0.0023	0.11
Univ. Fribourg	-0.1668	-1.27	-0.0295	-1.25
Univ. Geneva	*-0.4956*	-3.17	*-0.0914*	-2.38
Univ. Lausanne	*-0.3429*	-2.37	*0.0796*	2.64
Swiss Fed. Inst. of Technology Lausanne (EPFL)	-0.2090	-1.12	0.0626	1.87
Univ. Neuchâtel	*-0.6429*	-3.18	-0.0621	-1.2
Univ. St. Gall (HSG)	*-0.4479*	-3.09	0.0434	1.22
Swiss Fed. Inst. of Technology Zurich (ETHZ)	-0.1351	-0.9	*-0.0616*	-2.33
Arts & Humanities, Social Sciences	-0.0088	-0.08	*0.1720*	9.52
Law	*-0.4102*	-3.06	0.0002	0.01
Science	-0.1803	-1.48	*0.1810*	7.81
Medicine, Pharmacy	-0.0460	-0.24	*0.1354*	4.13
Technical Sciences	-0.1432	-0.83	*0.1508*	4.88
Other subjects	0.1130	0.43	*0.2252*	5.48
Age	*-0.0363*	-3.36	-0.0054	-1.95
Male	0.0305	0.52	0.0030	0.3
Foreigner	-0.1189	-1.66	-0.0205	-1.46
No. of Children	0.0675	0.84	-0.0088	-0.64
Study length (no. of semesters)	0.0050	0.43	-0.0027	-1.37
Jobbed during study: relation to study	0.0262	0.4	*0.0259*	2.31
Jobbed during study: no	*0.1764*	2.67	-0.0105	-0.74

relation to study				
Potential Experience	0.0122	0.47	0.0032	0.74
Potential Experience^2	-0.0002	-0.15	-0.0001	-0.29
Dummies for earlier educational certificates	yes		yes	
Dummies for Type of School Leaving Examination	yes		yes	
Region of residence fixed effects	yes		yes	
Part-time Work	0.0436	0.53	-0.0070	-0.5
Internship	0.1220	1.12	-0.0116	-0.61
Assistant at University	*-0.2550*	-1.95	0.0242	0.85
External Doctorand	-0.2047	-0.98	0.0340	0.87
Public Service	*0.2072*	1.98	0.0274	1.32
Private Firm, - employees	0.1386	1.3	*0.0476*	2.48
Private Firm, - employees	0.2855	1.73	0.0528	1.79
Private Firm, - employees	-0.0366	-0.31	*0.0963*	4.66
Private Firm, - employees	0.0889	0.86	*0.0823*	4.56
Training >6 month completed	0.1803	1.21	0.0073	0.29
Training >6 month started	0.2555	0.84	-0.0166	-0.32
Job Temporary: <1 year	-0.1374	-1.34	-0.0084	-0.43
Job Temporary: 1-2 year	-0.0636	-0.69	0.0083	0.53
Job Temporary: 2-3 year	0.1341	0.97	*0.0550*	2.36
Job Temporary: >3 year	-0.0739	-0.44	0.0564	1.9
Economic sector fixed effects	yes		yes	
Constant	*1.480*	3.86	*0.659*	9.97
rho	-0.4443			
sigma	0.1784			
lambda			0.0793	-0.77
Pseudo-R^2	0.052			
LR chi2 (95) / Wald chi2 (191)	*177.37*		*813.73*	
N	2635		2635	

Table 5: Heckman 2stage estimation for the imputation of missing cases in the grade variable

3rd step: OLS	**annual wage (13)**		**hourly wage (14)**	
ln wage 99	**b**	**t**	**b**	**t**
grade (imputed)	*0.0896*	2.98	0.0291	0.83
Univ. Basel	*-0.0491*	-2.15	-0.0092	-0.32
Univ. Berne	-0.0359	-1.8	-0.0075	-0.35
Univ. Fribourg	-0.0357	-1.56	0.0003	0.01
Univ. Geneva	-0.0373	-1.4	-0.0184	-0.61
Univ. Lausanne	-0.0191	-0.75	0.0151	0.53
Swiss Fed. Inst. of Technology Lausanne (EPFL)	0.0392	1.32	0.0769	2.29
Univ. Neuchâtel	-0.0241	-0.72	0.0410	1.11
Univ. St. Gall (HSG)	0.0201	0.82	-0.0244	-0.97
Swiss Fed. Inst. of Technology Zurich (ETHZ)	0.0259	1.08	0.0247	0.88

Arts & Humanities, Social Sciences	*-0.0755*	-4.3	-0.0191	-1.01
Law	*-0.0467*	-2.66	-0.0266	-1.29
Science	*-0.0723*	-3.77	-0.0354	-1.65
Medicine, Pharmacy	*0.1370*	3.28	0.0219	0.56
Technical Sciences	*-0.1299*	-4.88	*-0.1069*	-3.51
Other subjects	*-0.1337*	-3.97	-0.0320	-0.77
Age	*0.0070*	3.65	*0.0065*	3.05
Male	*0.0549*	5.61	*0.0259*	2.34
Foreigner	0.0133	1.11	0.0069	0.51
No. of Children	*0.0615*	4.56	*0.0431*	3.08
Study length (no. of semesters)	0.0030	1.53	-0.0013	-0.59
Jobbed during study: relation to study	*0.0340*	3.16	0.0185	1.53
Jobbed during study: no relation to study	0.0129	1.23	*0.0253*	2.18
Potential Experience	0.0027	0.64	0.0072	1.47
Potential Experience^2	0.0000	0.22	-0.0002	-1.00
Dummies for earlier educational certificates	yes			
Dummies for Type of School Leaving Examination	yes			
Region of residence fixed effects	yes			
Part-time Work	*0.0377*	2.66	0.0235	1.43
Internship	*-0.4041*	-17.54	-0.3578	-15
Assistant at University	*-0.0553*	-2.48	*-0.0747*	-2.97
External Doctorand	*-0.1366*	-3.92	*-0.1841*	-4.97
Public Service	*0.1952*	9.22	*0.1248*	5.18
Private Firm, - employees	*0.0952*	4.5	*0.0676*	2.83
Private Firm, - employees	*0.1593*	5.85	*0.1059*	3.89
Private Firm, - employees	*0.1663*	8.93	*0.1406*	6.68
Private Firm, - employees	*0.1898*	11.03	*0.1583*	8.46
Training >6 month completed	0.0300	1.33	0.0275	1.22
Training >6 month started	0.0629	1.73	*0.0834*	1.92
Job Temporary: <1 year	*-0.2478*	-12.26	*-0.2467*	-11.11
Job Temporary: 1-2 year	*-0.0990*	-6.18	*-0.1509*	-8.39
Job Temporary: 2-3 year	*-0.0941*	-3.9	*-0.1265*	-4.52
Job Temporary: >3 year	*-0.1387*	-5.33	*-0.1850*	-6.02
Economic sector fixed effects	yes		yes	
Constant	*10.803*	167.63	*3.180*	39.89
adj. R^2	0.650		0.558	
F	*51.49*		*32.29*	
N	2692		2631	

Table 6: wage regressions using the grade variable imputed as reported in table 5

Table 6 shows that the main message does not change when using the sample of more than 2600 observations where missing grades have been

imputed. The grade coefficient is similar to the one in table 1 for annual wage and drops for hourly wage. This drop is even more markedly than for the smaller sample, though.[25]

Explaining the findings for 1 year after graduation: hypotheses

We continue now to explain this striking difference of the results for annual formal wages and actual hourly wages. As already mentioned, two hypotheses can be brought forward:

1. Students differ with respect to their motivation for study and work. E.g., there are differences in preferences for education and work between individuals. If the preferences for education and for work are correlated, more interested and diligent students also work more diligently. This is the *intrinsic* motivation explanation. According to this explanation, motivated students like to work more than their colleagues and therefore work more in university as well as on their first job.

   Version 1a of this explanation states that grades have no causal effect on the first job and salaries, grades are just correlated with actual working time and thus, indirectly, with annual wages.

   Version 1b states that students with higher grades are more likely to get their preferred jobs, i.e., they can carry out the work they want to and receive more satisfaction from their work. Therefore, they are also willing to work more. According to Version 1b, grades have a causal effect on the worker-job matches and, thus, only indirectly via preferences again, on working time and annual wage.
2. Students with higher grades occupy different jobs than students with lower grades. These jobs offer better career prospects: they are beginner's positions which qualify for later promotion if workers fulfill employer's expectations. The motivation of graduates is *extrinsic*, as they receive an option value for promotion and, eventually, higher earnings per actual working time in the future.

[25] The reported t-values are not entirely correct, as the imputation of predicted values for

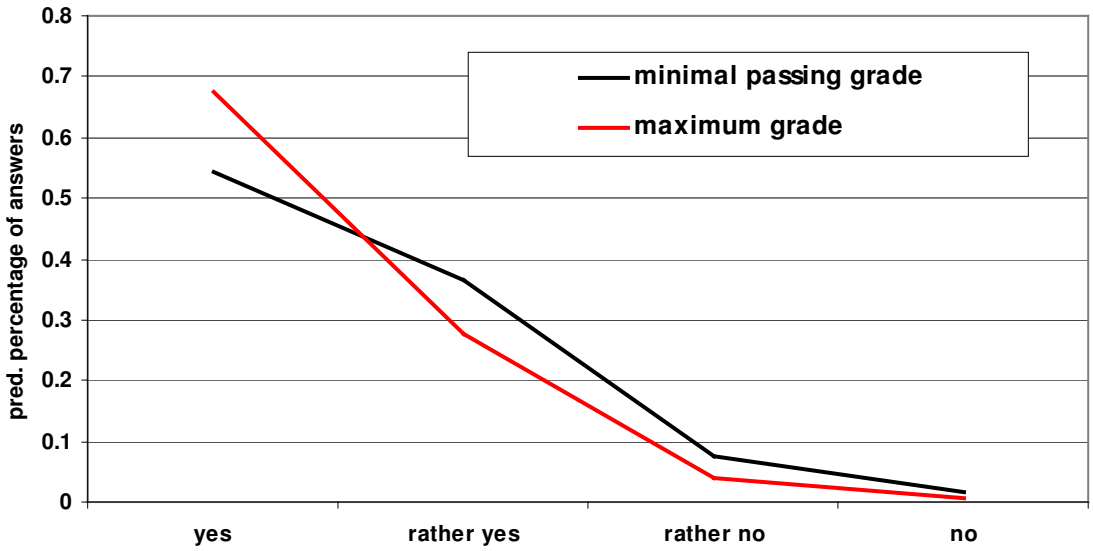
How do these hypotheses relate to our initial hypotheses in section 2? For annual wages based on formal working time, hypothesis (I) from section 2 has been confirmed. Our new hypotheses deal with the fact that the case is not so clear when looking at hourly wages based on actual working time. Hypothesis (1) says that grades have no direct, causal influence on actual hourly wages., i.e., for these wages the null hypothesis (0) from section 2 is renewed. Hypothesis (2), on the contrary, states that grades *do* have a causal influence on wages even when taking into account actual working time. This influence, however, can only be detected in the mid- or long-term.
The following sections will be dedicated to testing these hypotheses.

Job adequacy

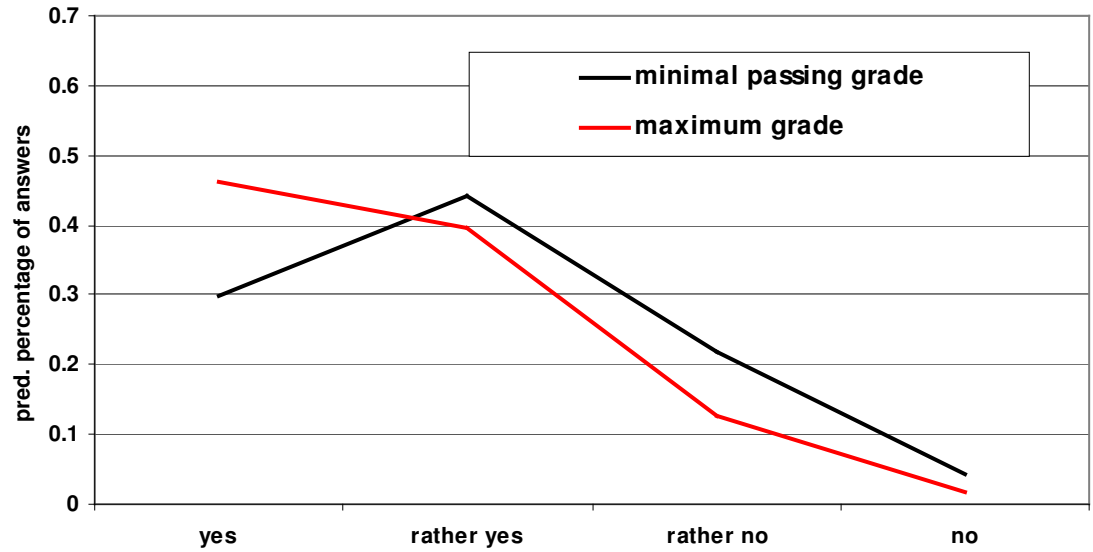
First, we test whether graduates with higher grades occupy jobs where they are more satisfied (hypothesis 1b). Job satisfaction has not directly been asked. The questionnaire contains questions about the adequacy of the job relatively to the own education concerning
1. the knowledge acquired during studies,
2. the possibility to produce and realize own ideas and

These were used as dependent variables in ordered probit model models. Grades have a significant effect[26], as is illustrated in Graph 4 and 5: graduates with higher grades think that they can use more of their skills and knowledge, and they deem themselves more able to produce and realize own ideas at their job.

roughly one third of the grades has not been accounted for in the OLS covariance matrix.
[26] On the 10 percent significance level for the first, on the 5 percent level for the second item.



Graph 4: Predicted distribution of answers to the question: "My opinion is that my actual job is adequate compared to my education concerning my possibilities to use my knowledge and skills"; Results of a ordered probit model; Reference category: Reference category: University of Zurich, Business/Economics, Female, Swiss, did not job during studying, worked fulltime in a private firm with 1 - 9 employees, followed no training and occupies a permanent job. Note: Regression models contains the independent variables listed in table 9 in the appendix (without wage variables).



Graph 5: Predicted distribution of answers to the question: "My opinion is that my actual job is adequate compared to my education concerning my possibilities to exert influence."; Results of a ordered probit model; Reference category: as in Graph 4. Note: Regression models contains the independent variables listed in table 9 in the appendix (without wage variables).

For the first year after graduation we find some evidence for hypothesis 1b. Graduates with higher grades seem to occupy jobs where they find more room for personal development.

Does this finding still hold four years after graduation? The analysis is hampered by the fact that the relevant items have been reformulated in the second wave questionnaire. For the broadly similar questions concerning the use of one's professional qualities and one's possibility to realize own ideas, the ordered probit regressions show no significant results for the grade variable any more. The results one year after graduation seem to be of transitory nature. Overall, support for hypothesis 1b is weak. Graduates with higher grades are not rewarded intrinsically via a more satisfactory job in the mid-term.

Wage regressions 2002

In order to evaluate career prospects (hypothesis 2), we will use the second wave data, i.e. the survey conducted four years after graduation. We do not know which is the relevant time period after which the potential career effects predicted by the hypothesis can be observed. The three years in between the two surveys may be regarded as a rather short period. On the other hand, graph 1 and 2 have shown that wages developed strongly in this period.

OLS:	**(15)**		**(16)**		**(17)**	
ln annual wage 02	**b**	**t**	**b**	**t**	**b**	**t**
grade	*0.1397*	4.23				
grade standardized 1			*0.0272*	4.40		
grade X (Arts & Humanities, Social Sciences)					0.1294	1.74
grade X (Business, Economics)					*0.2663*	3.53
grade X Law					-0.0433	-0.60
grade X Science					0.0228	0.26
grade X (Medicine, Pharmacy)					*0.1781*	2.20
grade X Technical Sciences					*0.2226*	3.01
grade X Other Subjects					0.2767	0.85
Arts & Humanities, Social Sciences	*-0.1235*	-5.19	*-0.1012*	-4.45	-0.0650	-1.11
Law	-0.0400	-1.73	-0.0426	-1.84	0.0900	1.92
Science	*-0.1452*	-5.64	*-0.1201*	-4.80	-0.0192	-0.28
Medicine, Pharmacy[27]	-0.0973	-1.92	-0.0829	-1.64	-0.0700	-1.08
Technical Sciences	*-0.2060*	-5.61	*-0.1913*	-5.22	*-0.2072*	-3.29
Other Subjects	*-0.2223*	-4.20	*-0.2020*	-3.87	-0.2612	-1.14
Study length (no. of semesters)	0.0014	0.52	0.0016	0.60	0.0019	0.72
Jobbed during study: relation to study	*0.0440*	3.07	*0.0445*	3.11	*0.0430*	2.96
Jobbed during study: no relation to study	0.0108	0.75	0.0118	0.82	0.0107	0.75
Constant	*11.206*	97.67	*11.263*	99.53	*11.153*	93.77
adj. R^2	0.432		0.432		0.434	
F	*13.62*		*13.87*		*13.12*	
N	1662		1660		1662	

table 7 : OLS-Regression, dependent variable ln annual wage 02 ; Reference category: University of Zurich, Business & Economics, Female, Swiss, did not job during studying, worked fulltime in a private firm with 1 - 9 employees, followed no training and occupies a non-permanent job; Note: Regressions contain also the independent variables listed in table 10 in the appendix.

[27] The coefficients for this dummy are not directly comparable to the 1999 regressions results due to a change in the questionnaires (see appendix, p. xx).

Models (15) and (16) in table 7 show higher and more significant coefficients for the grade variables than the respective regressions for 1999, (4) and (7). This means that four years after graduation, the effect of grades – whether defined in absolute or relative terms - on wage is slightly more pronounced than after one year for formal annual wages. This result provides already some support for hypothesis 2: graduates with higher grades are more successful than their fellows in the mid-term. Model (17) shows, however, that the effect of grades differs strongly across subjects. First, the coefficient for law graduates has changed drastically. In the first-year regressions, grades had a major impact only for law graduates, now the coefficient has become insignificant and has even changed sign. One reason might be that an important fraction of law graduates prepares for state-run examinations after graduation.[28] Therefore, there exist two distinct career paths directly after graduation that typically lead to different jobs, i.e. to different labour market segments.[29] The state exam in itself constitutes a information that might replace the information of grades from university, all the more as the state exam is graded, too, and these new grades might be valued higher by employers than the preceding grades.

A second striking observation concerning model (17) is the significance of grades in the subjects "Business, Economics", "Medicine, Pharmacy" and "Technical Sciences". Especially for the first and the latter category it seems plausible that graduates with higher grades enjoy better career prospects that can be detected in the form of higher wages four years after graduation.

[28] In order to be admitted to these examinations, one has to complete internships of, in sum, at least one and a half year at a court as well as at a barrister's.

[29] The state exam is necessary not only in order to work as a barrister, but also for most positions in justice and typically for higher positions in legal departments.

OLS:	**(18)**		**(19)**		**(20)**	
ln hourly wage 02	**b**	**t**	**b**	**t**	**b**	**t**
grade	0.0667	1.81				
grade standardized 1			*0.0136*	1.98		
grade X (Arts & Humanities, Social Sciences)					0.0197	0.23
grade X (Business, Economics)					0.1388	1.65
grade X Law					-0.0912	-1.18
grade X Science					0.0505	0.57
grade X (Medicine, Pharmacy)					0.0549	0.54
grade X Technical Sciences					*0.2078*	2.60
grade X Other Subjects					-0.1045	-0.38
Arts & Humanities, Social Sciences	*-0.0944*	-3.52	*-0.0838*	-3.29	-0.0371	-0.59
Law	-0.0320	-1.26	-0.0330	-1.31	0.0628	1.23
Science	*-0.1073*	-3.61	*-0.0951*	-3.34	-0.0685	-0.98
Medicine, Pharmacy	-0.0909	-1.67	-0.0837	-1.54	-0.0568	-0.73
Technical Sciences	*-0.1666*	-4.17	*-0.1595*	-4.02	*-0.2189*	-3.27
Other Subjects	-0.1069	-1.95	-0.0972	-1.81	0.0264	0.14
Study length (no. of semesters)	0.0022	0.75	0.0023	0.79	0.0025	0.86
Jobbed during study: relation to study	0.0271	1.78	0.0273	1.79	0.0259	1.69
Jobbed during study: no relation to study	0.0063	0.40	0.0068	0.44	0.0064	0.41
Constant	*3.493*	25.90	*3.518*	26.24	*3.465*	25.50
adj. R^2	0.501		0.501		0.502	
F	*17.60*		*17.89*		*16.83*	
N	1652		1650		1652	

table 8 : OLS-Regression, dependent variable ln hourly wage 02 ; Reference category: University of Zurich, Business & Economics, Female, Swiss, did not job during studying, worked fulltime in a private firm with 1 - 9 employees, followed no training and occupies a non-permanent job; Note: Regressions contain also the independent variables listed in table 10 in the appendix.

Table 8 shows the regression results for actual hourly wages. Again, the coefficients are smaller and less significant than for formal annual wages, but this time they remain significant: at the 10 percent level for the absolute definition of grades, and at the 5 percent level for the relative operationalisation of grades. Model (20) exhibits that, with the exception of "Other subjects" and the somewhat intriguing case of "law" we have discussed above, the remaining interacted subject coefficients are positive. Only the interacted coefficient for "Technical Science" is significant, however, and the coefficient for "Business, Economics" just misses 10 percent significance.

Overall, the effect of grades on wages becomes more robust four years after graduation.[30,31] It remains restricted to certain subjects and is stronger for formal wages as opposed to wages taking into account actual working time. Interestingly, the relative operationalisation of grades seems to fit slightly better four years after graduation. At least for graduates of "Business, Economics" and "Technical Sciences", we find supportive evidence for hypothesis 2. I.e., graduates in these subjects with higher grades benefit from higher wages not directly after graduation, but some years after graduation. On entering the labour market, grades help them to find positions that are more promising for the future, the effect of which can only be measured later on. This means that grades do not only have a transitory effect on graduates' labour market outcomes and that they probably affect their lifetime income in a significant way.

5. Conclusion

We have analysed the effect of university final grades on the wages one and four years after graduation in a representative sample of persons that graduated 1998 in Swiss universities. We have found significant effects for annual wages, but less clear effects when wages are based on actual working

[30] This effect is driven by males alone, as can be seen in table 11 in appendix C.
[31] We can, however, not apply our test for endogeneity used above as here not only the grade variable but also the wage variable and job characteristics are missing for people not participating in the second wave.

time reported by individuals rather than on formal working time. For this case, the effect of grades is insignificant after one year but becomes significant after four years, at least for certain subjects. These findings are robust regarding different operationalisations of the grade variable as well as for a correction of sample attrition. In contrast to this, we have not found evidence for the hypothesis that people with higher grades (and higher working hours) have a higher intrinsic motivation in the mid-term.

We interpret these findings as follows: University graduates with higher grades find jobs with higher formal wages and better career prospects. As they actually have (or want) to work more in these positions, given the same formal working time, they benefit from an actual wage advantage – i.e., after correcting for actual working time – only some years after graduation.

These findings should be regarded as first results. The data collected under the name “graduate studies” (*Absolventenstudien*) by the Swiss Federal Office offer material for further analyses. A third wave of the survey is planned, allowing for long-term analyses ten years after graduation. The basic (first wave) survey will, in the future, contain questions about grades, which will lead to pooled data for different cohorts containing grade information. Finally, the data set analysed in this article can further be exploited. The panel feature of the data has not yet been used, as we applied separate cross-section regressions here. Tracing the wage development of individuals is possible; this is, however, more demanding in terms of the number of observations and data quality. The frequent changes of items between the 1999 and the 2002 questionnaire are bothersome for this.

In the light of the findings presented in this article we conclude that grades have a non-negligible effect on wages. This is good news for researchers that use grades as a educational outcome measure (including value-added models). The scant number of studies on the link between grades and wages, however, reveals a real gap in the literature and calls for more empirical investigation: Which effect do grades still have eight or more years after graduation? Can similar effects of grades be found for university graduates in

other countries? Do grades matter for people with other educational degrees? How well do students' expectations of wage gains due to higher grades match real wage increases? The effect of grades should be put on the research agenda of education and labour economists.

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Appendix

A. Summary Statistics

Variables in italics have not usually been used in wage regressions (but for the Heckman or ordered probit regressions).

* indicates that more information concerning the respective variable can be found in part B of the appendix.

The number of observations N has been determined by including those cases that have been included either in the annual or the hourly wage regression (for 1999 or 2002, respectively).

Variable	N	Mean	Std. Dev.	Min	Max
Grades *					
grade	1764	0.5419	0.2030	0	1
grade dummy 0 - 0.2	1764	0.0539	0.2258	0	1
grade dummy 0.2 - 0.4	1764	0.1797	0.3841	0	1
grade dummy 0.4 - 0.6	1764	0.4138	0.4927	0	1
grade dummy 0.6 - 0.8	1764	0.2738	0.4460	0	1
grade dummy 0.8 - 1	1764	0.0913	0.2881	0	1
grade 1st quintile	1763	0.2734	0.4458	0	1
grade 2nd quintile	1763	0.3216	0.4672	0	1
grade 3rd quintile	1763	0.3642	0.4813	0	1
grade 4th quintile	1763	0.3018	0.4592	0	1
grade 5th quintile	1763	0.2513	0.4339	0	1
grade standardized 1	1763	-0.0276	0.9742	-4.080	2.910
grade standardized 2	1764	-0.0246	0.9875	-3.321	2.825
Grades interacted					
grade X (Arts & Humanities, Social Sciences)	1764	0.1232	0.2557	0	1
grade X (Business, Economics)	1764	0.0773	0.1846	0	0.915
grade X Law	1764	0.0722	0.1772	0	0.95
grade X Science	1764	0.0813	0.2247	0	1
grade X (Medicine, Pharmacy)	1764	0.0741	0.2066	0	1
grade X Technical Sciences	1764	0.1016	0.2328	0	1
grade X Other Subjects	1764	0.0121	0.0887	0	0.875
Universities					
Univ. Basel	1764	0.0884	0.2840	0	1
Univ. Berne	1764	0.1264	0.3324	0	1
Univ. Fribourg	1764	0.0771	0.2668	0	1
Univ. Geneva	1764	0.0777	0.2677	0	1
Univ. Lausanne	1764	0.1020	0.3028	0	1
Swiss Fed. Inst. of Technology Lausanne (EPFL)	1764	0.0714	0.2576	0	1
Univ. Neuchâtel	1764	0.0238	0.1525	0	1

Univ. St. Gall (HSG)	1764	0.0391	0.1939	0	1
Univ. Zurich	1764	0.2154	0.4112	0	1
Swiss Fed. Inst. of Technology Zurich (ETHZ)	1764	0.1740	0.3792	0	1
Other	1764	0.0034	0.0582	0	1
unknown	1764	0.0011	0.0337	0	1
Subjects					
Arts & Humanities, Social Sciences	1764	0.2069	0.4052	0	1
Business & Economics	1764	0.1735	0.3788	0	1
Law	1764	0.1689	0.3748	0	1
Science	1764	0.1281	0.3343	0	1
Medicine, Pharmacy	1764	0.1270	0.3330	0	1
Technical Sciences	1764	0.1763	0.3812	0	1
Other Subjects	1764	0.0193	0.1375	0	1
Individual characteristics					
Male	1764	0.6083	0.4883	0	1
Foreigner	1764	0.1695	0.3753	0	1
Age	1764	27.8980	3.2188	20	49
No. of children *	1764	0.0720	0.3688	0	4
Study length (no. of semesters)	1764	10.9802	2.8142	6	25
Jobbed during study: relation to study	1764	0.2200	0.4143	0	1
Jobbed during study: no relation to study	1764	0.2613	0.4395	0	1
Maturität with cantonal approval	1764	0.1173	0.3219	0	1
Eidgenössische Maturität	1764	0.0448	0.2069	0	1
Maturität in foreign country	1764	0.0244	0.1543	0	1
Maturität other	1764	0.0459	0.2094	0	1
former educational degrees: upper secondary level	1764	0.0850	0.2790	0	1
teachers licence	1764	0.0210	0.1433	0	1
tertiary vocational diploma	1764	0.0028	0.0532	0	1
higher professional school	1764	0.0102	0.1005	0	1
other university diploma	1764	0.0153	0.1228	0	1
other education	1764	0.0368	0.1884	0	1
weekly time for sports	1724	3.8028	3.2007	0	20
Current job characteristics					
ln annual wage 99 *	1716	11.0658	0.3650	9.800	11.948
ln hourly wage 99 *	1722	3.4011	0.3648	2.205	4.408
Potential experience *	1764	9.6663	4.0328	0	28
Part-time work	1764	0.1531	0.3601	0	1
Internship *	1764	0.1757	0.3807	0	1
Assistant at University *	1764	0.1032	0.3043	0	1
External Doctorand *	1764	0.0266	0.1611	0	1
Public Service *	1764	0.3849	0.4867	0	1
Other institution *	1764	0.0142	0.1182	0	1
Private Firm, 1 - 9 employees *	1764	0.1241	0.3298	0	1
Private Firm, 10 - 49 employees *	1764	0.1100	0.3130	0	1
Private Firm, 50 - 99 employees *	1764	0.0374	0.1898	0	1
Private Firm, 100 - 499	1764	0.0777	0.2677	0	1

employees *					
Private Firm, 500+ employees *	1764	0.2324	0.4225	0	1
Training >6 month completed	1764	0.0397	0.1953	0	1
Training >6 month started	1764	0.0079	0.0888	0	1
Job Temporary: <1 year	1764	0.1253	0.3311	0	1
Job Temporary: 1-2 year	1764	0.2211	0.4151	0	1
Job Temporary: 2-3 year	1764	0.0618	0.2408	0	1
Job Temporary: >3 year	1764	0.0471	0.2118	0	1
Job Temporary: unknown	1764	0.0164	0.1272	0	1
Job adequate: use knowledge	1764	1.5266	0.7316	1	4
Job adequate: exert influence	1755	1.8530	0.8374	1	4
economic sector					
University	1764	0.0969	0.2960	0	1
University of Applied Science	1764	0.0159	0.1250	0	1
Schools	1764	0.0300	0.1708	0	1
Judiciary	1764	0.1168	0.3212	0	1
Information and Culture	1764	0.0329	0.1784	0	1
Health Care	1764	0.1321	0.3387	0	1
Pedagogical, psychological, social services	1764	0.0249	0.1560	0	1
Agriculture	1764	0.0074	0.0856	0	1
Industry	1764	0.1599	0.3666	0	1
Services	1764	0.1576	0.3645	0	1
Financial services	1764	0.1355	0.3423	0	1
Public service	1764	0.0726	0.2595	0	1
Church	1764	0.0000	0.0000	0	0
Associations/Organisations	1764	0.0153	0.1228	0	1
Other	1764	0.0017	0.0412	0	1
unknown	1764	0.0006	0.0238	0	1
Region of residence *					
Zurich	1764	0.2438	0.4295	0	1
Berne	1764	0.1066	0.3087	0	1
Lucerne	1764	0.0397	0.1953	0	1
Uri	1764	0.0023	0.0476	0	1
Schwyz	1764	0.0159	0.1250	0	1
Obwalden	1764	0.0034	0.0582	0	1
Nidwalden	1764	0.0034	0.0582	0	1
Glarus	1764	0.0006	0.0238	0	1
Zug	1764	0.0147	0.1205	0	1
Fribourg	1764	0.0363	0.1870	0	1
Solothurn	1764	0.0255	0.1577	0	1
Basel Stadt	1764	0.0482	0.2142	0	1
Basel Landschaft	1764	0.0351	0.1842	0	1
Schaffhausen	1764	0.0074	0.0856	0	1
Appenzell Ausserrhoden	1764	0.0011	0.0337	0	1
St. Gall	1764	0.0346	0.1828	0	1
Graubünden	1764	0.0153	0.1228	0	1
Aargau	1764	0.0505	0.2189	0	1
Thurgau	1764	0.0096	0.0977	0	1
Ticino	1764	0.0357	0.1856	0	1
Vaud	1764	0.1139	0.3178	0	1

Valais	1764	0.0334	0.1799	0	1
Neuchâtel	1764	0.0244	0.1543	0	1
Genêve	1764	0.0658	0.2479	0	1
Jura	1764	0.0040	0.0629	0	1
unknown	1764	0.0289	0.1676	0	1

Table 9: Summary Statistics 1999 (one year after graduation) for variables used in regression models (N: only valid cases in annual or hourly wage regressions1999)

Variable	N	Mean	Std. Dev.	Min	Max
Grades *					
grade	1735	0.5540	0.2053	0	1
grade dummy 0 - 0.2	1735	0.0513	0.2207	0	1
grade dummy 0.2 - 0.4	1735	0.1654	0.3717	0	1
grade dummy 0.4 - 0.6	1735	0.4115	0.4923	0	1
grade dummy 0.6 - 0.8	1735	0.2807	0.4495	0	1
grade dummy 0.8 - 1	1735	0.1037	0.3050	0	1
grade 1st quintile	1733	0.2654	0.4417	0	1
grade 2nd quintile	1733	0.3145	0.4644	0	1
grade 3rd quintile	1733	0.3676	0.4823	0	1
grade 4th quintile	1733	0.3024	0.4594	0	1
grade 5th quintile	1733	0.2706	0.4444	0	1
grade standardized 1	1733	0.0153	0.9802	-4.0800	2.9097
grade standardized 2	1734	0.0177	0.9885	-3.3209	2.8251
Grades interacted					
grade X (Arts & Humanities, Social Sciences)	1735	0.1294	0.2649	0	1
grade X (Business, Economics)	1735	0.0782	0.1862	0	0.915
grade X Law	1735	0.0644	0.1697	0	0.95
grade X Science	1735	0.0968	0.2442	0	1
grade X (Medicine, Pharmacy)	1735	0.0776	0.2120	0	1
grade X Technical Sciences	1735	0.0923	0.2240	0	1
grade X Other Subjects	1735	0.0150	0.0978	0	0.875
Universities					
Univ. Basel	1735	0.0899	0.2861	0	1
Univ. Berne	1735	0.1297	0.3361	0	1
Univ. Fribourg	1735	0.0749	0.2634	0	1
Univ. Geneva	1735	0.0836	0.2768	0	1
Univ. Lausanne	1735	0.1037	0.3050	0	1
Swiss Fed. Inst. of Technology Lausanne (EPFL)	1735	0.0669	0.2498	0	1
Univ. Neuchâtel	1735	0.0254	0.1573	0	1
Univ. St. Gall (HSG)	1735	0.0386	0.1927	0	1
Univ. Zurich	1735	0.2069	0.4052	0	1
Swiss Fed. Inst. of Technology Zurich (ETHZ)	1735	0.1764	0.3812	0	1
Other	1735	0.0035	0.0587	0	1
unknown	1735	0.0006	0.0240	0	1

Subjects					
Arts & Humanities, Social Sciences	1735	0.2110	0.4081	0	1
Business & Economics	1735	0.1758	0.3808	0	1
Law	1735	0.1493	0.3565	0	1
Science	1735	0.1476	0.3548	0	1
Medicine, Pharmacy	1735	0.1314	0.3379	0	1
Technical Sciences	1735	0.1602	0.3669	0	1
Other Subjects	1735	0.0242	0.1537	0	1
Individual characteristics					
Male	1735	0.6277	0.4836	0	1
Foreigner	1735	0.1643	0.3706	0	1
Age	1735	30.7850	3.1970	23	56
No. of children *	1735	0.1787	0.5563	0	4
Study length (no. of semesters)	1735	10.9170	2.8558	6	26
Jobbed during study: relation to study	1735	0.2231	0.4164	0	1
Jobbed during study: no relation to study	1735	0.2559	0.4365	0	1
Maturität with cantonal approval	1735	0.1141	0.3180	0	1
Eidgenössische Maturität	1735	0.0438	0.2047	0	1
Maturität in foreign country	1735	0.0225	0.1483	0	1
Maturität other	1735	0.0507	0.2195	0	1
former educational degrees:	1735	0.0778	0.2679	0	1
upper secondary level	1735	0.0271	0.1624	0	1
teachers licence	1735	0.0040	0.0634	0	1
tertiary vocational diploma	1735	0.0133	0.1144	0	1
higher professional school	1735	0.0104	0.1014	0	1
other university diploma	1735	0.0363	0.1871	0	1
other education	1735	10.9170	2.8558	6	26
Current job characteristics					
ln annual wage 02 *	1704	11.4650	0.2991	9.7981	12.2061
ln hourly wage 02 *	1696	3.8065	0.3420	2.2318	4.6886
Potential Experience *	1735	3.9226	0.5802	0	4.7068
Part-time work	1735	0.2450	0.4302	0	1
Internship *	1725	0.1090	0.3117	0	1
Assistant/Doctorand *	1735	0.0986	0.2982	0	1
Medical Assistant *	1735	0.0882	0.2836	0	1
Public Service *	1735	0.3602	0.4802	0	1
Association/Organisation *	1735	0.0282	0.1657	0	1
Other institution *	1735	0.0248	0.1555	0	1
Private Firm, 1.5 - 5 employees *	1735	0.2945	0.4560	0	1
Private Firm, 6 - 49 employees *	1735	0.0847	0.2786	0	1
Private Firm, 50 - 249 employees *	1735	0.1447	0.3519	0	1
Private Firm, 250 - 500 employees *	1735	0.0467	0.2110	0	1
Freelance, alone *	1735	0.0081	0.0895	0	1
Training >6 month completed or started	1735	0.4859	0.4999	0	1
Job Temporary	1690	0.2538	0.4353	0	1
My job offers: use	1730	3.4191	0.7632	1	4

knowledge					
My job offers: exert influence	1728	3.3530	0.7051	1	4
economic sector					
University	1735	0.0928	0.2902	0	1
University of Applied Science	1735	0.0046	0.0678	0	1
Schools	1735	0.0484	0.2147	0	1
Judiciary	1735	0.0703	0.2558	0	1
Information and Culture	1735	0.0340	0.1813	0	1
Health Care	1735	0.1297	0.3361	0	1
Pedagogical, psychological, social services	1735	0.0202	0.1406	0	1
Agriculture	1735	0.0040	0.0634	0	1
Industry	1735	0.1706	0.3763	0	1
Services	1735	0.1545	0.3615	0	1
Financial services	1735	0.1412	0.3483	0	1
Public service	1735	0.0899	0.2861	0	1
Church	1735	0.0006	0.0240	0	1
Associations/Organisations	1735	0.0190	0.1366	0	1
Other	1735	0.0138	0.1168	0	1
unknown	1735	0.0063	0.0794	0	1
Region of work *					
Zurich	1735	0.2640	0.4409	0	1
Berne	1735	0.1078	0.3102	0	1
Lucerne	1735	0.0357	0.1857	0	1
Uri	1735	0.0029	0.0536	0	1
Schwyz	1735	0.0127	0.1119	0	1
Obwalden	1735	0.0052	0.0719	0	1
Nidwalden	1735	0.0023	0.0480	0	1
Glarus	1735	0.0012	0.0339	0	1
Zug	1735	0.0150	0.1215	0	1
Fribourg	1735	0.0334	0.1798	0	1
Solothurn	1735	0.0161	0.1260	0	1
Basel Stadt	1735	0.0484	0.2147	0	1
Basel Landschaft	1735	0.0300	0.1706	0	1
Schaffhausen	1735	0.0052	0.0719	0	1
Appenzell Ausserrhoden	1735	0.0029	0.0536	0	1
St. Gall	1735	0.0259	0.1590	0	1
Graubünden	1735	0.0144	0.1192	0	1
Aargau	1735	0.0507	0.2195	0	1
Thurgau	1735	0.0110	0.1041	0	1
Ticino	1735	0.0311	0.1737	0	1
Vaud	1735	0.1170	0.3215	0	1
Valais	1735	0.0259	0.1590	0	1
Neuchâtel	1735	0.0225	0.1483	0	1
Genêve	1735	0.0749	0.2634	0	1
Jura	1735	0.0086	0.0926	0	1
unknown	1735	0.0334	0.1798	0	1

Table 10: Summary Statistics 2002 (four years after graduation) for variables used in regression models (N: only valid cases in annual or hourly wage regressions 2002)

B. Definition of variables

This section contains additional information about variables that are marked (*) in table 9 or 10. Information that has already been given in the text of the article will not be repeated.

- *grade variables*

As reported in section 3 of the text, grade variables were computed from the variables "reported grade", g_i, and "reported grade scale", $g_{\max}$ and $g_{\min}$. In principle, the scale variables have been edited considering the valid scales that were indicated for the same strata, i.e. the same university, same subject and same diploma. Editing was applied according to the following rules:

- Obvious confusion between the minimum and the maximum grade was corrected. "Obvious" means that the indicated grade lay within the sufficient range of the (corrected) scale and this scale existed in the respective strata.
- Minimal grades were corrected if they had been misinterpreted as minimal *sufficient* grade or as *own* minimal grade during study.
- Missing minimal grades were imputed if "1" if the indicated maximum grade was 4, 5, 6, 8 or 10 and the indicated grade lay within the respective sufficient scale.
- If no scale at all had been indicated, we imputed a scale only if there existed only one valid scale in this strata. Due to students that graduated according to old study regimes with other scales, there exist numerous strata with more than one valid scale. We deemed it too risky to impute scales in these cases.

For the different specifications of the grade variables, see section 3.

- *number of children*

This variable is directly relevant for wage regressions in Switzerland as parents receive federal subsidies as a wage component.

- *wage variables*

Wages of the year 99 have first been transformed to make them directly comparable with the 2002 wages. From the well-known Fisher-Formula, we get the formula for the wage inflation rate between 1999 and 2002:

$$(1+R_i)=\frac{(1+R_n)}{(1+R_r)}$$

Where R_i is the wage inflation rate, R_n is the nominal wage growth rate and R_r is the real wage growth rate. Using the nominal and real wage indices (wi) of the Swiss Federal Statistical Office (see Die Volkswirtschaft 11/2003: 99), we get the factor to "inflationate" the 1999 wages:

$$\frac{wi_{nom}02}{wi_{nom}99}\times\frac{wi_{real}99}{wi_{real}02}=\frac{2047}{1938}\times\frac{280}{287}=1.03048$$

The 1999 wages have been multiplied by this factor and are, thus, measured in CHF with the base year 2002.

Outliers have then been deleted according to the following rules:
Annual Wage 1999: valid if wage higher than 36'000 CHF (higher than 18'000 for internships) and smaller than 160'000 CHF.
Hourly Wage 1999: valid if wage higher than 13 CHF/h (higher than 9 for internships) and smaller than 90 CHF/h and if the reported working hours per year are higher than half the formal working hours reported and smaller or equal than 80 hours per week.
Annual Wage 2002: valid if wage higher than 36'000 (higher than 18'000 for internships) and smaller than 200'000.
Hourly Wage 2002: valid if wage higher than 13 CHF/h (higher than 9 for internships) and smaller than 110 CHF/h and if the reported working hours per year are higher than half the formal working hours reported and smaller or

equal than 80 hours per week.

The different rules for annual and hourly wages lead to different valid N, as reported in the tables in the text.
After these transformations, log wage variables were computed for regression analyses.

- *Potential Experience*

This variable was computed as follows:
Experience = Date of respective survey – date of graduation – months until first job

- *Internship, University assistant, External Doctorand, Medical Assistant*

The categories “University assistant” and “external doctorand” have been combined in the questionnaire for 2002, which should not cause major problems. More problematic is the introduction of the last category, “medical assistant” in the 2002 questionnaire. It is unclear whether it should be included in the 2002 regressions or not. As a large number of medical graduates indicated a internship position in 1999, we decided to include the medical assistant dummy. Due to this, the interpretation of the subject dummy “Medicine, Pharmacy” might not be comparable between the 1999 and 2002 regressions.

- *Public Service, Association/Organisation, Other institution*

These dummies were designed to capture jobs that are not situated in the private economy. The last dummy has been added only in the 2002 questionnaire, so the significance of the “other institution” changes between both surveys.

- *Private firm, no. of employees*

These dummies have directly been asked as categories in the respective questionnaires. The change in the number of employees defining the dummies originates in a change of the item between the questionnaires 99 and 02.

- *Region of residence, Region of work*

For 1999, we include the region of residence as a proxy for the region of work. For 2002, the actual region of work has been asked.

C. Overview of results for separate regressions for females and males

OLS	Female				Male			
	1999		2002		1999		2002	
wage	annual	hourly	annual	hourly	annual	hourly	annual	hourly
grade					+		+	+
grade standardized 1	+	(+)			+	(+)	+	+
grade X (Arts & Humanities, Social Sciences)								
grade X (Business, Economics)							+	+
grade X Law	+	(+)		(-)	+	+		
grade X Science								
grade X (Medicine, Pharmacy)			(+)					
grade X Technical Sciences							+	+
grade X Other Subjects	+							

Table 11: Coefficient signs for wage regressions run separately for females and males; signs are reported if significant on the 5 percent level, in brackets if significant on the 10 percent level