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Earnings of University Dropouts Across Europe

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Earnings of University Dropouts across Europe*

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Abstract

This paper investigates relative earnings of individuals leaving tertiary education without a degree across 18 European countries employing survey data on adult workers. We find that, on average, university dropouts earn 8% more than those never enrolling into tertiary education, but 25% less than university graduates. Moreover, university dropouts do not appear to have better employment chances than other upper secondary graduates while they have a significantly lower employment probability than those graduating from tertiary education. We document substantial heterogeneity across countries concerning whether university attendance without completion is rewarded in the labour market. We find some suggestive evidence that university dropouts are less penalised in terms of earnings in countries with a lower share of tertiary graduates and with more flexible labour market policies.

JEL-classification: I23, I26, J31

Keywords: university dropout, returns to higher education, international comparisons

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1 Introduction

Many students in tertiary education leave university without acquiring a degree. Morevoer, due to the expansion in higher education, the number of individuals leaving university without a degree is increasing over time in most countries. Reducing university dropout rates is a policy target in many countries in order to increase the efficiency of public investment in higher education. For instance, several EU governments consider a reduction in dropout rates to be necessary for meeting the Europe 2020 target of achieving at least 40% tertiary graduates among individuals aged 30 to 34 (Vossensteyn et al., 2015). However, there is relatively little research on how university dropouts fare in the labour market. If there are substantial returns to university attendance without completing a degree, public investment in higher education may be efficient independent of degree completion and university dropout may be an optimal outcome for many individuals.

This paper provides a first overview on the relative earnings of tertiary education non-completers across European countries. Previous studies analysing whether and to what extent higher education non-completion is rewarded in the labour market mainly focused on the US. While some studies find high returns to university attendance independently of completion (Kane and Rouse, 1995), others show results consistent with the idea that credentials are an important labour market signal (Jaeger and Page, 1996). Ost et al. (2018) exploit college dismissal policies with a regression discontinuity design and find that there is a substantial payoff of college persistence for low-performing students. However, there is still little evidence on whether enrolling in higher education is also a valuable investment for individuals who do not complete their studies, i.e. for the comparison between university dropouts and those never enrolling. Moreover, few papers have investigated the labour market outcomes of university dropouts outside the United States. The outcomes of dropout from higher education might be different in European countries because of differences in the education system and in labour market institutions.

In this paper, we compare the earnings of university dropouts to the earnings of both university graduates and individuals with an upper-secondary education qualification that never enrolled in university across 18 European countries employing data from the Programme for the International Assessment of Adult Competencies (PIAAC). We estimate hourly wage regressions for a sample of employed individuals aged 25 to 64 with at least upper secondary education and control for an extensive set of individual characteristics

including parental education. We then follow different empirical strategies to deal with omitted variable and selection biases. In particular, we are able to control for proxies for skills at the time of the interview and, for Germany, for detailed school background characteristics including the type and the final grade of the upper secondary qualification. While remaining biases could account for an important portion of within-country differences in earnings, it is unlikely that selection is a major driver of the cross-country differences in the earnings differentials. Moreover, in an explorative regression analysis we investigate country characteristics of the education system and labour market regulations that might explain observed differences.

We find that, on average, individuals dropping out from tertiary education earn 8% more than those never enrolling into higher education, but 25% less than tertiary graduates. When distinguishing between different types of higher education, individuals dropping out from academic programs do not earn significantly more than dropouts from vocational programs. Moreover, they earn circa 10% less than graduates from vocational programs and 30% less than graduates from academic universities. On average, tertiary dropouts do not appear to have better employment chances than other upper secondary graduates while they have a significantly lower employment probability than those graduating from higher education. However, there is substantial heterogeneity across countries. Tertiary education without graduation appears to be relatively more rewarded in Anglo-Saxon countries (Ireland and the UK) and in some Eastern European countries, such as Slovenia and the Slovak Republic. Conversely, in most Central and Northern European countries tertiary dropouts do not fare better than other upper secondary graduates in the labour market. Finally, we find some suggestive evidence that tertiary dropouts are less penalised in terms of earnings in countries with a lower share of tertiary graduates and with more flexible labour market policies.

This paper contributes to the literature on returns to different types of education and, in particular, to papers investigating returns to education non-completion. Our paper is very close to Schnepf (2017) who also employs PIAAC data and finds that university dropouts have a higher employment probability and are more likely to work in a professional position than other upper secondary graduates in most European countries. We extend her findings by analysing differences in earnings, which are arguably a very important dimension for both individual workers and public finances. By doing so, we

also contribute to the relatively scarce literature investigating wage payoffs of attending university without earning a degree at the country level (e.g. Carruthers and Sanford, 2018; Giani et al., 2020; Grubb, 1997; Jaeger and Page, 1996; Pfeiffer and Stichnoth, 2020; Turner, 2016; Zeidenberg et al., 2015).

This paper is also related to the literature on international comparisons of the returns to education and skills. Hanushek et al. (2015) show that there is a large variation in the returns to skills across OECD countries, highlighting labour market characteristics, such as employment protection rules and the degree of unionization, that may contribute to cross-country differences. Brunello and Comi (2004) study how experience profiles differ by educational attainment in 11 European countries, suggesting that the level of corporatism and the stratification in secondary education may contribute to cross-country differences in the earnings growth by education. Moreover, Trostel et al. (2002) estimate returns to years of education for 28 countries. We contribute to this literature by estimating wage payoffs of dropping out from higher education besides looking only at qualifications obtained.

The paper is structured as follows. Section 2 describes the empirical strategy and discusses potential threats to validity. Section 3 presents the PIAAC data and descriptive statistics by educational attainment. Section 4 provides the main results on relative earnings of tertiary dropouts, including heterogeneous analyses and robustness checks. Section 5 investigates whether specific characteristics of the education system and the labour market can explain differences in the relative wage payoffs of tertiary dropout across countries. Finally, section 6 concludes.

2 Empirical strategy

In order to compare how higher education non-completers fare in the labour market, we first estimate a modified Mincer equation on the sample of individuals with at least upper secondary education including dummies for different educational qualifications:

$$lny_i = \beta_0 + \gamma Sec_i + \delta Ter_i + \beta_1 A_i + \beta_2 A_i^2 + X_i\beta_3 + \epsilon \tag{1}$$

where y_i is the gross hourly wage of individual i. Sec_i is a binary variable indicating upper secondary education as the highest qualification achiedved with no tertiary educa-

tion experience, Ter_i is a binary variable indicating any type of tertiary degree obtained, and the reference category is tertiary education attendance without degree completion. A_i denotes the age in years, while X_i is a vector of individual level control variables including a gender dummy, an indicator of migration background, indicators for the highest qualification of the parents, an indicator for living with a partner, having children below age 6 and below age 16, as well as gender interactions with the partner and children variables. We compare the estimates across country by estimating separate regressions for each country using sampling weights. We also estimate a pooled equation with country fixed effects, where each country receives the same weight.

It is important to point out that the estimated coefficients of the three educational categories may be biased for different reasons. In particular, tertiary education non-completion may be the outcome of underachievement. If pre-university competencies and skills are negatively related to the probability of tertiary dropout and positively related to wages, the coefficient of tertiary education (compared to tertiary dropout) will be overestimated. On the contrary, measurement error in education categories, which may be particularly severe in the case of non-completion, is likely to bias the estimated coefficients downwards. Given the lack of evidence with respect to the labour market outcomes of tertiary dropouts, the main aim of the present study is to provide a descriptive overview of the earnings of tertiary dropouts across European countries. To the extent that the biases of the wage outcomes of tertiary dropouts are similar across countries, the cross-country comparisons should provide correct and valuable information about the relative remuneration of higher education experience without completion across countries. Nevertheless, we carry out several analyses and robustness checks in order to tackle the main sources of bias.

First, we include measures of numeracy and literacy skills gathered from a test taken at the time of the interview. On the one hand, these skill measures may proxy for innate ability and competencies acquired in school, so that it might reduce the omitted variable bias. On the other hand, these variables may also measure competencies that have been acquired on the job and be themselves outcomes of the acquired education. In this case including these variables in the estimation may lead to an underestimation of the returns to education. Reassuringly, the estimated coefficients are only marginally smaller when controlling for numeracy and literacy skills. Second, for Germany we can include more

precise information about the school curriculum. In particular, we include information about the school track, school final examination grades and a dummy for grade repetition. Finally, we address selection into employment through a Heckman selection model using whether an individual has an employed partner as an exclusion restriction. We show that tertiary graduates are more likely to be employed compared to tertiary dropouts and other upper secondary graduates. This could lead to a selection bias in the estimated wage differences. However, the results of the selection model turn out to be similar to the baseline estimates.

3 Data and descriptive statistics

3.1 Data

The analysis is based on data from the Programme for the International Assessment of Adult Competencies (PIAAC). The survey was conducted by the OECD in three rounds. During the first round in 2011 data was collected in 24 countries of which 15 are used in this study: Belgium (Flanders), Cyprus, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Poland, Slovak Republic, Spain and the UK (England and Northern Ireland). Out of the 9 countries participating in the second round in 2014, we include Greece, Lithuania and Slovenia. We are thus able to include 18 countries in the analysis. The main aim of the PIAAC survey is to assess the literacy, numeracy and problem solving competencies of adults aged 16 to 65 years across countries. A background questionnaire provides information about demographic characteristics, labour market status and earnings, experience, education as well as dropout from formal education. As the earnings data for Germany are only reported in deciles in the Public Use File, we obtained the Scientific Use File with continuous earnings data from the national data centre (GESIS).

The main variables in this study are three education statuses; upper secondary education, dropout from tertiary education, and completion of a tertiary degree, as well as gross hourly wages. Survey respondents are asked about qualification non-completion in the highest education level attained. We define dropout from tertiary education if an individual does not have a university degree and reports having dropped out of tertiary education. In line with the International Standard Classification of Education 1997

(ISCED-97), tertiary education refers to the ISCED-97 levels of 5B, 5A and 6. Upper secondary education refers to the ISCED-97 levels 3A, 3B and 4. We set the upper secondary education identifier equal to zero for tertiary dropouts, so that we end up with three education categories that are mutually exclusive. Concerning the gross hourly earnings, we employ purchasing power parity corrected hourly earnings excluding bonuses for wage and salary earners. Furthermore, we trim the bottom and top one percent of the wage distribution to correct for the likely misspecification of extreme values.

We restrict our sample to survey respondents that are 25 to 64 years old, have at least an upper secondary qualification and who are not in formal education at the time of the survey. Moreover, we exclude self-employed workers, individuals working less than 15 hours per week ans those with missing values in the variables included in the analysis. This leads to a sample size ranging from 600 in Greece to 1,900 in Germany and an overall sample size of 24,624 individuals. [1]

3.2 Descriptive statistics

Figure 1 shows the share of individuals aged 25 to 64 that have enrolled in tertiary education but never earned a tertiary degree for the countries included in our analysis. On average, 15% of individuals enroll into tertiary education without completing it. However, there are some large differences across countries. While the share of tertiary dropout is below 10% in Norway, Greece, Germany and France, it is higher than 30% in Italy and Slovenia. When distinguishing between academic and vocational programs, the dropout rates are on average higher in both types of tertiary education (see Figure A.1). While circa 16% of students in academic programs leave university without earning a degree, circa 19% do so in vocational programs. The overall dropout rate is lower, because about 25% of academic university dropouts earn a vocational tertiary degree.

Countries may not only differ with respect to the share of tertiary dropouts, but also as regards the share of individuals with a tertiary degree. In the pooled sample, 7% of individuals have attended tertiary education without completion while 52% have a

[1] There are circa 85,000 observations in the age range 25 to 64 for the countries included. Most of the reduction in sample size arises due to the fact that about 30,000 individuals do not have an upper secondary qualification, while circa 5,000 individuals are still in formal education. Moreover, about 17,000 individuals are either non-employed or self-employed. Further 4,000 observations are lost because of missing values and restrictions in the wage and working hours variables. Finally, circa 4,800 observations have missing values in the main control variables.

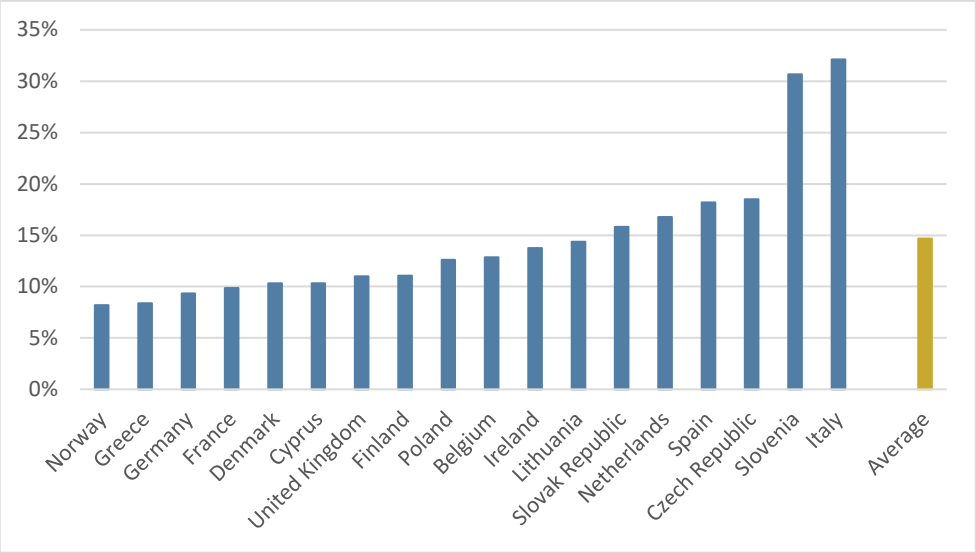

Figure 1: Share of tertiary education dropout by country

Note: Ratio of individuals leaving tertiary education without a degree over all individuals ever attending tertiary education. PIAAC data on individuals aged 25 to 64 in 18 European countries from the rounds in 2011 and 2014 before sample selection.

tertiary degree (see Table A.1).[2] There is considerable variation across countries in the share of individuals with upper secondary education that complete tertiary education, which spans from 33% in Italy to 82% in Denmark.

How do tertiary dropouts differ from tertiary graduates and individuals with upper secondary education that never enrolled into higher education? Table 1 reports the mean value of the main dependent and control variables by the three education groups for the pooled sample, as well as a t-test for differences in means. Tertiary dropouts earn on average slightly more than other upper secondary graduates, but substantially less than tertiary graduates. There are also important differences according to demographic characteristics and parental background. Tertiary dropouts tend to be younger than the other two groups, reflecting in part higher dropout rates for younger cohorts. Males are on average more likely to dropout from tertiary education: while the male share is 56% among dropouts, it is just 44% among tertiary graduates. The parents of tertiary dropouts earned on average higher qualifications than parents of other upper secondary graduates, but lower than parents of tertiary graduates. The three education groups also differ according to variables on partner and children status, possibly reflecting age differences. These variables are included in the estimation model together with gender interactions, because they may be important for wage outcomes, especially for women. Finally, the

[2]These shares are higher than those out of the total country populations, because the sample considered includes only individuals with at least upper secondary education.

three education groups also differ significantly as regards numeracy and literacy skills gathered at the time of the survey. Again, tertiary dropouts are in a middle position between tertiary graduates and other upper secondary graduates. We do not include these variables in the main estimation, since skills may in part be an outcome of tertiary education. However, we show in section 4.3 that the results are robust to adding numeracy and literacy skills as further control variables in the estimation.

Table 1: Summary statistics by educational qualification

	Tertiary Dropout	Upper secondary education	Tertiary education	Dropout vs. upper secondary		Dropout vs. Tertiary	
Dependent variables							
Hourly wages	14.88	13.95	21.07	0.94***	(4.28)	-6.19***	(-22.69)
Monthly wages	2477	2275	3449	202***	(5.32)	-972***	(-20.23)
Main control variables							
Male	0.56	0.49	0.44	0.07***	(5.06)	0.12***	(9.10)
Age	40.37	42.81	41.62	-2.44***	(-8.83)	-1.26***	(-4.62)
Partner	0.78	0.81	0.84	-0.03***	(-3.14)	-0.07***	(-6.61)
Migration background	0.12	0.1	0.11	0.02**	(2.48)	0.01	(1.13)
Children aged 0-5	0.26	0.2	0.26	0.06***	(5.62)	-0.00	(-0.27)
Children aged 6-15	0.39	0.38	0.42	0.01	(0.89)	-0.02*	(-1.70)
No children below 16	0.5	0.54	0.49	-0.04***	(-2.92)	0.01	(1.01)
Education mother: low	0.47	0.58	0.43	-0.11***	(-8.46)	0.04***	(3.29)
Education mother: medium	0.42	0.36	0.36	0.06***	(4.43)	0.05***	(4.07)
Education mother: high	0.11	0.06	0.21	0.06***	(8.27)	-0.10***	(-9.00)
Education father: low	0.37	0.48	0.33	-0.11***	(-8.27)	0.03***	(2.63)
Education father: medium	0.46	0.43	0.38	0.03*	(1.86)	0.08***	(5.87)
Education father: high	0.18	0.09	0.29	0.09***	(10.54)	-0.11***	(-9.19)
Further control variables							
Numeracy skills	287.99	271.37	299.19	16.62***	(14.35)	-11.20***	(-9.86)
Literacy skills	284.28	271.61	297.28	12.67***	(11.89)	-13.00***	(-12.59)
Actual work experience	18.13	21.25	18.48	-3.12***	(-10.73)	-0.35	(-1.25)
Observations	1559	8963	14102				

Note: The table displays mean values for the main dependent and control variables by educational qualification, as well as a t-test for differences in means. Source: PIAAC, sample of 24,624 individuals in 18 European countries from the rounds in 2011 and 2014. Monthly wages are only available for a sub-sample of 24,491 individuals.

4 Hourly wages of university dropouts across European countries

4.1 Baseline results

The main focus of the paper is the comparison of earnings between tertiary dropouts, tertiary graduates and upper secondary graduates without any higher education experi-

ence across European countries. Table 2 reports the results from estimating equation (1) by country and for the pooled sample, where equal weights are assigned to each country. The reference category are individuals who leave tertiary education without earning a degree. On average, individuals dropping out from tertiary education earn 8% more than those never enrolling into tertiary education. This could suggest that tertiary education is positively rewarded in the labour market even if no final degree is earned. However, tertiary dropouts earn significantly less than their peers who complete their studies. The point estimate is 0.22, corresponding to a difference of about 25%.

Table 2: Effect of educational qualifications on log hourly wages: baseline results

	All countries	Belgium	Cyprus	Czech Rep	Denmark	Finland	France	Germany	Greece	Ireland
Ref: Dropout from tertiary education										
Upper secondary education	-0.081***	0.011	-0.007	-0.047	-0.032	-0.081**	0.003	-0.017	-0.099	-0.153***
	(0.012)	(0.031)	(0.047)	(0.046)	(0.038)	(0.039)	(0.039)	(0.045)	(0.082)	(0.043)
Tertiary education	0.222***	0.241***	0.325***	0.175***	0.107***	0.188***	0.260***	0.346***	0.229***	0.201***
	(0.012)	(0.030)	(0.047)	(0.056)	(0.034)	(0.039)	(0.036)	(0.046)	(0.078)	(0.042)
Observations	24624	1540	1361	1025	1814	1844	1315	1900	600	1500
R^2	0.595	0.269	0.298	0.211	0.211	0.293	0.269	0.240	0.339	0.298

	Italy	Lithuania	Netherlands	Norway	Poland	Slovak Rep	Slovenia	Spain	UK
Ref: Dropout from tertiary education									
Upper secondary education	-0.060*	-0.101	-0.102***	0.022	-0.113*	-0.174***	-0.108***	-0.087	-0.135*
	(0.034)	(0.068)	(0.032)	(0.035)	(0.060)	(0.051)	(0.032)	(0.058)	(0.069)
Tertiary education	0.256***	0.308***	0.178***	0.193***	0.324***	0.140***	0.285***	0.155***	0.132**
	(0.039)	(0.067)	(0.032)	(0.033)	(0.058)	(0.053)	(0.032)	(0.059)	(0.063)
Observations	863	1587	1387	1540	1297	1229	1169	1036	1617
R^2	0.353	0.263	0.331	0.229	0.310	0.230	0.330	0.298	0.183

Note: The table shows the estimates of weighted OLS regressions. The dependent variable is the log hourly wage. Control variables included are age, age squared, gender, marital status, migration background, kids below the age of 6 and 16 and parental education. The kids and partner dummies are also interacted with a gender dummy. In the pooled regression country fixed effects are included and each country is given the same weight. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The table shows that there are substantial heterogeneities across countries. The difference in earnings between tertiary dropouts and other upper secondary graduates appears to be either equal to zero or very small and statistically insignificant in most central European countries as Germany, France and Belgium, as well as in most northern European countries, such as Norway and Denmark. On the contrary, the differences are larger than 10% and significant in Anglo-Saxon countries (Ireland and the UK) and in some Eastern European countries, like Slovenia, the Slovak Republic and Poland. The coefficients for Southern European countries are in a middle range (0.05-0.10), but only the one for Italy is statistically significant (at the 90% confidence level).

There are also important cross-country heterogeneities concerning the difference be-

tween tertiary graduates and dropouts. While in Denmark graduates earn circa 10% more than non-completers, for Cyprus, Germany and Poland this difference is larger than 35%. The earnings payoffs of completing tertiary education may be related in part to overall differences in returns to education. It is thus interesting to compare the relative position of tertiary dropouts with respect to the earnings gap between tertiary and upper secondary graduates. In Ireland, the Slovak Republic and the UK the wage differences between tertiary dropouts and the other two groups are similar. This could be an indicator that university education brings large payoffs in those countries independent of graduation. In section 5 we explore whether the relative earnings of tertiary dropouts can be partly explained by country-level differences in labour market characteristics. Moreover, in section 4.2 we explore heterogeneities by the type and duration of the acquired tertiary education. However, the wage differences between the three groups may be amplified by positive selection into higher education and in successful program completion. As far as selection issues are small and comparable across countries, a comparison between countries would still provide valuable results. In section 4.3 we show that the results are robust to including proxies for individual skills, school grades, and school quality.

4.2 Heterogeneities by program type and other characteristics

In the previous analysis we grouped all tertiary programs together without distinguishing between vocational and academic higher education or between programs with a different duration. If tertiary programs substantially differ across countries, cross-country comparisons of returns to higher education may be misleading. Concerning the program type, there are important differences across European countries with respect to the prevalence and quality of vocational tertiary education. While in the sample considered these programs account for the majority of tertiary degrees in Belgium and Denmark, vocational higher education appears to be almost entirely missing in Poland, the Slovak Republic and Italy (see Figure A.2 in the appendix).

Table 3 reports results for earnings of tertiary graduates and dropouts by vocational or academic programs. The reference category is now dropout from academic higher education.[3] Overall, the difference in earnings between individuals leaving an academic

[3]Also these five categories are mutually exclusive. Individuals dropping out from an academic university but holding a vocational tertiary degree are classified as vocational tertiary graduates. Individuals dropping out from both tertiary programs without earning a tertiary degree are classified as dropouts

Table 3: Effect of educational attainment on log hourly wages: Vocational vs. academic programs

	All countries	Belgium	Cyprus	Czech Rep	Denmark	Finland	France	Germany	Greece	Ireland
Reference: Dropout from academic university										
Upper secondary education	-0.092***	-0.019	-0.048	-0.013	-0.011	-0.079	0.024	-0.036	-0.166*	-0.242***
	(0.019)	(0.056)	(0.062)	(0.048)	(0.052)	(0.049)	(0.055)	(0.052)	(0.088)	(0.056)
Academic university degree	0.288***	0.290***	0.415***	0.221***	0.225***	0.274***	0.358***	0.414***	0.279***	0.234***
	(0.019)	(0.055)	(0.064)	(0.060)	(0.050)	(0.049)	(0.054)	(0.054)	(0.088)	(0.055)
Vocational tertiary degree	0.088***	0.167***	0.097	0.118	0.059	0.064	0.187***	0.206***	-0.029	-0.049
	(0.022)	(0.055)	(0.066)	(0.078)	(0.050)	(0.050)	(0.054)	(0.056)	(0.092)	(0.057)
Dropout from vocational tertiary	-0.025	-0.036	-0.065		0.043	0.042	0.043			-0.114
	(0.034)	(0.062)	(0.088)		(0.064)	(0.074)	(0.067)			(0.072)
Observations	24539	1540	1361	1012	1814	1844	1315	1882	591	1500
R^2	0.478	0.286	0.338	0.215	0.269	0.336	0.299	0.259	0.376	0.348

	Italy	Lithuania	Netherlands	Norway	Poland	Slovak Rep	Slovenia	Spain	UK
Reference: Dropout from academic university									
Upper secondary education	-0.061*	-0.123*	-0.109***	0.025	-0.113*	-0.174***	-0.145***	-0.125*	-0.146
	(0.034)	(0.074)	(0.036)	(0.039)	(0.060)	(0.051)	(0.055)	(0.065)	(0.093)
Academic university degree	0.251***	0.345***	0.191***	0.203***	0.324***	0.140***	0.325***	0.228***	0.173*
	(0.039)	(0.075)	(0.035)	(0.037)	(0.058)	(0.053)	(0.056)	(0.067)	(0.090)
Vocational tertiary degree		0.052	0.070	0.153***			0.180***	-0.101	0.010
		(0.091)	(0.044)	(0.044)			(0.056)	(0.070)	(0.092)
Dropout from vocational tertiary			-0.028				-0.042		-0.022
			(0.073)				(0.061)		(0.118)
Observations	857	1573	1387	1533	1297	1229	1169	1018	1617
R^2	0.349	0.280	0.338	0.230	0.310	0.230	0.345	0.357	0.201

Note: The table shows the estimates of weighted OLS regressions. The dependent variable is the log hourly wage. Control variables included are as in Table 2. In the pooled regression country fixed effects are included and each country is given the same weight. For Poland and the Slovak Republic there is no observation with a vocational tertiary degree in the sample. For Italy we observe only 6 individuals with such a degree and exclude them from the analysis. In the Czech Republic, Germany, Greece, Lithuania, Norway and Spain we observe less than 20 individuals leaving vocational higher education without a degree and exclude these from the analysis. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

university without a degree and other upper secondary graduates remains statistically significant and similar in size. The difference in earnings between graduates and dropouts from academic universities appears to be higher than the one for all tertiary programs. University graduates have earnings that are more than 30% larger than those enrolling but never graduating. Graduates from vocational programs earn also more than those dropping out from academic programs (about 10% in average), but there are large differences across countries. The earnings differential is particularly high in France, Germany and Slovenia, while it is negative but statistical insignificant in Ireland and Spain. Conversely, dropouts from vocational programs have earnings that lie in between those of dropouts from academic programs and other upper secondary graduates, but the differences are not statistically significant. Only for Ireland is the coefficient statistically significant. This may reflect large differences in returns between academic and vocational programs

from academic universities.

in the country but may also be partly due to selection and omitted variable biases that we cannot completely address in the present analysis.

Finally, we analyse heterogeneities with respect to gender, age and the type of job (see table A.2). The difference between wages of tertiary graduates and dropouts is larger for women. This partly reflects a larger wage difference between these groups in the case of part-time employment. Moreover, the relative reward of university dropout appears to be slightly larger among workers below the age of 45. This could be both due to cohort and experience effects, which we cannot disentangle given data restrictions. The private sector appears to reward tertiary education without completion more compared to the public sector. One possible explanation is that wages in the public sector often depend on formal qualifications obtained.

4.3 Including proxies for skills and further variables

In this section we test whether the baseline results for the pooled sample are robust to including job-related variables, as well as proxies for individual skills. We did not include the characteristics in the baseline model, since they are measured after education is completed and may be themselves outcomes of the different educational paths. Moreover, for Germany, we exploit richer data on education curricula to investigate whether the inclusion of the school track of secondary education, school final grades and grade repetition leads to different results. These are variables that may affect both the educational path and wages, but are unfortunately not available in the PIAAC data.

Columns (1)-(6) of table 4 report results on log hourly wages for the pooled sample. The sample size is slightly reduced, because we now drop almost 750 observations with missing values in the variables included. Column (1) reports the results for the estimation without the inclusion of any control variables, while column (2) reports the results for the baseline model with the inclusion of the main regressors. The estimates from the two columns are surprisingly very similar. Even if the included variables are important from a theoretical point of view, they affect the differences between the three educational groups only little. Moreover, the coefficients of the baseline results are not affected by the reduction in sample size. The estimates are also fairly robust when including the years of actual experience and experience squared (column 3). If anything, the point estimates increase slightly in absolute value, because individuals spending less time in education

Table 4: Effect of educational qualification on wages: including more controls

	Log hourly wages						Log monthly wages
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ref: Dropout from tertiary education							
Upper secondary education	-0.082***	-0.082***	-0.089***	-0.076***	-0.057***	-0.044***	-0.100***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.013)
Tertiary education	0.226***	0.219***	0.230***	0.202***	0.203***	0.101***	0.211***
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.011)	(0.013)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Main controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Actual work experience	No	No	Yes	No	No	No	No
Field of highest qualification	No	No	No	Yes	No	No	No
Numeracy and literacy skills	No	No	No	No	Yes	No	No
Broad industry and occupation	No	No	No	No	No	Yes	No
Observations	23884	23884	23884	23884	23884	23884	23884
Adjusted R^2	0.532	0.593	0.600	0.598	0.605	0.653	0.524

Note: The table shows the estimates of weighted OLS regressions where each country is given the same weight. The dependent variables are the log hourly wages and the log monthly wages. Main controls refer to the control variables included in the baseline estimates in Table 2. In column (3) also actual years of labour market experience and its squared term are included as regressors. Column (4) additionally includes the field of study of the highest qualification attained and column (5) includes numeracy and literacy scores as regressors. In column (6) 21 industry and 9 occupation dummies are included. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

have on average longer work experience at a given age. In column (4) we include the field of the highest completed qualification (9 different fields). This may be particularly important for the difference between tertiary dropouts and other upper secondary graduates, since it may reflect differences in school tracks that we cannot perfectly account for in the baseline model. However, the estimated wage payoff of higher education without completion is barely unchanged with the inclusion of educational fields.

Column (5) of table 4 presents estimates for regressions including numeracy and literacy scores measured at the time of the survey. Including these proxies for skills leads to point estimates that are circa two percentage points smaller than those of the baseline estimates. However, both coefficients are statistically different from zero and the results are barely affected from a qualitative point of view. This is reassuring, since it is not possible to disentangle the extent to which the different results are due to a selection bias or to skills acquired in higher education and through labour market experience. When including 21 industry and 9 occupation dummies the estimated differences drop by about a half but remain statistically significant (column 6). Individuals with different higher education experience are likely to work in different occupations because of their educational choices. Therefore, our preferred estimates are those of the baseline model. However, it is

interesting that we can observe significant differences among the three education groups even within broad occupations and industries. Finally, column (7) shows that the results are robust when looking at monthly instead of hourly wages. If anything, the wage difference between tertiary dropouts and other upper secondary graduates is slightly larger with monthly wages, because individuals who never enroll into higher education work on average fewer hours.

We then analyse whether the results for Germany are robust to including more precise information about the school curriculum and experience. First, we account for the highest school qualification corresponding to different school tracks.[4] When including this variable the difference in wages between tertiary dropouts and tertiary graduates is not much affected, suggesting that the failure to account for school tracking is not a huge problem for this margin (see table A.3 , column 2). Instead, the coefficient for the difference between tertiary dropouts and upper secondary graduates that never enroll in higher education becomes positive and relatively large (0.075), but not statistically different from zero. This is an indication that accounting for the school track is potentially very important when comparing the earnings of these two groups. Second, we employ data from the National Educational Panel Study (NEPS, SC6) to control for school final grades and grade repetition.[5] The school final examination grade is considered to be especially important in the German context, since it is the main variable considered for university admission in case restrictions are in place. However, the estimated coefficients do not change much when including the grade of the school final exam, as well as an interaction with the highest school qualification, and a dummy variable denoting whether an individual has repeated one grade in school (see table A.3, columns 3 and 4).[6] This is an indication that the failure to account for school grades is not leading to a large omitted variable bias in the present analysis, at least in the case of Germany.

[4]We have access to this information only for Germany, through the scientific use file provided by the national data centre (GESIS).

[5]This is a survey on German adults carried out since 2009, which is comparable to PIAAC but includes more detailed information about the educational paths. We employ data for the years 2010 to 2014 and follow the same sample restrictions as with the PIAAC data.

[6]Note that when estimating the same model with the two datasets, the coefficient for tertiary education turns out to be circa 6 percentage points larger using the NEPS data compared to the PIAAC results. This is mainly due to a lower share of upper secondary graduates earning low wages in the NEPS data, which is not accouted for by sampling weights.

4.4 Accounting for differences in employment

Tertiary education may not only positively affect labour market earnings, but also the probability to be employed. In this section, we first analyse differences in the employment likelihood across the three educational statuses and then assess whether the estimated wage differences are robust to accounting for selection into employment. Table 5 reports results from estimating a linear probability model with employment as a dependent variable on the extended sample including the non-employed. We use the same explanatory variables as in equation 1. The results of the pooled model on all countries show that the tertiary educated are circa 9 percentage points more likely to be employed than those leaving higher education without a degree. This difference is larger than 13 percentage points for Poland, Denmark and Germany. Conversely, it is smaller than 5 percentage points and not statistically significant for Italy, Greece and Belgium. Moreover, the table shows that the employment differences between tertiary dropouts and upper secondary graduates are small and not statistically different from zero for most countries. Lithuania and especially Italy provide an exception. In these countries, higher education non-completers face a significantly higher probability of being employed than other upper secondary graduates.

Table 5: Effect of educational qualifications on employment

	All countries	Belgium	Cyprus	Czech Rep	Denmark	Finland	France	Germany	Greece	Ireland
Ref: Dropout from tertiary education										
Upper secondary education	-0.016	-0.024	0.047	0.058	0.056	-0.027	0.024	0.054	-0.098	-0.056
	(0.010)	(0.030)	(0.056)	(0.048)	(0.049)	(0.042)	(0.042)	(0.043)	(0.064)	(0.042)
Tertiary education	0.086***	0.045	0.114**	0.095*	0.143***	0.060	0.094**	0.136***	0.045	0.109***
	(0.010)	(0.028)	(0.055)	(0.050)	(0.044)	(0.041)	(0.038)	(0.043)	(0.065)	(0.040)
Observations	36591	2016	2048	1741	2407	2444	1737	2641	1533	2525
R^2	0.134	0.183	0.102	0.261	0.082	0.128	0.107	0.131	0.160	0.121

	Italy	Lithuania	Netherlands	Norway	Poland	Slovak Rep	Slovenia	Spain	UK
Ref: Dropout from tertiary education									
Upper secondary education	-0.134***	-0.085*	0.023	-0.014	0.000	0.040	0.006	-0.010	0.009
	(0.038)	(0.050)	(0.035)	(0.046)	(0.048)	(0.044)	(0.028)	(0.047)	(0.052)
Tertiary education	-0.020	0.089*	0.063*	0.093**	0.189***	0.097**	0.095***	0.074*	0.052
	(0.040)	(0.049)	(0.034)	(0.043)	(0.046)	(0.044)	(0.027)	(0.043)	(0.045)
Observations	1286	2576	1848	1839	2164	1878	1865	1671	2372
R^2	0.065	0.123	0.103	0.068	0.209	0.200	0.227	0.062	0.131

Note: The table shows the estimates of linear probability models with sample weights. The dependent variable is a an employment indicator that is equal to one if an individual reports to be employed. The sample includes the non-employed, individuals with missing or extreme values for wages, as well as those working less than 15 hours per week. Control variables included are as in Table 2. In the pooled regression country fixed effects are included and each country is given the same weight. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The employment results have shown that in most countries tertiary graduates face a higher probability of employment than the other two groups. This could lead to an underestimation of the wage payoffs of a higher education degree. We attempt to address this potential bias by estimating a Heckman selection model using an indicator on whether the partner is employed to identify the participation equation. In general, the results turn out to be very similar when accounting for selection into employment with few exceptions (see table A.4). The difference between tertiary dropouts and other secondary graduates becomes larger and statistically significant for Lithuania and Poland, but smaller and not significant for the UK. The difference between tertiary dropouts and tertiary graduates becomes larger especially for Greece, while it decreases for Poland.

5 What explains cross-country differences in earnings?

We have shown that there are significant differences across European countries in how individuals leaving tertiary education without a degree fare in the labour market. In this section, we aim to explore whether there are country characteristics related to the education system and labour market regulations that are systematically related to the observed wage differences across education groups. Similarly to Schnepf (2017), we first investigate whether the share of tertiary graduates and the proportion of vocationally educated upper secondary graduates can explain part of the observed differences in the relative outcomes of tertiary dropouts. Conditional on labour demand, a larger supply of tertiary educated in the labour market may reduce not only the returns to higher education, but also the returns to attending higher education without completion. The proportion of upper secondary graduates that have a vocational (vs. general) degree may be positively or negatively related to the relative wages of tertiary dropouts who typically earn a general upper secondary degree. On the one hand, a higher share of vocational secondary education may be related to better outcomes of tertiary dropouts because of the failure to account properly for the type of secondary education degree. On the other hand, if the quality of vocational education is high, tertiary dropouts with a general upper secondary degree may face a higher competition in the labour market from peers that already acquired job-related skills during secondary education.

We then analyse the role of three different features of the labour market. First, tertiary dropouts may be more penalised in labour markets with a high degree of occupational regulation where formal degrees may be needed to enter an occupation. Second, a low level of labour market flexibility and a high level of employment protection legislation may increase the costs for employers of hiring workers leaving tertiary education without a degree, because of the larger uncertainty related to the skills acquired in higher education. Third, a higher degree of unionization may be associated to smaller wage differences across our three groups given that trade unions' policies tend to reduce wage dispersion (Freeman, 1980).

Our empirical estimation builds on the baseline wage model pooled across countries including the main individual-level regressors and country fixed effects. Following Hanushek et al. (2015), we then include interaction terms between the individual educational attainment dummies and different country characteristics C_n:

$$lnY_{in} = \mu_n + \gamma_1 Sec_{in} + \gamma_2(Sec_{in}C_n) + \delta_1 Tert_{in} + \delta_2(Tert_{in}C_n) + \beta X_{in} + \epsilon_{in} \qquad (2)$$

As in the previous estimations, we include the dummy for an upper secondary degree and no enrollment into higher education Sec_{in} and the dummy for a higher education degree $Tert_{in}$, having tertiary dropout as the reference group. The coefficients γ_2 and δ_2 show the extent to which the wage differences between tertiary dropout and the other two groups vary with the country-level proxies C_n. All country characteristics C_n are de-meaned and standard errors are clustered by country.

We gather proxies of the country-level characteristics from different sources. All variables refer to 2011 if not noted otherwise. The tertiary education share is taken directly from the PIAAC data using sample weights. The proportion of vocational upper secondary degrees refers to the share of individuals with vocational education among the 25-64 year-olds whose highest level of education is upper secondary or post-secondary non-tertiary education and is derived from OECD (2013).[7] The degree of occupational regulation is proxied by the proportion of workers with a professional certification to practice their occupation in 2015 and is gathered from the EU Survey of Regulated Occupations (Koumenta and Pagliero, 2017). Employment protection legislation refers to the OECD indicator of employment protection against individual and collective dismissals for

[7]For the UK the variable refers to 2014 and is derived from OECD (2015)

employees on regular contracts (see Venn, 2009). Union density measures the share of wage and salary workers who are members of a trade union.[8] We conduct the analysis on a sub-sample of 13 countries taking part in the first PIAAC survey round and with no missing value in the relevant variables. In particular, we do not observe the index of occupational certification for Norway, as well as the employment protection indicator and union coverage for Cyprus.

Table 6 shows that the correlations between country characteristics and wage differences are mostly consistent with our hypotheses, even though most estimated coefficients turn out not to be statistically significant. While the analysis focuses on a sub-sample of 13 countries, the coefficients for the differences between the three educational attainment groups are comparable to the baseline results on 18 countries. Column (1) shows that countries with a higher share of tertiary educated tend to have a smaller wage difference between the educational groups. While both estimated coefficients are not statistically different from zero in the simple model, the interaction between the share of tertiary education and the upper secondary dummy becomes statistically significant when entering all five characteristics in column (6). This suggests that the earnings differential between individuals leaving tertiary education without a degree and other upper secondary graduates is smaller in countries with more tertiary educated individuals. Both coefficients of the interactions with the proportion of upper secondary graduates with a vocational degree are not statistically different from zero and rather small. This is in line with our hypothesis of an ambiguous effect of this variable on the wage differentials.

As regards labour market policies, we cannot find any significant correlation between the share of workers with an occupational certification and the relative earnings of tertiary dropouts. Conversely, both interactions with the indicator of employment protection are statistically significant in column (4). In countries with stricter rules to protect regular employment against individual and collective dismissals, individuals attending tertiary education without earning a degree appear to be more penalised in the labour market. In particular, they tend to have a smaller earnings premium compared to other upper secondary graduates and a larger earnings gap compared to their peers that successfully completed their studies. Finally, the sign of the interaction coefficients for union density go in the expected direction with wages that tend to be more compressed in countries

[8]Union density data is provided by the OECD. It refers to 2009 for the Czech Republic and to 2010 for Denmark, Poland and Spain.

Table 6: Correlation between country-level characteristics and wage differences by educational attainment

	(1)	(2)	(3)	(4)	(5)	(6)
Upper secondary education	-0.083***	-0.085***	-0.084***	-0.093***	-0.083***	-0.087***
	(0.015)	(0.015)	(0.015)	(0.012)	(0.014)	(0.010)
* Share tertiary	0.134					0.433**
	(0.181)					(0.185)
* Vocational secondary		-0.018				-0.058
		(0.063)				(0.048)
* Occupational certification			-0.190			-0.343
			(0.290)			(0.338)
* Employment protection				0.076**		0.137***
				(0.026)		(0.025)
* Union density					0.099	-0.013
					(0.104)	(0.107)
Tertiary education	0.209***	0.207***	0.206***	0.202***	0.206***	0.203***
	(0.018)	(0.019)	(0.018)	(0.017)	(0.017)	(0.016)
* Share tertiary	-0.159					0.023
	(0.184)					(0.224)
* Vocational secondary		-0.017				-0.041
		(0.077)				(0.098)
* Occupational certification			0.254			0.148
			(0.268)			(0.328)
* Employment protection				0.055*		0.064
				(0.027)		(0.041)
* Union density					-0.089	-0.056
					(0.089)	(0.127)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Main controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	18367	18367	18367	18367	18367	18367
R^2	0.555	0.555	0.556	0.555	0.556	0.557

Note: The table shows the estimates of weighted OLS regressions where each country is given the same weight. The dependent variable is the log hourly wage. Control variables included are as in Table 2. Robust standard errors clustered by country in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

with higher unionization. However, both estimates are not statistically significant, so that we cannot establish a clear pattern for this variable.

All in all, we could establish few systematic relationships between country differences in the education system and labour market policies and the relative wage payoffs of tertiary dropouts. In particular, the share of tertiary educated and labour market flexibility appear to explain existing cross-country differences. In countries with a higher share of higher education graduates and a stricter employment protection, tertiary dropouts do not earn much more than upper secondary graduates that never enrolled into higher education. However, we cannot rule out that these systematic relationships are due to

further characteristics not included in the analysis. Moreover, the analysis hinges on a relatively small set of countries, so that the failure to find other significant associations may be due to the small sample size.

6 Conclusion

Using survey data on employed individuals aged 25 to 64 for 18 European countries, we show that individuals dropping out from tertiary education earn 8% more than those never enrolling into higher education, but 25% less than tertiary graduates. When distinguishing between different types of higher education, individuals dropping out from academic programs do not earn significantly more than dropouts from vocational programs. Moreover, academic university dropouts earn circa 10% less than graduates from vocational programs and 30% less than graduates from academic universities. On average, tertiary dropouts do not appear to have better employment chances than other upper secondary graduates, while they have significantly lower employment chances than those graduating from higher education. The wage results hold for both men and women and for different age groups. Furthermore, the results change only little when controlling for further characteristics, such as numeracy and literacy skills at the time of the interview and more precise information about the qualifications gained in school.

The results on the pooled sample mask wide heterogeneity across countries. Tertiary education without graduation appears to be relatively more rewarded in Anglo-Saxon countries and in some Eastern European countries. Conversely, in most Central and Northern European countries tertiary dropouts do not fare better than other upper secondary graduates in the labour market. We then analyse whether country characteristics of the education system and labour market regulations are systematically related to these differences. University dropouts appear to be less penalised in terms of earnings in countries with a lower share of tertiary graduates and with more flexible labour market policies. We do not find any evidence for the countries of our analysis that the share of vocational school graduates and the the degree of occupational regulation is related to how university attendance without completion is rewarded in the labour market.

While this study provides a valuable comparison on how university dropouts fare in European labour markets, it has several limitations. University dropout may be the

outcome of underachievement or even of an individual choice following positive labour market opportunities. Since we cannot fully account for these issues in this study, our estimates may be subject to selection biases. Moreover, we do not have information about the duration of the studies and of the field of study for non-completers. Recent studies for the US have shown the existence of important heterogeneities in that respect (e.g. Jepsen et al., 2014; Stevens et al., 2019). Nevertheless, to the extent that estimation biases are similar across countries, our analysis should provide correct information about the relative wage outcomes of university attendance without completion across countries.

In this respect, the results provide relevant insights for education policy. While most European countries aim to reduce dropout in tertiary education, policies to tackle dropout are especially important in countries with high dropout rates and no or little labour market payoffs of attending university without completion. In such countries policymakers may also consider introducing further credentials, such as a formal certificate for the successful completion of the first year of studies.

References

Brunello, G. and Comi, S. (2004). Education and earnings growth: Evidence from 11 European countries. *Economics of Education Review*, 23(1):75–83.

Carruthers, C. K. and Sanford, T. (2018). Way station or launching pad? unpacking the returns to adult technical education. *Journal of Public Economics*, 165:146–159.

Freeman, R. B. (1980). Unionism and the dispersion of wages. *ILR Review*, 34(1):3–23.

Giani, M. S., Attewell, P., and Walling, D. (2020). The value of an incomplete degree: Heterogeneity in the labor market benefits of college non-completion. *The Journal of Higher Education*, 91(4):514–539.

Grubb, W. N. (1997). The returns to education in the sub-baccalaureate labor market, 1984–1990. *Economics of Education Review*, 16(3):231–245.

Hanushek, E. A., Schwerdt, G., Wiederhold, S., and Woessmann, L. (2015). Returns to skills around the world: Evidence from PIAAC. *European Economic Review*, 73:103–130.

Jaeger, D. A. and Page, M. E. (1996). Degrees matter: New evidence on sheepskin effects in the returns to education. *The Review of Economics and Statistics*, 78(4):733–740.

Jepsen, C., Troske, K., and Coomes, P. (2014). The labor-market returns to community college degrees, diplomas, and certificates. *Journal of Labor Economics*, 32(1):95–121.

Kane, T. J. and Rouse, C. E. (1995). Labor-market returns to two- and four-year college. *The American Economic Review*, 85(3):600–614.

Koumenta, M. and Pagliero, M. (2017). Measuring prevalence and labour market impacts of occupational regulation in the EU. *European Commission*, pages 6854283–08.

OECD (2013). Education at a glance 2013: OECD indicators. Paris: OECD.

OECD (2015). Education at a glance 2015: OECD indicators. Paris: OECD.

Ost, B., Pan, W., and Webber, D. (2018). The returns to college persistence for marginal students: Regression discontinuity evidence from university dismissal policies. *Journal of Labor Economics*, 36(3):779–805.

Pfeiffer, F. and Stichnoth, H. (2020). Fiscal and individual rates of return to university education with and without graduation. *Applied Economics Letters*. forthcoming.

Schnepf, S. V. (2017). How do tertiary dropouts fare in the labour market? A comparison between EU countries. *Higher Education Quarterly*, 71(1):75–96.

Stevens, A. H., Kurlaender, M., and Grosz, M. (2019). Career technical education and labor market outcomes evidence from California community colleges. *Journal of Human Resources*, 54(4):986–1036.

Trostel, P., Walker, I., and Woolley, P. (2002). Estimates of the economic return to schooling for 28 countries. *Labour Economics*, 9(1):1 – 16.

Turner, L. J. (2016). The returns to higher education for marginal students: Evidence from Colorado welfare recipients. *Economics of Education Review*, 51:169–184.

Venn, D. (2009). Legislation, collective bargaining and enforcement: Updating the OECD employment protection indicators. OECD Social, Employment and Migration Working Papers, No. 89, OECD Publishing, Paris.

Vossensteyn, H., Kottmann, A., Jongbloed, B., Kaiser, F., Cremonini, L., Stensaker, B., and Wollscheid, S. (2015). Dropout and completion in higher education in Europe: Main report. Luxembourg: European Commission.

Zeidenberg, M., Scott, M., and Belfield, C. (2015). What about the non-completers? the labor market returns to progress in community college. *Economics of Education Review*, 49:142–156.

A Additional tables and figures

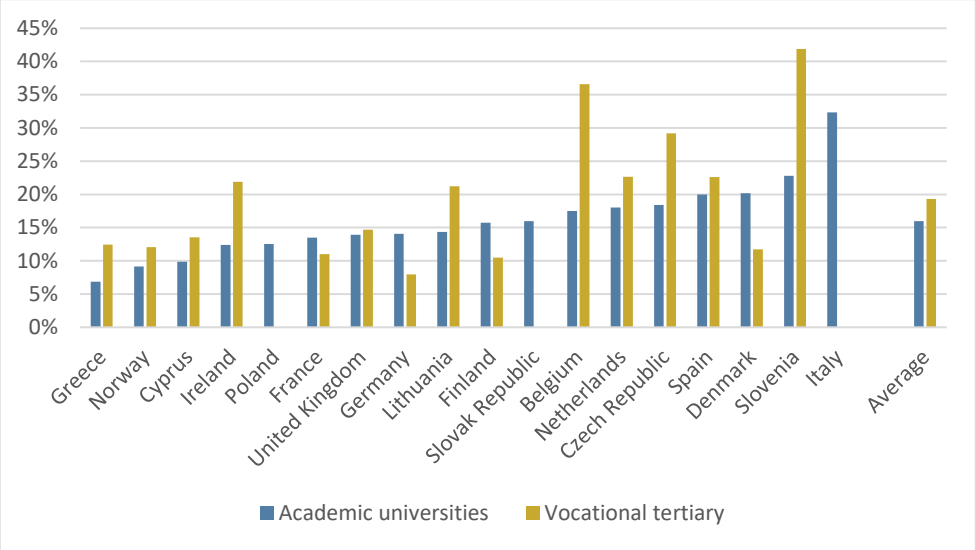

Figure A.1: Share of tertiary education dropout by program type and country

Note: Share of individuals leaving tertiary education without a degree among all individuals ever attending tertiary education by academic and vocational programs. PIAAC data on individuals aged 25 to 64 in 18 European countries from the rounds in 2011 and 2014 before sample selection.

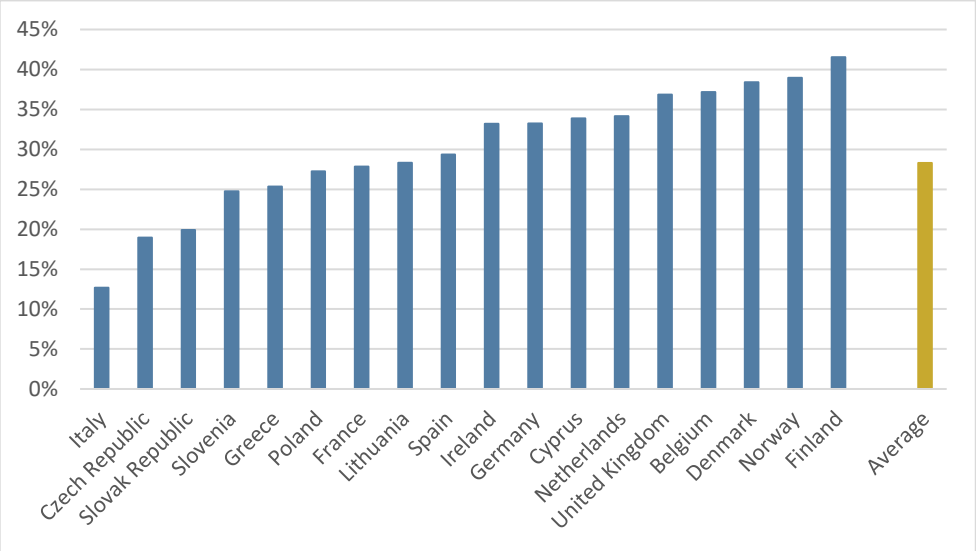

Figure A.2: Share of vocational graduates among all tertiary graduates by country

Note: Share of individuals with a vocational tertiary degree (ISCED-97 5B level) among all individuals with a tertiary degree. PIAAC data on individuals aged 25 to 64 in 18 European countries from the rounds in 2011 and 2014 before sample selection.

Table A.1: Educational attainment by country

	Pooled	Belgium	Cyprus	Czech Rep	Denmark	Finland	France	Germany	Greece	Ireland
Tertiary dropout	0.07	0.08	0.05	0.09	0.04	0.05	0.06	0.04	0.04	0.07
Tertiary education	0.52	0.58	0.49	0.36	0.81	0.57	0.69	0.40	0.52	0.56
Upper secondary education	0.41	0.35	0.47	0.54	0.15	0.39	0.25	0.57	0.44	0.38
Observations	24624	1540	1361	1025	1814	1844	1315	1900	600	1500

	Italy	Lithuania	Netherlands	Norway	Poland	Slovak Rep	Slovenia	Spain	UK
Tertiary dropout	0.17	0.05	0.08	0.03	0.07	0.07	0.18	0.09	0.06
Tertiary education	0.33	0.37	0.53	0.69	0.54	0.37	0.50	0.65	0.73
Upper secondary education	0.50	0.58	0.38	0.27	0.39	0.57	0.32	0.25	0.21
Observations	863	1587	1387	1540	1297	1229	1169	1036	1617

Note: The table displays the shares of the three main education groups for the pooled sample and by country.

Table A.2: Educational attainment and log hourly wages: Heterogenous results by gender, age and sector

	Gender			Age		Sector	
	Men	Women	Women, full-time	25-44	45-64	Private	Public
Upper secondary education	-0.077***	-0.079***	-0.075***	-0.088***	-0.057***	-0.098***	-0.026
	(0.016)	(0.016)	(0.018)	(0.014)	(0.021)	(0.014)	(0.018)
Tertiary education	0.204***	0.248***	0.223***	0.198***	0.275***	0.199***	0.254***
	(0.016)	(0.016)	(0.018)	(0.014)	(0.021)	(0.015)	(0.018)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Main controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11405	13219	10724	14555	10069	14788	9815
R^2	0.563	0.618	0.646	0.593	0.608	0.592	0.632

Note: The table shows the estimates of weighted OLS regressions where each country is given the same weight. The dependent variable is the log hourly wage. Control variables included are as in Table 2. Full-time employment refers to individuals working at least 30 hours per week. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.3: Effect of educational qualification on wages in Germany: including more school background information

	PIAAC data		NEPS data	
	(1)	(2)	(3)	(4)
Upper secondary education	-0.017	0.075	0.072	0.068
	(0.045)	(0.046)	(0.054)	(0.054)
Academic university degree	0.346***	0.339***	0.278***	0.270***
	(0.046)	(0.045)	(0.052)	(0.052)
Main controls	Yes	Yes	Yes	Yes
School track	No	Yes	Yes	Yes
School grade	No	No	No	Yes
Observations	1900	1900	8392	8392
R-squared	0.240	0.290	0.287	0.288

Note: The table shows the estimates of weighted OLS regressions for Germany. The dependent variables is the log hourly wages. Columns (1) and (2) are based on the PIAAC SUF data for Germany. Columns (3) and (4) are based on the National Educational Panel Study (NEPS, SC6). Main controls refer to the control variables included in the baseline estimates in Table 2. In column (2) and (3) dummies for different school tracks are also included in the model. In column (4) the highest grade of the university entrance examination, as well as its interactions with the highest school qualification dummies, and a dummy denoting whether the individual ever repeated a grade in school are also entered as regressors. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4: Effect of educational qualifications on hourly wages: Heckman correction

	All countries	Belgium	Cyprus	Czech Rep	Denmark	Finland	France	Germany	Greece	Ireland
Ref: Dropout from tertiary education										
Upper secondary education	-0.086***	0.001	-0.052	-0.008	-0.024	-0.103***	-0.031	-0.012	0.015	-0.161***
	(0.011)	(0.028)	(0.053)	(0.049)	(0.035)	(0.039)	(0.039)	(0.051)	(0.091)	(0.045)
Tertiary education	0.208***	0.232***	0.269***	0.234***	0.106***	0.147***	0.223***	0.365***	0.333***	0.132***
	(0.011)	(0.027)	(0.052)	(0.054)	(0.033)	(0.039)	(0.037)	(0.052)	(0.087)	(0.046)
Observations	34210	1929	1874	1569	2338	2410	1671	2511	1373	2351

	Italy	Lithuania	Netherlands	Norway	Poland	Slovak Rep	Slovenia	Spain	UK
Ref: Dropout from tertiary education									
Upper secondary education	-0.031	-0.189**	-0.092***	-0.035	-0.221***	-0.152***	-0.113***	-0.088	-0.075
	(0.036)	(0.076)	(0.034)	(0.039)	(0.069)	(0.058)	(0.032)	(0.058)	(0.059)
Tertiary education	0.260***	0.360***	0.183***	0.130***	0.195***	0.188***	0.283***	0.136**	0.210***
	(0.040)	(0.078)	(0.035)	(0.037)	(0.066)	(0.061)	(0.032)	(0.059)	(0.055)
Observations	1183	2391	1742	1785	1963	1688	1633	1549	2250

Note: The table shows the estimates of two step Heckman selection model with sample weights using a variable denoting whether an individual has an employed partner as the excluded restriction in the selection equation. The dependent variable is the log hourly wage. Control variables included are as in Table 2. In the pooled regression country fixed effects are included and each country is given the same weight. Robust standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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