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IZA DP No. 18134

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ABSTRACT

Vocational Education, Earnings and Job Satisfaction in Europe

This paper examines the earnings and job satisfaction of Vocational Education and Training (VET) graduates in the European Union (EU) using two definitions of vocational education: a self-reported definition and a more specific definition that incorporates work-based learning. The incidence of third-level VET falls from 74% to 29% under the stricter definition. Across the EU, the returns to vocational and academic qualifications are comparable for upper secondary, post-secondary and tertiary qualifications. Earnings premia vary between countries, with VET generating higher returns in just under one-third of all EU-28 members. Additionally, third level VET graduates enjoy higher levels of job satisfaction.

JEL Classification: I21, I26, J24, J30, J31

Keywords: vocational education, earnings, job satisfaction, european countries, work-based learning, on-the-job training

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1. *Introduction & Literature*

The support of vocational education and training (VET) pathways is a key policy cornerstone of the European Union's (EU's) approach to enhancing and maintaining adequate skills supply. However, little is known about the labour market outcomes – employment, or otherwise – of those with vocational qualifications in Europe when compared to graduates with academic qualifications. There are a number of reasons for this. First, defining VET presents its own issues for measurement. VET is a broad concept and is instituted in a variety of ways across Europe. This variation leads to inconsistent measurement approaches between national studies when examining VET and its associated labour market outcomes. Furthermore, there remains a dearth of high-quality, internationally comparable data on vocational education and the labour market outcomes of those with VET qualifications in Europe. In this paper, we leverage data collected in the European Skills and Jobs Survey (ESJS) in 2014 to provide insight into the labour market outcomes of VET graduates in comparison to those with purely academic qualifications.

Broadly, VET can be understood as education or training qualifications where the primary goal is developing applicable skills for employment. This can be contrasted with academic qualifications, where more emphasis is placed on exploring and furthering knowledge of specific fields of study, and employment-oriented skills are secondary.[1] According to the 2021 wave of the ESJS, approximately 60% of employees in the EU reported that their highest educational qualification was vocational (Redmond, Brosnan and Kelly, 2025). However, VET qualifications are not homogenous; VET learning pathways vary substantially between member states. For example, many member states do not offer VET pathways until learners are at upper secondary (ISCED 3) level. However, the Netherlands offer VET programmes as early as lower secondary (ISCED[2] 2) level, while Ireland do not offer VET until after upper secondary level (CEDEFOP, 2023). In addition, the substance of VET programmes differ between member states. For example, as of June 2023, Spain mandates that all vocational programmes must contain some work-based learning, whereas Sweden offer both a school-based and apprenticeship format (CEDEFOP, 2023). While there are differences between VET programmes, they are distinct from academic pathways in that all VET programmes prioritise the acquisition of practical skills that are directly applicable to specific occupations.

[1] Of course, these are not mutually exclusive. Academic qualifications can provide students with applicable skills, and VET can facilitate students in exploring and furthering knowledge of academic disciplines. This intersection between qualifications further obfuscates the distinction between VET and academia.

[2] International Standard Classification of Education.

Despite its importance for both policy and research, a common measurement approach to identifying workers with VET qualifications remains absent from the empirical literature. Perhaps the closest measure is provided by the European Centre for the Development of Vocational Training (CEDEFOP), who use EU Labour Force Survey (EU-LFS) data to identify workers with vocational qualifications (CEDEFOP 2013, 2020). That said, this approach is limited in that it does not provide information on the content of workers' qualifications (beyond their own assessment of whether their qualifications are vocational or not). In this paper, we leverage European survey data and provide a commonly-applicable, flexible measurement to identifying these workers which accounts for course content. To do this, we draw on the definition of VET proposed by the United Nations Educational, Scientific and Cultural Organization (UNESCO), who state that TVET[3] "is understood as comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods", and that "TVET, as part of lifelong learning, can take place at secondary, post-secondary and tertiary levels and includes work-based learning and continuing training and professional development which may lead to qualifications" (UNESCO, 2015). Based on this definition, we understand that VET may be delivered in an educational setting, or via work-based learning. To account for both modes of delivery, this paper uses survey data from the first wave of the ESJS (2014) to measure VET in two ways. First, we identify those with vocational qualifications as those who defined that their highest educational qualification was vocational. We then restrict this definition to those who stated as such, but also reported that they undertook some work-based learning or training as part of their qualification. This imposes a common, tangible feature of vocational education on our definition, accounting for cross-country differences in vocational programmes.

We use these two definitions to examine the labour market outcomes of those with vocational qualifications relative to those with academic qualifications. More specifically, we aim to compare how labour market outcomes – specifically earnings and job satisfaction – differ between graduates of vocational programmes and graduates of academic programmes. Understanding the labour market outcomes of European vocational graduates is critical for informing skills and VET policy. For many prospective students, expected earnings and job quality post-graduation are key factors in determining the attractiveness of academic and vocational programmes. If it is the case that earnings and/or job satisfaction differ systematically and substantially between academic and vocational programmes, and

[3] TVET refers to Technical Vocational Education and Training, which is interchangeable with VET.

prospective students may substitute one programme type for another,[4] this may have implications for labour supply stemming from either qualification pathway across Europe.

1.1 VET and Employment

The consensus in the associated literature is that vocational education eases transitions from education into the labour market. However, transition benefits may be short-lived, and skills gained from vocational training are more likely to become obsolete over time (Hanushek et al., 2017). Nevertheless, vocational education plays a vital role in meeting labour market demands, especially for students who prefer a more practical, hands-on approach over traditional academic pathways. In Croatia, prolonging the years of general study at the expense of starting vocational studies were found to have negative impacts on educational attainment, particularly for male students (Zilic, 2018). Despite, vocational education due to the benefits mentioned typically being seen as a positive, there remains a perception that vocational education is 'easier' relative to general education even by those who undertook vocational studies themselves (Cedefop, 2017).

Others have found that while vocational education may be inherently beneficial for employment, it is more specifically the simultaneous use of on-the-job learning which can be particularly fruitful. Students gain relevant, ready-to-use skills which leads to an immediate increase in their employment prospects (Hanushek et al., 2017; Cedefop, 2013). Additionally, work-based learning may also provide access to jobs via professional networks or employers using them as a screening device for potential employees (Wolter and Ryan, 2011). A particularly insightful example comparing these aspects of vocational education comes from Neyt *et al*. (2020), who examine the labour market outcomes of those with vocational qualifications in Flanders, Belgium. In Flanders, students may undertake one of three secondary[5] educational pathways; 1) a 'traditional' academic qualification, 2) a predominantly school-based vocational qualification or 3) a predominantly work-based vocational qualification in a training centre. The authors compare the labour market outcomes of students across all three programmes. For students who undertook work-based vocational qualifications in training centres (i.e. Pathway 3 above), there are greater employment benefits – either by being employed at all or possessing a permanent employment contract – when transitioning to the labour market relative to those who undertook the traditional academic pathway (i.e. Pathway 1), but these are short lived. In contrast, school-based vocational learners (Pathway 2) see better educational attainment and no difference in terms of employment outcomes over

[4] This paper does not assess the extent to which vocational and academic qualifications are complements, substitutes or unrelated. However, it remains a reasonable possibility that students make choices between vocational and academic tracks in tertiary education and take expected earnings and/or job satisfaction post-graduation into account.

[5] This diversion in educational pathways occurs when students turn either 15 or 16 years of age.

the longer term relative to those in full-time academic education. Previous work by Verhaest and Baert (2015) came to similar conclusion for Flanders.

The potential decline of labour market benefits related to vocational education may occur because the job- or occupation-specific skills gained, though immediately useful, may become irrelevant or obsolete (Weber, 2014). This is likely to increasingly be the case given the ongoing rapid technological changes which are impacting the labour market. These context-specific skills are also very much dependent on skill demand at a particular point in time, compared to more general skills which can adapt to a changing labour market (Golsteyn and Stenberg, 2017). Additional general education also increases skills which are beneficial for future learning (Hanushek et al., 2017; Weber, 2014). For instance, lifelong learning or career development may improve employability over the long run, and those with more general education have been found to be more likely to invest in training after they complete their formal education (Brunello and Medio, 2001). These latter two factors are particularly important for long-term labour market outcomes. Rosenbaum (2001) reported that employers prefer candidates with adaptable, learning-oriented skills over those with a fixed set of specific skills, as many job-specific abilities can be developed while at work. However, it should be noted that vocational graduates tend to have longer job tenures than their peers with general education qualifications (Cedefop, 2013).

Other studies examine the outcomes of those with VET qualifications with regard to how well they are matched to their job post-qualification. In the skills mismatch literature, Mavromaras and McGuinness (2012) find that while overskilling is apparent in the Australian labour market amongst both those with vocational and academic qualifications, state dependence associated with overskilling is highest for those with academic qualifications. Therefore, while vocational education may not protect against overskilling, it does protect against the negative impacts associated with it, with vocationally qualified workers more likely to exit overskilling compared to those with academic qualifications (McGuinness et al., 2025a).

1.2 VET and Earnings

Several empirical studies conducted in specific countries examine the earnings returns to VET. In Australia, Ryan (2002) reports that those with VET qualifications exhibit a wage advantage of ten percent relative to those who completed school. However, the wages of VET-qualified workers were found to grow more slowly over the course of their career compared to academic graduates. McIntosh and Morris (2016) examine the issue using UK data, finding substantial variation in the returns to vocational qualifications across both qualification level and field of study, with some vocational qualifications found to earn returns

in excess of ten per cent *ceteris paribus*. Meer (2007) found that technical (vocational) track students in the USA were unlikely to have earned more had they chosen alternative educational pathways. In Finland, Sillman and Virtanen (2022) found that individuals who undertook a vocational secondary education earned a wage premium of seven percent by age 31, with no indication of the wage advantage diminishing over time. McGuinness et al. (2018) found no evidence of any wage advantage arising from Ireland's principal post-secondary vocational qualification.

Empirical studies that compare the economic returns to VET across countries in Europe are sparse. Lavrijsen and Nicaise (2017) use PIAAC[6] data to measure the returns to vocational education for persons who have obtained a secondary or post-secondary qualification (ISCED 3 or ISCED 4) as their highest level of schooling. Vocational education is measured based on the share of the qualification that is orientated towards a particular occupation. Lavrijsen and Nicaise (2017) find that the initial wage advantage to vocational, over general education, is small and depreciates over the life cycle. However, apart from estimates of the incidence of vocational education, the authors provide no assessment of the extent to which the economic returns vary by country.

1.3 Job Satisfaction

The literature examining determinants of job satisfaction is vast and multifaceted. Unlike earnings, job satisfaction is fundamentally subjective, presenting measurement issues when comparing self-reported outcomes between workers and countries. While it is possible to standardise and compare earnings across countries, it is plausible that some countries are systematically more or less likely to report higher (or lower) job satisfaction, even if their lived experience is comparable to those in other countries who report different values. A study by Kristensen and Johansson (2006) provides evidence of such intrinsic cross-national differences between European workers in responding to survey questions relating to job satisfaction. The authors analyse how respondents compare hypothetical jobs to their own, allowing them to account for country-specific patterns in reporting job satisfaction.. These fundamental differences can be difficult to account for in most studies, given that data relating to inherent differences in satisfaction is not collected regularly, presenting temporal issues when attempting to correct unweighted estimates.

Broadly, empirical studies examine the extent to which institutional, employment- and employee-specific factors influence job satisfaction among workers. Important factors examined in the literature include

[6] Programme for the International Assessment of Adult Competencies.

earnings, gender (Clark, 1997; Kaiser, 2007), intrinsic worker preferences (Bender, Donohue and Heywood, 2005; Redmond and McGuinness, 2020), job security/contract type (Blanchflower and Clark, 1999; Origo and Pagani, 2009; Artz and Kaya, 2014), occupational choice[7] (Bradley and Roberts, 2004; Millán et al., 2013), education level (Clark and Oswald, 1996; Meng, 1990; Idson, 1990) age (Clark et al., 1996), disability status (Pagan-Rodriguez, 2014) and institutional/macroeconomic factors (Pichler and Wallace, 2009). Compared to the literature on earnings returns to education, the volume of studies examining variation in job satisfaction by education level and type is comparatively smaller. Clark (1996) examines job satisfaction and education in Britain, finding a negative association between higher education levels and satisfaction. The author argues that those with higher education levels could exhibit higher expectations of earnings or job quality, imposing a stricter satisfaction constraint on employment and raising the probability of dissatisfaction.

Studies examining variation in job satisfaction outcomes among VET graduates and those with academic qualifications are largely non-existent. One exception to this is Vila and García-Mora (2007), who examine differences in varying types of job satisfaction (rather than overall satisfaction with work) across education levels and types among employees in Spain. Compared to those with academic upper-secondary education, employees whose highest level of education was vocational upper-secondary education were associated with lower levels of job satisfaction with regard to pay, the job itself (i.e. day-to-day activities), number of hours worked, the working schedule and working conditions. Nevertheless, the results of the study cannot be generalised to other European countries, given that it only examines vocational education among upper secondary school recipients in Spain.

This study shall contribute to the limited literature on the cross-country differences in the returns to vocational education in Europe. While ample country-specific studies exist, very few studies examine between-country differences. Furthermore, almost no studies examine differences in non-financial or non-employment outcomes of those who undergo vocational education in European countries.

2. Materials and Methods

The data for this study comes from the European Skills and Jobs Survey (ESJS) from 2014. We examine earnings and job satisfaction for full-time employees that have graduated from third-level tertiary education. Our aim is to distinguish between survey respondents who possess academic qualifications and those who possess vocational qualifications. We employ two definitions of vocational education. For our first definition, we draw on a question in the ESJS which asks respondents "*Overall, would you describe*

[7] Self-employed versus non-self-employed.

your highest qualification as a vocational qualification?" (Question 16B). Only respondents whose highest education level is upper secondary education (i.e. ISCED 3 or higher) were asked this question, thereby restricting our sample to approximately 33,000 respondents. Respondents who answered "*Yes*" to Question 16B are considered to have undertaken vocational education, while respondents who answered "*No*" were considered to have undertaken academic education. We do not include respondents who did not answer this question in our estimates. This measure shall be referred to as VET1 herein.

VET1 relies on respondents' subjective assessment of their own education in order to identify vocational education, meaning it is liable to measurement error. For example, it is possible that a respondent considers their education to be vocational, but the course content of their education is more in line with an academic programme, or *vice versa*. While we do not explicitly observe respondents' course content, we attempt to address this issue by employing a second, more specific definition of VET. In the ESJS, respondents are asked whether their studies took place solely in an educational setting, or whether their studies involved some learning in a workplace (Question 16). We consider respondents to have undertaken vocational education if they 1) indicated that their highest level of education was vocational (i.e. were vocationally-educated under VET1), and 2) indicated that their studies involved work-based learning. We refer to this measure as VET2 herein. Note that VET2 is a subset of VET1; VET2 respondents are VET1 respondents who indicate that their studies involved work-based learning. In the interest of maintaining a consistent comparison group (i.e. academic graduates), we exclude respondents who indicated that their studies were vocational, but that they did not involve work-based learning in our VET2 specifications.[8]

This is a nontrivial distinction from a measurement perspective. Table 1 displays the incidence of vocational qualifications by EU-28 country for each definition of VET.[9] Column 1 displays the incidence of $VET1$ among survey respondents. Column 2 displays the incidence of $VET2$. On average, 73 percent of respondents working full-time[10] in EU-28 countries classify their highest qualification as being vocational, with figures ranging from 90 percent in Austria to 50 percent in Bulgaria. However, the

[8] We acknowledge that it is also possible for respondents to inaccurately report that their studies involved (or did not involve) work-based learning, meaning VET2 is also liable to measurement error. However, given that work-based learning encompasses a tangible, lived experience, we believe it is less likely that respondents will incorrectly report that they have or have not experienced it, when compared to making a general judgement relating to the content of their education (i.e. defining it as vocational or not vocational).

[9] Since the ESJS was collected in 2014, the UK was an EU member state at the time, but has since left the EU. For brevity, we simply consider them an EU member state throughout the paper, given that they were during the data collection period.

[10] We exclude part-time workers from the sample due to the possibility that they may be engaged in education, while simultaneously working part-time. It is plausible that such workers will transition to other employment upon completion of their education, meaning their earnings and job satisfaction are transitory, but would be attributed to their ongoing education.

subgroup of respondents whose programmes included a work-based learning component is considerably smaller – 32 percent of respondents on average. The incidence of vocational qualifications containing a work-based component ranges from 64 per cent in Austria to just over 3 percent in Luxembourg.

Table 1: Incidence of VET and Work-Based Learning, Countries and EU-28

Country	VET1	VET2
Austria	90.1%	63.8%
Belgium	69.1%	30.9%
Bulgaria	50.8%	20.4%
Croatia	69.7%	29.7%
Cyprus	70.7%	23.6%
Czech Republic	73.6%	32.2%
Denmark	85.8%	43.4%
Estonia	79.3%	40.0%
Finland	73.9%	29.2%
France	68.5%	40.0%
Germany	79.9%	32.8%
Greece	71.3%	28.8%
Hungary	70.7%	28.8%
Ireland	61.9%	21.3%
Italy	62.3%	15.6%
Latvia	68.5%	26.7%
Lithuania	77.3%	41.2%
Luxembourg	78.3%	3.1%
Malta	69.5%	41.6%
Netherlands	72.7%	22.4%
Poland	70.7%	7.6%
Portugal	75.1%	28.9%
Romania	60.1%	28.8%
Slovakia	79.3%	35.4%
Slovenia	77.1%	34.3%
Spain	85.8%	38.7%
Sweden	65.1%	20.9%
United Kingdom	73.4%	26.6%
EU-28	**73.2%**	**32.3%**
N	**31,887**	**31,444**

Notes: The above sample consists of respondents who were asked whether their highest qualification was vocational, meaning that it is limited to those with qualifications of ISCED 3 or above. This explains the disparity between this table and some of the earnings model specifications, which include low-educated respondents as the reference group.

We report descriptive statistics by academic/VET1/VET2 qualifications in Table 2. In general, academic graduates tend to earn slightly higher wages than both VET1 and VET2 vocational graduates, though the magnitude of the differences are small. That said, both VET1 and VET2 respondents were more likely to be highly-satisfied with their job than academic graduates; approximately 21 percent of academic graduates were highly satisfied, compared to 27 percent of both VET1 and VET2 graduates. In addition, vocational graduates were more likely to have been in their current employment for longer periods, were slightly less likely to work in the private sector and were slightly less likely to be managers when

compared to academic graduates. Broadly speaking, the academic and vocational cohorts were similar across other characteristics.

Table 2: Descriptive Statistics by Educational Qualification Type

Variable	Academic	VET1	VET2	Total	Dif A
ln(Wages)	2.216 (0.886)	2.172 (0.864)	2.186 (0.845)	2.184 (0.870)	
Job Satisfaction	0.205 (0.403)	0.266 (0.442)	0.274 (0.446)	0.25 (0.433)	
Tenure (Years)	9.656 (8.696)	10.721 (9.241)	10.495 (9.217)	10.436 (9.111)	
Male	0.604 (0.489)	0.594 (0.491)	0.589 (0.492)	0.597 (0.491)	
Informal Contract	0.023 (0.150)	0.017 (0.130)	0.017 (0.128)	0.019 (0.135)	
Permanent Contract	0.852 (0.355)	0.860 (0.346)	0.853 (0.354)	0.858 (0.349)	
Multiple Places of Work	0.629 (0.483)	0.624 (0.484)	0.628 (0.483)	0.625 (0.484)	
Private Sector	0.682 (0.466)	0.628 (0.483)	0.614 (0.487)	0.642 (0.479)	
Company Size					
1-9	1,739 (20.3%)	4,395 (18.8%)	1,911 (18.8%)	6,134 (19.2%)	
10-49	2,308 (27.0%)	6,564 (28.1%)	2,932 (28.9%)	8,872 (27.8%)	
50-99	1,078 (12.6%)	3,041 (13.0%)	1,304 (12.9%)	4,119 (12.9%)	
100-249	1,139 (13.3%)	3,009 (12.9%)	1,229 (12.1%)	4,148 (13.0%)	
250-499	630 (7.4%)	1,934 (8.3%)	807 (8.0%)	2,564 (8.0%)	
500+	1,432 (16.8%)	3,843 (16.5%)	1,690 (16.7%)	5,275 (16.5%)	
Occupation					
Managers	844 (9.9%)	1,998 (8.6%)	730 (7.2%)	2,842 (8.9%)	
Professionals	1,521 (17.8%)	5,590 (24.0%)	2,226 (21.9%)	7,111 (22.3%)	
Technicians and associate professionals	1,424 (16.7%)	4,415 (18.9%)	2,003 (19.7%)	5,839 (18.3%)	
Service and market sales workers	1,138 (13.3%)	2,634 (11.3%)	1,304 (12.9%)	3,772 (11.8%)	
Clerical Support	2,147 (25.1%)	4,740 (20.3%)	1,808 (17.8%)	6,887 (21.6%)	
Skilled Agricultural, Forestry and Fishing	38 (0.4%)	156 (0.7%)	80 (0.8%)	194 (0.6%)	
Building, Crafts or a Related Trades	452 (5.3%)	1,833 (7.9%)	1,007 (9.9%)	2,285 (7.2%)	
Plant and machine operators and assemblers	586 (6.9%)	1,344 (5.8%)	724 (7.1%)	1,930 (6.1%)	
Elementary	346 (4.0%)	532 (2.3%)	229 (2.3%)	878 (2.8%)	
N	**8,547**	**23,340**	**10,146**	**31,887**	

Notes: *Difference tests for continuous and binary variables are linear regression tests. Difference tests for factor variab*
tests.

2.1 Identification Strategy

We formally model how VET impacts earnings and job satisfaction. As outlined earlier, the nature of vocational education is such that it may be instituted in a variety of different ways between European countries, meaning that it may not be appropriate to consider them comparable within the same pooled model.[11] For example, Germany's dual system combines classroom learning with structured apprenticeships, providing standardised, industry-recognised qualifications, whereas Italy's system is often more school-based with less formal workplace integration. These structural differences mean that pooling vocational education data across countries could obscure important distinctions in training quality, industry alignment, and career outcomes. In other words, there may be systematic differences in vocational programmes associated with international differences. Given that we do not observe the nature and magnitude of between-country differences in VET, we separate the models into individual country-level samples.

First, we examine earnings in the graduate labour market (ISCED levels 5 and 6). We restrict our sample to full-time employees. Our identification strategy aims to compare the earnings premia of respondents with different levels of vocational qualifications to those with academic qualifications, using individuals with lower levels of education as a reference group. We begin by estimating wage equations using OLS in the form of Equation 1, both pooled at the EU-28 level, and separated by individual country samples.

$$\ln(Wages)_{ij} = \beta_0 + \beta_1 Vocational_{ij} + \beta_2 X_{ij} + \epsilon_{ij} \quad (1)$$

$\ln(Wages)_{ij}$ represents the natural logarithm of the hourly wage of each employee i in country j. $Vocational_{ij}$ represents a set of dummy variables indicating highest qualification level distinguished by VET (of either definition) or academic. The reference category for the models is the group of respondents whose highest education level is below ISCED 3. Additionally, X_{ij} is a set of demographic control variables including gender, tenure (in years), occupation, previous labour market status[12], firm size[13] and contract

[11] Fundamentally, this is based on the assumption that compositional differences between vocational programmes 1) primarily manifest between countries and 2) are relatively small (or non-existent) within countries.

[12] This refers to the question "What was your main activity before you started working for your current employer?" (Q39). Dummy variables for respondents who were either previously unemployed or were not working for "Other reasons (e.g. childcare, family care, injury, disability)" are included in our model specifications.

[13] This variable is binned by the number of employees into the following four categories: 1) 1-9 Workers, 2) 10-49 Workers, 3) 50-99 Workers, 4) 100-249 Workers, 5) 250-499 Workers and 6) 500+ Workers.

type (temporary/permanent).[14] ϵ_{ij} is an IID error term capturing the unexplained elements of the wage equation. The coefficients of interest are captured in the set of estimates represented by β_1, which provide estimates of the difference in earnings outcomes between VET-educated and academically educated respondents relative to those with lower levels of education.

We utilise both vocational definitions as we believe there is a dearth of literature on the importance of the definition of VET. We believe that our measure of VET including a work-based component (VET2) is more reliable than that routinely used in the literature based solely on respondents' interpretations of their highest qualification's vocational content. *A priori*, answering the question of whether one's education is "vocational" is far less tangible and more subjective than verifying whether one has undergone work-based training as part of their education. By using $VET2$, we implement a more specific distinction between those who have vocational qualifications and those who do not. In all models examining $VET2$, we exclude respondents who reported that their qualifications were vocational, but did not undertake work-based learning. We do this to ensure that our comparison group consists of respondents who possess academic qualifications, meaning that it would be inaccurate to include respondents who state that their qualifications are vocational in this group.

For all subsequent models, we restrict our sample to graduates of tertiary education (i.e. respondents whose highest level of education is ISCED 5 and above). To estimate the relationship between VET qualifications and job satisfaction, we first estimate a probit model, as outlined in Equation 2.

$$JobSatisfaction_{ij} = \beta_0 + \beta_1 VET_{ij} + \beta_2 X_{ij} + \epsilon_{ij} \quad (2)$$

Where $JobSatisfaction_{ij}$ represents a binary variable equal to one if respondents gave the answer of nine or ten when asked to rate how satisfied they were with their job on a 10-point scale[15], and zero otherwise. Additionally, $\beta_1 VET_{ij}$ refers to a binary variable equal to one if the respondent is categorised as having vocational qualifications and zero if they are classified as having non-vocational (academic) qualifications, per our previous definitions. Note that the reference category in this model is no longer the same as in Equation 1, where we examine the earnings of academic/VET qualification recipients

[14] We also estimate specifications in which we include dummy variables for the sector in which respondents worked (i.e. NACE sector). The estimates are reported in Tables A5 and A6 in the appendix.
[15] Higher values indicate higher job satisfaction.

relative to those with lower levels of education. In this case, X_{2ij} relates to the same sets of dummy and control variables as specified in Equation 1, and ϵ_{ij} is an IID error term.

2.2 Robustness Check: Propensity Score Matching (PSM)

It is possible that possession of VET qualifications is non-randomly correlated with an explanatory variable, which may influence the outcome variable (i.e. sample selection bias). For instance, it is possible that some group X is overrepresented in VET, and may also systematically have different job satisfaction outcomes. In this sense, the coefficient estimate β_1 would be biased. To account for this, we estimate the relationship between VET qualifications and job satisfaction using Propensity Score Matching (PSM). The propensity score $p(X)$ is defined as the conditional probability of receiving treatment given certain determining characteristics, as outlined in Equation 3 below:

$$p(X) = \Pr\{D = 1|X\} = E\{D|X\} \tag{3}$$

The binary variable D denotes exposure to the treatment, which in this case is whether respondents possess vocational qualifications. X is a vector of determining characteristics, which is the same set of control variables denoted by the vector X_{ij} in Equations 1 and 2. We compare the treatment group – graduates who have undergone vocational education (by the relevant definition) – to tertiary academic graduates (i.e. the control group). We match treatment and control observations using propensity scores calculated as per Equation 3 (the conditional probability of being treated given observable respondent characteristics captured in X) and compare earnings and job satisfaction outcomes between groups. Rosenbaum and Rubin (1983) show that matching individuals using propensity scores calculated from observables is equivalent to matching on actual characteristics.

We also conduct post-estimation procedures to verify the balance of covariates between treatment and control groups. However, we can only verify balance on observable characteristics, leaving our estimates open to the influence of unobserved factors. To assess the extent to which our estimates are sensitive to unobserved heterogeneity, we conduct sensitivity tests using the *mhbounds* command in Stata.[16] In brief, the *mhbounds* sensitivity check computes the extent to which some unobserved factor would have to influence the odds of being assigned to the treatment group before our estimates became statistically

[16] The details of mhbounds are outlined in Becker and Caliendo (2007).

unreliable. If our estimated treatment effect became statistically unreliable where some unobservable adjusted the odds of treatment assignment very little[17], then our estimates would be highly sensitive to hidden bias. A low susceptibility to hidden bias means we would have less confidence in our estimates and would conclude that our estimates are highly sensitive to unobserved heterogeneity. The procedure does not explicitly test for the presence of bias in the estimates themselves, but gives a sense of how reliable the estimates statistical significance will alter in the presence of hidden bias.

3. Results

3.1 Earnings

In Table 3, we estimate a wage equation (Equation 1) in which we compare the returns to VET and academic qualifications under both definitions of VET.[18] The reference group in all specifications consists of respondents who obtained ISCED Levels 1 or 2 ($Low\ Education$), and the standard errors are clustered by country. $VET1$ refers to the definition of VET based on respondents' classification of their qualification only, while $VET2$ combines both respondents' classification and the confirmation that the qualification involved some workplace learning. Under this approach, some individuals who are classified as having VET qualifications under $VET1$ are no longer included in the sample for VET2 as discussed in the data section above.

[17] Suppose that some unobservable adjusted the probability of undergoing by 5%. If it were the case that our estimates were not statistically significant as a result of the inclusion of this unobservable, then we may not be capturing the unbiased effect of VET on job satisfaction.

[18] For all coefficients, see Tables A8 and A9in the Appendix.

Table 3: Earnings Returns to Academic and Vocational Education (EU-28, Pooled Sample)

Outcome: Log Earnings	(1) VET1	(2) VET2
Education Level/Type		
Low Education (≤ ISCED 2)	*Ref.*	*Ref.*
Upper Secondary (Academic)	0.103***	0.112***
	(0.027)	(0.030)
Post-Secondary (Academic)	0.146***	0.169***
	(0.044)	(0.045)
Tertiary (Academic)	0.221***	0.216***
	(0.031)	(0.030)
Upper Secondary (Vocational)	0.086***	0.072**
	(0.025)	(0.027)
Post-Secondary (Vocational)	0.137***	0.124***
	(0.029)	(0.028)
Tertiary (Vocational)	0.239***	0.226***
	(0.039)	(0.040)
Constant	2.424***	2.421***
	(0.047)	(0.051)
Country	YES	YES
Occupation	YES	YES
Observations	32,781	19,127
R-Squared	0.648	0.652

Notes: Country-clustered standard errors in parentheses. All models include control variables for 1) tenure, 2) tenure squared, 3) gender, 4) binary indicators indicating whether the respondent was previously employed, in education or otherwise, 5) whether the respondent was not an a formal contract, 6) whether the respondent was on a permanent contract, 7) whether the respondent had multiple places of work, 8) public/private sector, 9) company size, 10) country and 11) ISCO occupation. Extended table of coefficients available in Table A8 in the Appendix.
**** p<0.01, ** p<0.05, * p<0.1*

Under both definitions of VET, earnings returns increase with higher levels of education for both vocational and academic qualifications, reaffirming considerations of human capital theory (Becker, 1964) and the findings of many empirical studies. Having tertiary qualifications of either type is associated with an earnings premium of between 22-24% relative to those with the lowest levels of education. Furthermore, the wage returns to education are broadly similar across all specifications.

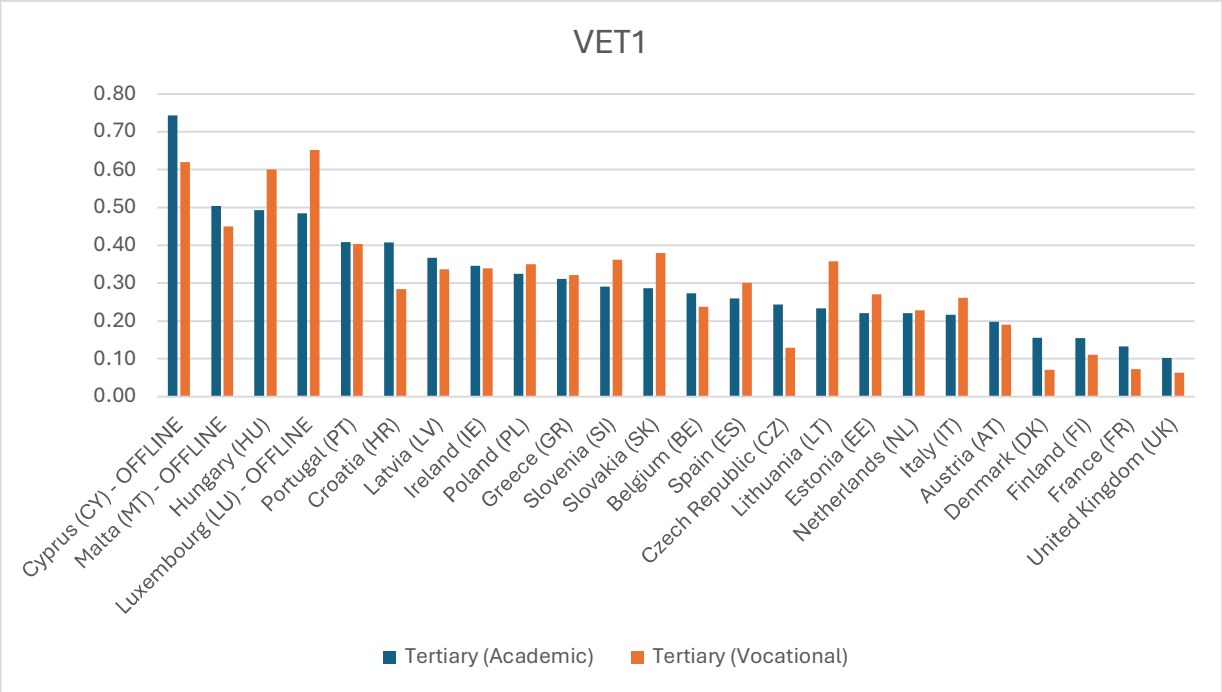
Comparing returns between academic and vocational qualifications across the EU-28, the estimates suggest that earnings returns are broadly similar under all definitions of VET. The stability of the VET wage estimates is quite remarkable given the substantial differences in the incidence of VET education under the two definitional approaches. Examining differences in the returns to academic and vocational

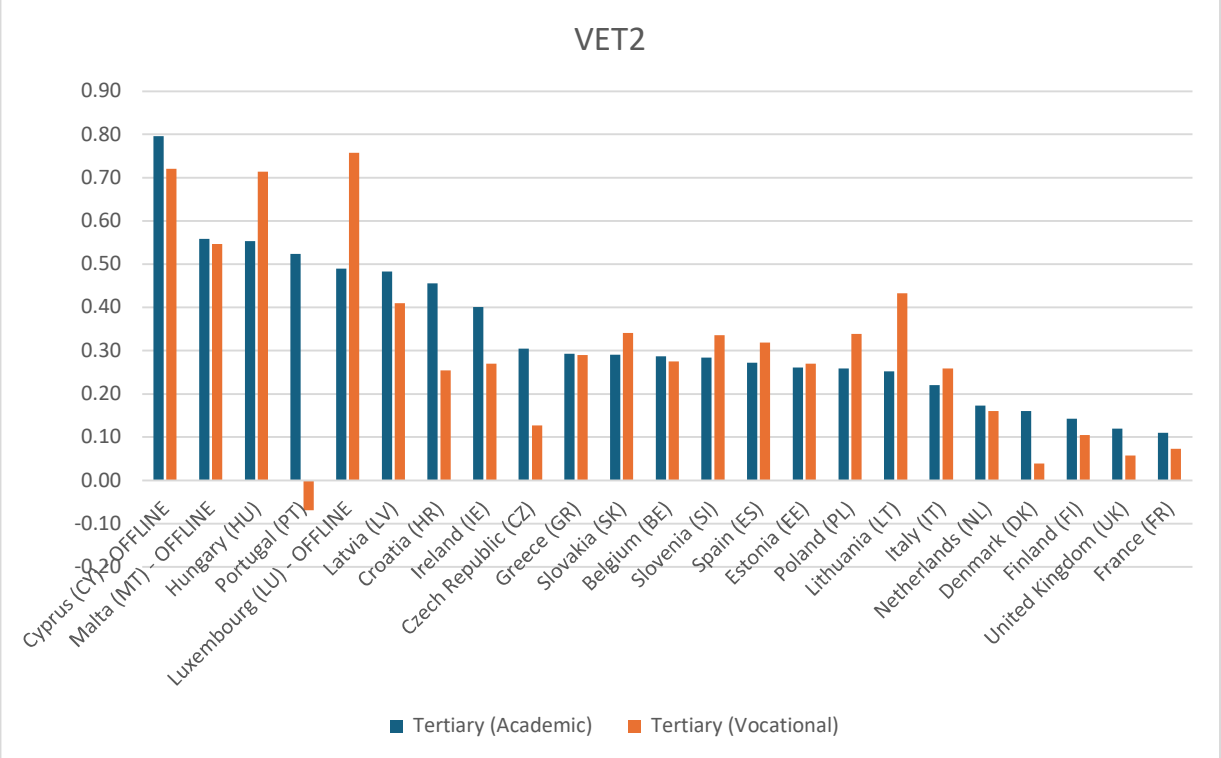
education qualifications within each of the three levels of education (lower secondary, upper secondary and tertiary), rates differ between one and three percentage points, with little consistent evidence of higher returns to a specific form of education. Broadly speaking, at the European level, the returns to vocational and academic qualifications are highly similar across all educational levels; furthermore, we find that wage estimates of the returns to VET are not sensitive to the definition of VET adopted.

We also investigate country-level differences in earnings returns to education between vocational and academic qualifications. To do this, we estimate Equation 1 for each EU-28 country separately. In Figure 1, we plot the statistically significant earnings premia (β_1 coefficients) to vocational, and academic third-level qualifications for each country relative to the reference category of ISCED 2 or less. It should be noted that some country-level data does not generate statistically significant estimates of one or both coefficients and, at least to some extent, this will be related to sample size constraints. In the top panel of Figure 1, we contrast third level academic and VET qualifications under the VET 1 measure, with lower panel displaying the results generated using VET 2. We observe that the returns to vocational and academic study are broadly comparable within countries, though there is some variation in academic rates of returns across countries. Relative to the reference category, the premium to vocational tertiary education varies from below 10 per cent in the United Kingdom, Denmark and France to above 60 per cent in Luxembourg and Cyprus (upper panel Figure 1).

We can also contrast the VET estimates generated within countries using both definitional approaches by comparing the VET returns in the upper and lower panels of Figure 1. The estimated rates of return are broadly similar, with no large differences apparent in either direction.

Figure 1: Coefficient Estimates – Returns to Tertiary-Level Education (Academic and Vocational, Sorted by Descending Academic Premia)

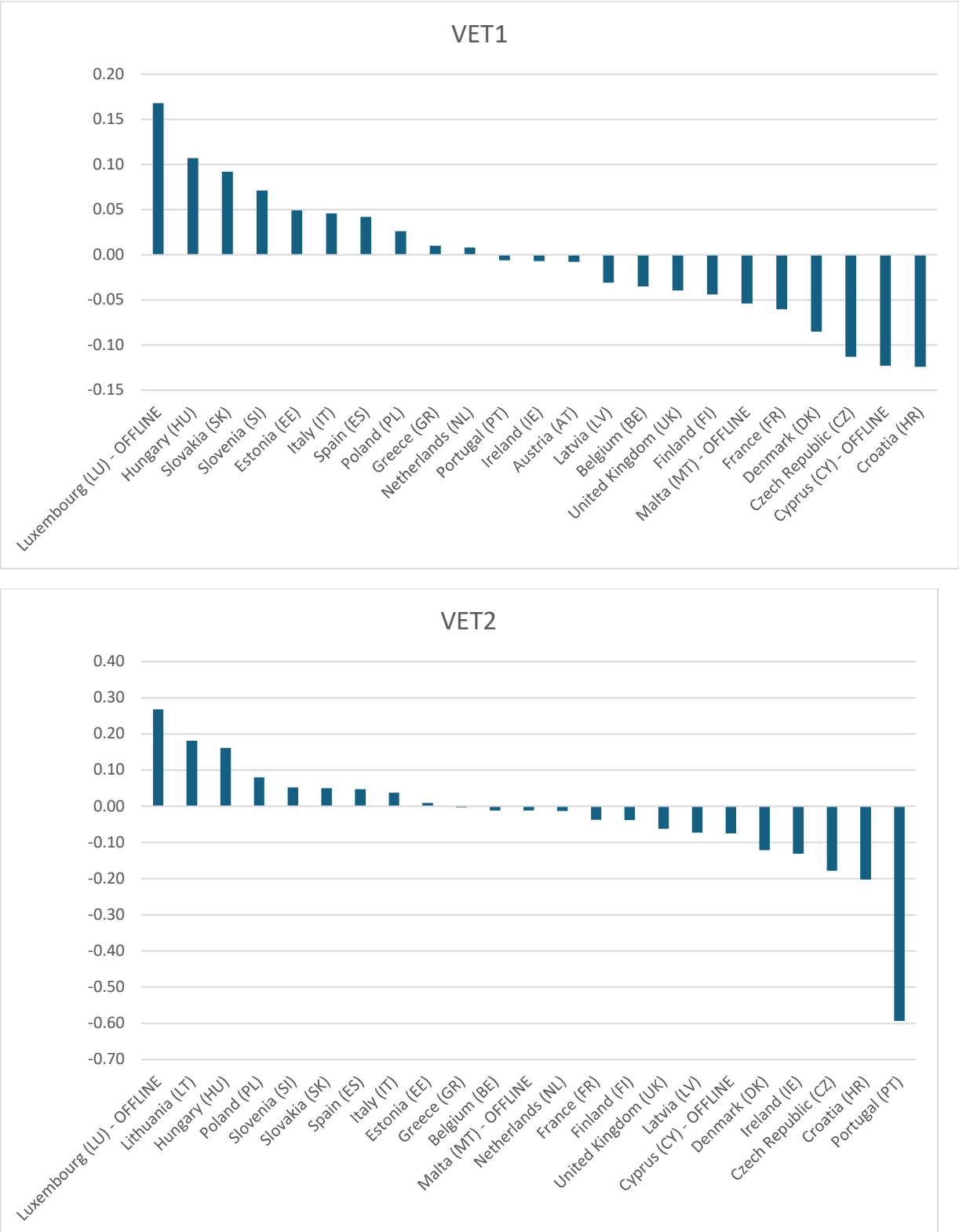




Notes: Where both coefficient estimates are not statistically significant, country estimates have been excluded from the figure. Estimates available upon request.

We next compare the country level estimates of academic and tertiary schooling within countries (see Figure 2 below). Using VET 1, the earnings premium is higher for tertiary VET graduates in 11 of the 28 countries and lower in 13 countries, with no statistically significant differences found for the remaining four countries (Germany, Sweden, Romania and Bulgaria). The wage advantage to tertiary VET with work-based learning is highest in Luxembourg, Lithuania and Hungary, and most negative in Croatia, Cyprus and Czechia. Where $VET2$ is used, we estimate 23 (from a possible 28) pairwise sets of statistically significant earnings premia. Using VET2, the earnings premium is higher for tertiary VET graduates in nine countries and lower in thirteen countries, while it is approximately zero in Greece. We find no statistical differences for Germany, Sweden, Austria, Romania and Bulgaria. The wage advantage to tertiary VET with work-based learning is highest in Luxembourg, Lithuania and Hungary, and is most negative in Czechia, Croatia and Portugal.

Figure 2: Premium of Vocational Qualifications relative to Academic Qualifications, EU28, 2014



Notes: Where both coefficient estimates are not statistically significant, country estimates have been excluded from the figure. Estimates available upon request.

3.2 Job Satisfaction

We next examine the link between tertiary qualification type and job satisfaction. Table 4 contains the coefficient estimates based on the probit model outlined in Equation 2. We are conscious that VET/academic qualifications may be correlated with specific fields of study. Due to their content, some fields of study are inherently more conducive to vocational or academic education. For example, it's reasonable to infer that a discipline such as Forestry – a typically practical and hands-on discipline – would be more likely to place emphasis on applicable skills in the workplace than a discipline such as Literature or Arts. We therefore report estimates with field-of-study added in Columns 3 and 4 as a preliminary robustness check.

Table 4: Vocational Education and Job Satisfaction (Tertiary Graduates, VET1 and VET2)

	(1)	(2)	(3)	(4)
Outcome: Job Satisfaction	VET1	VET2	VET1	VET2
Academic	*Ref.*	*Ref.*	*Ref.*	*Ref.*
VET	0.064***	0.073***	0.060***	0.066***
	(0.010)	(0.012)	(0.011)	(0.013)
Field of Study	NO	NO	YES	YES
Observations	15,742	8,493	14,057	7,549
Pseudo R-Squared	0.02	0.03	0.02	0.03

Notes: Country-clustered standard errors in parentheses All models include control variables for 1) tenure, 2) tenure squared, 3) gender, 4) binary indicators indicating whether the respondent was previously employed, in education or otherwise, 5) whether the respondent was not an a formal contract, 6) whether the respondent was on a permanent contract, 7) whether the respondent had multiple places of work, 8) public/private sector, 9) company size, 10) country and 11) ISCO occupation. Extended table of coefficients available in Table A9 in the Appendix.
**** p<0.01, ** p<0.05, * p<0.1*

Those with vocational qualifications are more likely to be satisfied in their jobs than their peers with non-vocational (academic) qualifications. Those with vocational qualifications were at least 6 percentage points more likely to report high job satisfaction than those with academic qualifications, regardless of the specification used. In terms of the other model controls, those who were previously unemployed were less likely to be satisfied, as were those employed in firms with multiple sites. The results changed marginally when field of study was introduced into the specification, just four fields of study had a statistically significant relationship with job satisfaction. Those with qualifications in Teaching, Maths,

Medicine and Security and Transport Services were more likely to be satisfied. As was the case with earnings, we find that the estimated impacts of vocational education on job satisfaction are not sensitive to the definitional approach adopted

We generate country-level estimates for the probit model examining job satisfaction for both vocational specifications in Table 5. We find positive marginal effects of possessing vocational qualifications under both definitional approaches for eight EU-28 countries.[19] Applying $VET1$ we find positive (negative) and significant impacts in eleven (two) of 28 countries. Utilising $VET2$ we find positive (negative) and significant impacts in nine (zero) of 28 countries. Of the coefficients that are non-significant under both measurement approaches, the vast majority have a positive sign and (at least in some cases) the lack of statistical significance is likely to be a consequence of small sample sizes. There is again strong country level evidence to support the view that graduates from vocational degrees have higher levels of job satisfaction and that this finding is not sensitive to the definitional approach taken to measuring vocational education. The marginal effects range from an increased probability of higher job satisfaction of 5% (UK, $VET1$) to 34% (Malta, $VET2$). For four countries – Denmark, Austria[20], Finland and Latvia – statistically significant estimates are found under the $VET1$ definition, but not for the cohort who undertook work-based learning.

[19] These are France, Germany, Greece Italy, Malta, Poland, Slovenia, and Spain. However, the estimates for Malta and Slovenia are derived from very small sample sizes (64 and 284 respectively), meaning they should be interpreted with extreme caution.

[20] The estimates for Austria are derived from a comparatively small sample (N = 48), meaning they should be interpreted with extreme caution.

Table 5: Country-Level Job Satisfaction Estimates (Tertiary Graduates, Marginal Effects, EU-28)

	VET1		VET2	
Country	**dY/dX**	**Observations**	**dY/dX**	**Observations**
Austria (AT)	-0.523***	48	--	--
Belgium (BE)	0.0299	366	0.0185	211
Bulgaria (BG)	0.0645	408	0.0685	194
Croatia (HR)	0.194	79	1.05e-10	18
Cyprus (CY) - OFFLINE	-0.0629	195	-0.0981	97
Czech Republic (CZ)	0.106	303	0.172	125
Denmark (DK)	0.124**	331	0.105*	249
Estonia (EE)	0.0599	323	0.0516	216
Finland (FI)	0.0740**	977	0.0625*	605
France (FR)	0.0839***	757	0.105***	445
Germany (DE)	0.0947**	1,357	0.111**	769
Greece (GR)	0.0899**	893	0.0827**	497
Hungary (HU)	-0.026	406	-0.0318	164
Ireland (IE)	0.00356	396	-0.0266	191
Italy (IT)	0.0878***	844	0.0773**	490
Latvia (LV)	-0.113**	453	-0.0742	220
Lithuania (LT)	0.0336	414	-0.0874	120
Luxembourg (LU) - OFFLINE	-0.179	97	-0.0952	44
Malta (MT) - OFFLINE	0.255***	153	0.337***	64
Netherlands (NL)	0.0930*	348	0.0668	164
Poland (PL)	0.0701**	1,287	0.0641**	683
Portugal (PT)	0.138	436	1.435***	25
Romania (RO)	0.0665	694	0.104*	260
Slovakia (SK)	-0.0992*	322	-0.152*	132
Slovenia (SI)	0.118***	416	0.147***	284
Spain (ES)	0.104***	1,427	0.146***	746
Sweden (SE)	-0.00217	305	-0.00590	162
United Kingdom (UK)	0.0461**	1,460	0.0431	987
Field of Study	NO		NO	

All models include control variables for 1) tenure, 2) tenure squared, 3) gender, 4) binary indicators indicating whether the respondent was previously employed, in education or otherwise, 5) whether the respondent was not an a formal contract, 6) whether the respondent was on a permanent contract, 7) whether the respondent had multiple places of work, 8) public/private sector, 9) company size and 10) ISCO occupation.
**** p<0.01, ** p<0.05, * p<0.1*

4.3 Propensity Score Matching (PSM) Models

To verify that our baseline job satisfaction estimates are not subject to selection bias, we estimate PSM models for job satisfaction. It is difficult to generate reliably balanced estimates for tertiary VET earnings given that the characteristics of workers the reference category (ISCED 2 and below) are markedly

different from the graduate treatment group. We first calculate propensity scores for each respondent to be assigned to treatment (i.e. having a VET qualifications) based on the set of observable covariates represented by X_{ij}. Using the propensity scores, we match treated respondents to respondents in the control group (Non VET employees) within the pooled EU-28 sample and estimate the Average Treatment Effect on the Treated (ATT) of VET on job satisfaction. We estimate models using both $VET1$ and $VET2$ definitional approaches. To verify matching quality and covariate balance, we also report a number of postestimation statistics, including the pre- and post-matching R-Squared figures, Rubin's B and Rubin's R (Rosenbaum and Rubin, 1983).[21] The PSM scores are estimated using the full set of covariates used to generate the probit estimates in Table 4 (see Table A9). Successful covariate balancing should result in few observable differences between the treatment and control group and a post-matching Pseudo-R^2 that approaches zero. Further, it is recommended that Rubins' B scores of less than 25 and Rubins' R scores between 0.5 and 2 are acceptable thresholds for successful covariate balancing (Rubin, 2001). We also report the critical value outlined in the *mhbounds* procedure in Section 3 for job satisfaction, as well as the critical value for *rbounds* in the case of earnings. Here, values of over 1.3 are considered robust to unobserved factors (see Card and Kruger, 1993).

The ATT estimates are reported in Table 6 below.

Table 6: ATT and Postestimation Statistics (Job Satisfaction, Comparison Group: Tertiary Academic Graduates, EU-28, Pooled)

Variable	ATT	Pseudo R^2 Pre (Post)	Rubin's B (R)	Mhbounds	N
VET1	0.06***	0.09***	17.1	1.35	15,333
	(0.01)	(0.01***)	(1.10)		
VET2	0.06***	0.135***	20.1	1.35	8,295
	(0.02)	(0.01***)	(1.04)		

All PSM models computed with a caliper set at 0.01.
**** p<0.01, ** p<0.05, * p<0.1*

Our ATT estimates indicate a 6 percentage point difference in job satisfaction in favour of vocational graduates. The postestimation statistics indicate that matching quality is generally high, though our estimates are potentially predisposed to potential unobserved heterogeneity. While the *mhbounds* statistic is above the 1.3 threshold outlined in Card and Kruger (1990), the difference is only 5 percentage points, meaning that unobserved heterogeneity is still a somewhat credible threat. That said, the ATT

[21] Rubins' B score is the absolute standardised difference of the means of the linear index of the propensity score in the treated and (matched) non-treated group. The Rubins' R score is the ratio of the treated to (matched) non-treated variances of the propensity score index.

estimates broadly align with those from our initial probit model (see Table 4), confirming that our original estimates were unlikely to be distorted by selection bias.

3.3 Heterogenous Effects by Age

As discussed in the Literature Review section, previous research suggests that earnings premia to vocational education (relative to academic education) can vary over time. For example, vocational education may exhibit an earnings advantage over academic education in early career stages, but the opposite may be the case in later stages (Neyt *et al.,* 2020; Verhaest and Baert, 2015). To assess this, we evaluate the existence of heterogeneous earnings and job satisfaction returns to different age groups. We split our sample into three groups – 1) those aged between 24 and 35 years of age, 2) those aged between 36 and 49 and 3) those aged between 50 and 65. We re-estimate our baseline OLS and probit models predicting earnings and job satisfaction for each age group and compare the coefficients and marginal effects on vocational education across groups. We report our estimates in Tables 7 and 8.

For earnings, the premia to vocational education and academic qualifications are broadly similar, and rise simultaneously with age. For young people, tertiary education for academic and vocational qualifications is associated with an earnings premium of approximately 21-23 percent (VET1) or 22-23 percent (VET2), relative to low-educated people. For people aged between 36 and 49, the premia are similar, ranging from 20-22 percent for academic qualifications, and 23-24 percent for vocational qualifications. However, for older people, the disparity is much larger; both academic and qualifications are associated with wage premia of approximately 27-28 percent, relative to low-educated older people. In short, there is little difference in earnings returns to tertiary academic and vocational education over time, with both qualification modes exhibiting comparable earnings returns in different age groups.

For job satisfaction, vocational education exhibits a persistent advantage over academic education. However, the gap is widest among the older cohort. Vocationally-educated tertiary respondents aged between 50 and 64 were approximately 9-10 percentage points more likely to be highly satisfied with their job than academic tertiary graduates, with the same figure ranging from 4-6 percentage points across both younger cohorts. The estimates are similar across both measures of vocational education (i.e. VET1 and VET2).

Table 7: Earnings OLS Estimates by Age Group

Variables	(1) Log Earnings (24-35)	(2) Log Earnings (36-49)	(3) Log Earnings (50-64)
VET1			
Education Level/Type			
Low Education (≤ ISCED 2)	*Ref.*	*Ref.*	*Ref.*
Upper Secondary (Academic)	0.102***	0.090***	0.124***
	(0.030)	(0.028)	(0.036)
Post-Secondary (Academic)	0.187**	0.140***	0.112
	(0.079)	(0.038)	(0.067)
Tertiary (Academic)	**0.213*** **	**0.219*** **	**0.284*** **
	(0.035)	**(0.031)**	**(0.051)**
Upper Secondary (Vocational)	0.094***	0.069***	0.117***
	(0.033)	(0.024)	(0.037)
Post-Secondary (Vocational)	0.119***	0.142***	0.185***
	(0.037)	(0.029)	(0.043)
Tertiary (Vocational)	**0.228*** **	**0.244*** **	**0.281*** **
	(0.045)	**(0.037)**	**(0.053)**
Constant	2.323***	2.502***	2.411***
	(0.056)	(0.051)	(0.069)
Observations	9,473	14,732	8,576
R-Squared	0.595	0.641	0.708
VET2			
Education Level/Type			
Low Education (≤ ISCED 2)	*Ref.*	*Ref.*	*Ref.*
Upper Secondary (Academic)	0.118***	0.103***	0.127***
	(0.034)	(0.029)	(0.036)
Post-Secondary (Academic)	0.203**	0.166***	0.149**
	(0.087)	(0.036)	(0.070)
Tertiary (Academic)	**0.220*** **	**0.206*** **	**0.274*** **
	(0.039)	**(0.029)**	**(0.045)**
Upper Secondary (Vocational)	0.069	0.072***	0.101***
	(0.045)	(0.025)	(0.033)
Post-Secondary (Vocational)	0.100**	0.151***	0.159***
	(0.042)	(0.036)	(0.043)
Tertiary (Vocational)	**0.226*** **	**0.234*** **	**0.274*** **
	(0.049)	**(0.045)**	**(0.054)**
Constant	2.311***	2.464***	2.437***
	(0.068)	(0.062)	(0.077)
Observations	5,466	8,533	5,128
R-Squared	0.600	0.646	0.715

Country-clustered standard errors in parentheses. All models include control variables for 1) tenure, 2) tenure squared, 3) gender, 4) binary indicators indicating whether the respondent was previously employed, in education or otherwise, 5) whether the respondent was not an a formal contract, 6) whether the respondent was on a permanent contract, 7) whether the respondent had multiple places of work, 8) public/private sector, 9) company size, 10) country and 11) ISCO occupation. Extended table of coefficients available in Table A9 in the Appendix.
**** p<0.01, ** p<0.05, * p<0.1*

Table 8: Job Satisfaction Estimates by Age Group (Tertiary Graduates, Marginal Effects)

Variables	(1) Job Satisfaction (24-35)	(2) Job Satisfaction (36-49)	(3) Job Satisfaction (50-64)	(4) Job Satisfaction (24-35)	(5) Job Satisfa (36-49
VET1					
Vocational	0.0440***	0.0673***	0.0931***	0.0405***	0.0584*
	(0.0143)	(0.0151)	(0.0199)	(0.0141)	(0.0168
Field of Study	NO	NO	NO	YES	YES
Observations	5,448	6,787	3,507	5,448	6,787
VET2					
Vocational	0.0609***	0.0662***	0.107***	0.0552***	0.0572*
	(0.0162)	(0.0198)	(0.0308)	(0.0155)	(0.0212
Field of Study	NO	NO	NO	YES	YES
Observations	3,125	3,568	1,783	3,125	3,568

Country-clustered standard errors in parentheses. All models include control variables for 1) tenure, 2) tenure square indicating whether the respondent was previously employed, in education or otherwise, 5) whether the respondent w whether the respondent was on a permanent contract, 7) whether the respondent had multiple places of work, 8) publ 10) country and 11) ISCO occupation. Extended table of coefficients available upon request from

**** p<0.01, ** p<0.05, * p<0.1*

3.4 Alternative Specifications

We estimate several alternative specifications of our baseline earnings (OLS) and job satisfaction (probit) models to evaluate the robustness of our results. We detail each of these in turn below, and report all estimates in the appendix.

Our first alternative specification concerns the cohort of respondents who report that their studies are not vocational, but that they undertook some work-based learning. In our baseline estimates, we do not consider such respondents to have undertaken vocational education. However, we accept that it is possible that some respondents in this group undertook vocational education, given that their course content involved work-based learning, even if they did not indicate that their course was vocational. Nevertheless, it is reasonable to assume that the cohort of respondents who report that their education was vocational and involved work-based learning are the most likely candidates to have undertaken vocational education programmes. In the interest of completeness, we reclassify respondents who undertook work-based learning, but did not indicate that their studies were vocational as vocationally educated (where previously they were considered to be academically educated) and re-estimate our pooled OLS and probit specifications as a robustness check (see Tables A1 and A2 in the appendix). Our estimates are broadly in line with the baseline results.

Second, we alter the job satisfaction variable to leverage the full ten-point range of the question asked in the ESJS. Recall that job satisfaction is captured by a question in which respondents were asked to score their satisfaction with their job from one to ten, with higher values indicating higher job satisfaction. In our baseline estimates, we opt for a conservative estimation approach; we can't be certain that respondents who indicate a middling score are satisfied with their job, but it is reasonable to assume that respondents with scores of 9 or 10 are almost certainly satisfied with their job. As a robustness check, we estimate an OLS model in which we include the ten-point job satisfaction variable as the dependent variable. We report the estimates of this specification in Table A3 in the appendix. The coefficient estimates are consistent with our baseline probit estimates.

Our third alternative specification includes respondents who reported that their studies were vocational, but they did not undertake work-based learning; our baseline VET2 estimates excluded this group from the sample (Tables A4 and A5). To do this, we construct a mutually exclusive indicator variable denoting whether respondents 1) had academic qualifications, 2) reported having vocational qualifications, but did

not take part in work-based learning or 3) reported having vocational qualifications and took part in work-based learning. For earnings, we further divide these three groups by their level of education to maintain consistency with our baseline approach. For job satisfaction, we simply include the three-point indicator variable as an independent variable, with the reference group being the academic cohort. For earnings, the vocational, non-work-based learning cohort with tertiary qualifications exhibited slightly higher earnings returns than their academic and vocational (work-based learning) counterparts. However, the magnitude of the difference is relatively small. For job satisfaction, the vocational cohort that experienced work-based learning exhibited the highest returns, followed by the vocational cohort with no work-based learning, and then academically-qualified respondents. Broadly, these estimates are in line with the baseline models.

Finally, we estimate specifications in which we include a dummy variable for NACE industry (Tables A6 and A7). As we include ISCO occupation in our baseline estimates, this aspect of the data is already somewhat captured. However, given that earnings and job satisfaction may vary by industry beyond the influence of occupational differences between respondents, we deem it appropriate to control for industry. The estimates do not differ substantially from our baseline results.

4. Discussion

The issue of the measurement and definition of VET has received very little attention in the academic literature, despite the recognised importance of VET pathways for human capital accumulation. The phrasing of survey questions relating to the nature of educational pathways undertaken vary considerably and there are generally little or no mechanisms to ensure that courses perceived as VET by respondents include a work placement component. Furthermore, there is relatively little evidence relating to the relative impacts of VET education on both earnings and job satisfaction, both at a national and international level, which represents a substantial gap in the literature. In many countries, VET pathways are seen by students (and some parents) as second best options, therefore, it is important from a policy perspective that the returns to VET, relative to academic pathways, are demonstrated.

In this paper, we examine and compare the labour market outcomes of those with vocational qualifications and those with academic qualifications in the EU-28. We examine these questions using two measurement approaches to VET, the first using the standard subjective course classification by respondents, with the second stricter measure restricted to perceived VET qualifications that had a work

placement element within them. Our first major finding is that the incidence of VET qualifications across the EU 28 varies substantially depending on the measurement approach adopted. The EU incidence of third-level VET, among employees, falls from 74% to 29% when the stricter definition of VET is adopted, however, return estimates are generally unaffected by the definitional approach adopted.

On aggregate, we find that earnings premia increase with higher levels of educational attainment for both vocational and academic graduates. This holds true whether we use a broader definition of VET or include the work-based learning criterion. In fact we find no evidence of superior returns to academic over vocational tertiary pathways, or vice versa. When examining country-level differences, we uncover substantial variation. Using $VET1$ ($VET2$), in 11 (9) of the EU-28 countries, the earnings premium on vocational qualifications is greater than the premium on academic qualifications, with 13 (13) EU-28 countries exhibiting the opposite effect and one exhibiting no substantial difference. Statistically significant estimates were not produced for the remaining six countries. We also compare job satisfaction outcomes between VET and academic graduates. At the European level, we observe that workers with vocational qualifications exhibit higher levels of job satisfaction than those with academic qualifications under both definitions of VET. While explaining the mechanisms behind the higher rates of job satisfaction among the vocationally qualified is somewhat outside the remit of the current research, a potential explanation may lie in higher rates of skill utilisation among this group. It could be the case that graduates from vocational pathways, who have been equipped with higher rates of work related competencies, are able to utilise higher proportions of the acquired skills in the workplace which, in turn, leads to higher levels of job satisfaction.

Finally, the research also shows substantial variations in the VET premiums at country level. There are a number of possible explanations for such variation, including structural differences in the nature of labour demand and in the substance and delivery of VET education and training. The relative importance of such factors in explaining variations in the VET earnings and job satisfaction premia are a matter for future research. There is also persuasive country-level evidence to support the view that employees with vocational degrees have higher levels of job satisfaction, relative to graduates from academic pathways, and that this finding is not sensitive to the definitional approach taken to measuring vocational education. The results of our PSM models broadly confirm our initial findings in relation to job satisfaction. These findings are insensitive to the definitional approach used for vocational education, despite the fact that the prevalence of both types of vocational education differ greatly across Europe.

Declaration of Interest Statement: The authors declare that there are no competing interests associated with this paper.

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5. *Appendix*

Table A1: Vocational Education and Earnings, Adjusted Groups (Coefficients)

Outcome: Log Earnings	(1) VET (Adjusted)
Education Level/Type	
Low Education (≤ ISCED 2)	*Ref.*
Upper Secondary (Academic)	0.106***
	(0.030)
Post-Secondary (Academic)	0.170***
	(0.040)
Tertiary (Academic)	0.219***
	(0.030)
Upper Secondary (Vocational)	0.082***
	(0.026)
Post-Secondary (Vocational)	0.130***
	(0.030)
Tertiary (Vocational)	0.223***
	(0.039)
Constant	2.418***
	(0.050)
Country	YES
Occupation	YES
Observations	19,127
R-Squared	0.652

*Notes: Country-clustered standard errors in parentheses. Respondents who indicated that their studies were not vocational, but undertook work-based learning are classified as vocationally-educated in this specification. *** p<0.01, ** p<0.05, * p<0.1*

Table A2: Vocational Education and Job Satisfaction, Adjusted Groups (dY/dX)

Outcome: Job Satisfaction	(1) VET (Adjusted)	(2) VET (Adjusted)
Academic	*Ref.*	*Ref.*
VET	0.055*** (0.011)	0.047*** (0.012)
Field of Study	NO	YES
Observations	8,493	8,493
Pseudo R-Squared	0.02	0.03

*Notes: Country-clustered standard errors in parentheses. Respondents who indicated that their studies were not vocational, but undertook work-based learning are classified as vocationally-educated in this specification. *** p<0.01, ** p<0.05, * p<0.1*

Table A3: Vocational Education and Job Satisfaction (OLS, Continuous Outcome Variable)

Outcome: Job Satisfaction (Continuous)	(1) VET1	(2) VET2	(3) VET1	(4) VET2
Academic	*Ref.*	*Ref.*	*Ref.*	*Ref.*
VET	0.371*** (0.041)	0.424*** (0.057)	0.357*** (0.043)	0.417*** (0.054)
Constant	7.461*** (0.147)	7.423*** (0.141)	7.527*** (0.133)	7.508*** (0.163)
Field of Study	NO	NO	YES	YES
Observations	15,724	8,486	15,724	8,486
R-Squared	0.05	0.06	0.05	0.06

Notes: Robust standard errors in parentheses. Standard errors are clustered by country. Full estimates available from the authors upon request.
**** p<0.01, ** p<0.05, * p<0.1*

Table A4: Indicator Variable Specification (Earnings)

Outcome: Log Earnings	(1) Earnings
Qualification Type	
Low Education	*Ref.*
Upper Secondary (Academic)	0.107***
	(0.032)
Post-Secondary (Academic)	0.163***
	(0.047)
Tertiary (Academic)	0.211***
	(0.031)
Upper Secondary (VET, No Work-Based Learning)	0.100***
	(0.025)
Post-Secondary (VET, No Work-Based Learning)	0.151***
	(0.033)
Tertiary (VET, No Work-Based Learning)	0.262***
	(0.039)
Upper Secondary (VET, Work-Based Learning)	0.077**
	(0.028)
Post-Secondary (VET, Work-Based Learning)	0.127***
	(0.031)
Tertiary (VET, Work-Based Learning)	0.221***
	(0.041)
Constant	2.425***
	(0.048)
Observations	28,973
R-Squared	0.648

Country-clustered standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1*

Table A5: Indicator Variable Specification (Job Satisfaction)

Variables	(1) Job Satisfaction (dY/dX)
Qualification Type	
Academic	*Ref.*
Vocational, No Work-Based Learning	0.051***
	(0.009)
Vocational, Work-Based Learning	0.072***
	(0.011)
Observations	15,197
Pseudo R-Squared	0.03

Country-clustered standard errors in parentheses.
**** p<0.01, ** p<0.05, * p<0.1*

Table A6: Earnings Returns to Academic and Vocational Education (EU-28, Pooled Sample, Industry Dummies Included)

Outcome: Log Earnings	(1) VET1	(2) VET2
Education Level/Type		
Low Education (≤ ISCED 2)	*Ref.*	*Ref.*
Upper Secondary (Academic)	0.099***	0.108***
	(0.028)	(0.030)
Post-Secondary (Academic)	0.141***	0.162***
	(0.043)	(0.044)
Tertiary (Academic)	0.211***	0.205***
	(0.032)	(0.030)
Upper Secondary (Vocational)	0.083***	0.071**
	(0.024)	(0.026)
Post-Secondary (Vocational)	0.134***	0.124***
	(0.029)	(0.028)
Tertiary (Vocational)	0.233***	0.226***
	(0.039)	(0.040)
Constant	2.461***	2.451***
	(0.051)	(0.056)
Country	YES	YES
Occupation	YES	YES
Industry Dummies	YES	YES
Observations	32,781	19,127
R-Squared	0.651	0.656

Notes: Country-clustered standard errors in parentheses. Full estimates available from the authors upon request.
**** p<0.01, ** p<0.05, * p<0.1*

Table A7: Marginal Effects (VET1 and VET2, Industry Dummies Included)

Outcome: Job Satisfaction	(1) VET1	(2) VET2	(3) VET1	(4) VET2
Academic	*Ref.*	*Ref.*	*Ref.*	*Ref.*
VET	0.061***	0.070***	0.059***	0.066***
	(0.010)	(0.011)	(0.011)	(0.013)
Field of Study	NO	NO	YES	YES
Observations	15,742	8,493	14,057	7,549
Industry Dummies	YES	YES	YES	YES
Pseudo R-Squared	0.02	0.03	0.02	0.03

Notes: Robust standard errors in parentheses. Standard errors are clustered by country. Full estimates available from the authors upon request.
**** p<0.01, ** p<0.05, * p<0.1*

Table A8: Earnings Equation (All Coefficients)

Variables	(1) VET1	(2) VET2
Education Level/Type		
Low Education (≤ ISCED 2)	*Ref.*	*Ref.*
Upper Secondary (Academic)	0.103***	0.112***
	(0.027)	(0.030)
Post-Secondary (Academic)	0.146***	0.169***
	(0.044)	(0.045)
Tertiary (Academic)	0.221***	0.216***
	(0.031)	(0.030)
Upper Secondary (Vocational)	0.086***	0.072**
	(0.025)	(0.027)
Post-Secondary (Vocational)	0.137***	0.124***
	(0.029)	(0.028)
Tertiary (Vocational)	0.239***	0.226***
	(0.039)	(0.040)
Tenure	0.013***	0.013***
	(0.002)	(0.002)
$Tenure^2$	-0.000***	-0.000***
	(0.000)	(0.000)
Male	0.119***	0.135***
	(0.014)	(0.017)
Prev. Unemployed	-0.108***	-0.110***
	(0.014)	(0.015)
Prev. Education	-0.056***	-0.057***
	(0.009)	(0.011)
Prev. Other	-0.077***	-0.085***
	(0.018)	(0.024)
Informal	-0.044*	-0.048
	(0.024)	(0.035)
Permanent	0.090***	0.081***
	(0.011)	(0.017)
Multisite	0.039***	0.040***
	(0.007)	(0.007)
Private	0.032***	0.032***
	(0.011)	(0.012)
Company Size (Employees)		
1-9	*Ref.*	*Ref.*
10-49	0.071***	0.056***
	(0.011)	(0.011)
50-99	0.086***	0.066***
	(0.013)	(0.015)
100-249	0.137***	0.114***
	(0.011)	(0.014)
250-499	0.157***	0.144***

	(0.020)	(0.024)
500+	0.187***	0.165***
	(0.018)	(0.020)
Constant	2.424***	2.421***
	(0.047)	(0.051)
Country	YES	YES
Occupation	YES	YES
Observations	32,781	19,127
R-Squared	0.648	0.652

Notes: Robust standard errors in parentheses. Standard errors are clustered by country. Country and occupation coefficients excluded from table for brevity. Full estimates available upon request from the authors.
**** p<0.01, ** p<0.05, * p<0.1*

Table A9: Probit Model for Job Satisfaction (All Marginal Effects)

	(1)	(2)	(3)	(4)
Variables	VET1	VET2	VET1	VET2
VET	0.06***	0.08***	0.06***	0.07***
	(0.009)	(0.012)	(0.011)	(0.012)
Tenure	-0.00	-0.00	-0.00	-0.00**
	(0.002)	(0.002)	(0.002)	(0.002)
$Tenure^2$	0.00***	0.00***	0.00***	0.00***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.00	0.00	0.00	-0.00
	(0.008)	(0.009)	(0.009)	(0.012)
Prev. Unemployed	-0.06***	-0.07***	-0.06***	-0.06***
	(0.015)	(0.018)	(0.016)	(0.019)
Prev. Education	-0.00	-0.01	-0.00	-0.01
	(0.008)	(0.013)	(0.008)	(0.013)
Prev. Other	0.04	0.04	0.03	0.03
	(0.030)	(0.031)	(0.031)	(0.032)
Informal	-0.04	-0.03	-0.04	-0.02
	(0.035)	(0.035)	(0.033)	(0.031)
Permanent	0.02	0.02	0.02	0.02
	(0.011)	(0.013)	(0.011)	(0.012)
Multisite	-0.03***	-0.02**	-0.03***	-0.02**
	(0.007)	(0.011)	(0.008)	(0.011)
Private	-0.01	-0.00	-0.01	0.00
	(0.012)	(0.016)	(0.012)	(0.015)
Field of Study	NO	NO	YES	YES
Observations	15,438	8,310	13,803	7,421
Pseudo R-Squared	0.0219	0.0286	0.0230	0.0309

Notes: Robust standard errors in parentheses. Standard errors are clustered by country. Company size and country variables included in all specifications, but excluded from table for brevity. Full estimates available upon request from the authors.
**** p<0.01, ** p<0.05, * p<0.1*