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The Employment–Education Trade-off in School-Based Vocational Education: Evidence from Peers' Choices*

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Abstract

Vocational education and training (VET) may accelerate employment transitions at the cost of reducing further education participation. We quantify this trade-off in a school-based VET system, drawing on linked administrative and survey data in Portugal. We use the share of lower-secondary classmates who subsequently choose upper-secondary VET as an instrument for individual VET enrollment. We find a pronounced trade-off in early post-school transitions: vocational enrollment increases employment by 26-34 percentage points and improves several job quality indicators; however, VET reduces further education participation by 30-40 percentage points and is associated with higher unemployment.

Keywords: school-based vocational education, peer choices, school-to-work transition, NEET, job quality.

JEL Codes: I21, I26, J24, C26.

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1 Introduction

Vocational education and training (VET) in secondary education seeks to equip students with occupation-specific skills and facilitate their labor market transitions. However, this focus on jobs may impact negatively on students' enrollment in higher education, which may also affect the students' subsequent labor market transitions. Although this potential trade-off between (faster) employment and (less) higher education is acknowledged in the VET literature Malamud and Pop-Eleches (2010, 2011); Bertrand et al. (2021); Silliman and Virtanen (2022); Bentolila et al. (2023); Cahuc and Hervelin (2024), it has received little attention in school-based VET systems (OECD, 2023b, 2025).

While dual VET systems combine workplace- and school-based training through close cooperation between education providers and employers, school-based VET is delivered predominantly in educational institutions.[1] Although it may include limited periods of workplace training, the nature of school-based VET is significantly different, leading to potentially contrasting trade-offs between employment and higher education.

This paper evaluates this trade-off in the case of upper-secondary school-based VET. Specifically, we evaluate the effects of VET enrollment on both labor transitions and on higher education enrollment. Our research design also leverages novel within-school leave-out variation in the share of *lower-secondary* classmates who subsequently choose *upper-secondary* VET, which we use as an instrumental variable.

We examine the case of Portugal, in which VET is a established track, enrolling around 40% of all upper-secondary students, in compulsory schooling. We draw on administrative education data linked to a post-secondary longitudinal survey. This is a longitudinal survey conducted by the Portuguese Ministry of Education over three waves in upper secondary school (entrance, exit and 14 months after graduation). We examine multiple labor market and educational outcomes, including the comparatively understudied NEET status and several measures of job quality. We also investigate heterogeneity by types of institutions (public/private, specialized/non-specialized) and fields of specialization.

Our findings, which identify local effects of VET, for students at the margin between vocational and academic tracks who respond to peer choice, reveal a pronounced trade-off in post-school transitions. VET enrollment significantly increases the probability of employment by 26-34 percentage points (approximately 2.5 times the rate of academic students) and improves several job quality indicators, such as full-time employment. Conversely, VET reduces participation in tertiary education by 30-40 percentage points (roughly half the rate of participation among academic students). Although VET increases employment by encouraging earlier labor market entry, it also shifts some students out of education without a successful transition into work, thereby increasing unemployment and NEET incidence.

[1] Eichhorst et al. (2015) distinguish between three main models: school-based VET, formal apprenticeships, and dual systems. These models differ in both the specificity of the curriculum and the primary setting in which training takes place. Formal apprenticeships occur mainly in the workplace, complemented by limited institutional training.

This paper contributes to the existing literature along three main dimensions. First, it adds to the empirical literature on school-to-work transitions in vocational education by highlighting and quantifying the trade-off between employment and further education. This contribution is particularly relevant because transition evidence remains scarce for school-based VET systems, where school-firm linkages are less extensive than in dual systems and labor market entry may be more difficult. Second, our identification strategy leverages variation in peers' subsequent track choices, contributing not only to the literature on vocational education trade-offs but also to the broader literature on peer effects in education. Third, we extend the analysis to outcomes that remain underexplored in the literature, namely NEET status and job quality indicators. Overall, by providing quasi-causal evidence from a predominantly school-based system, the paper contributes to policy debates on the role of VET in contexts where vocational pathways account for a substantial share of upper-secondary enrollment, particularly regarding the balance between facilitating early labor market entry and preserving progression to further education.

The paper is structured as follows. Section 2 reviews the literature on labor and educational effects of vocational education and section 3 provides an overview of the Portuguese institutional context. Section 4 presents the dataset and descriptive statistics, while section 5 clarifies the estimation strategy. Section 6 breaks down the results and expands on complementary analyses. Section 7 explores key mechanisms related to the alignment between formal training and labor market demands. Section 8 provides an overview of our main conclusions and recommendations.

2 Literature Review

The theoretical foundation of the debate on vocational education returns lies in the human capital theory (Becker, 1964), which distinguishes between general and specific skills.[2] The distinction is associated with a dynamic trade-off between short-term gains and potential long-term disadvantages of vocational education (Hanushek et al., 2017; Hampf and Woessmann, 2017). VET graduates may experience smoother and earlier transitions into employment due to occupation-specific skills, while general education graduates may benefit from higher returns (higher and better employment) later in life. A recent meta-analysis on VET labor market outcomes finds that around half of the analyzed studies report, on average, an increase of 4.8 percentage points in the probability of employment for VET graduates when compared with general education, while no significant effects are found on earnings (Kemper et al., 2026).[3]

However, the magnitude and persistence of these effects vary substantially across institutional settings. Evidence from Nordic countries, characterized by strong dual systems and firm involve-

[2] General skills are transferable across employers and enhance workers' adaptability and mobility, whereas specific skills are tied to particular occupations or firms and may limit outside opportunities.

[3] A study on VET labor market outcomes by Cedefop (2013) highlights that, in comparison with their general education counterparts, at the upper secondary level, VET graduates exhibit higher odds of being employed and unemployed. While general education graduates tend to pursue further studies or balance study and work, VET graduates are more prone to participate in the job market, regardless of employment status. In addition, upper secondary VET graduates display a higher likelihood of having permanent and full-time contracts.

ment in training, suggests more persistent advantages for vocational graduates. In Finland, Silliman and Virtanen (2022) employ a regression discontinuity design among applicants to both vocational and academic tracks and document an earnings premium for VET graduates that persists into the early thirties, with limited evidence of later penalties. Additionally, the authors find that admission to the vocational track does not increase the likelihood of working in jobs at risk of replacement by automation or offshoring. Birkelund and van de Werfhorst (2022) use an instrumental variable approach, similar to what we propose in this paper, and leverage variation at the school-level and between siblings to instrument upper-secondary track choice in Denmark. The authors find that vocational education reduces unemployment risk relative to upper secondary drop-outs. They also show that the general track does not result in higher earnings, but it can lead to higher-status occupations.

By contrast, evidence from systems with weaker school–firm linkages is more mixed. In the UK, Brunello and Rocco (2017) and Matthewes and Ventura (2022) find evidence of wage trade-offs for certain groups of vocational students, although effects differ by formal educational attainment and revealed preferences. For Portugal, Hartog et al. (2022) document an initial employment advantage for vocational graduates that fades over time among individuals who do not pursue further education, while wage premiums appear concentrated among younger cohorts (Hartog et al., 2022) and graduates post-VET expansion (Ferreira and Martins, 2026).

Studies comparing dual and school-based VET generally find more favorable labor market outcomes for dual systems, although these effects may depend on institutional contexts and characteristics. A cross-country study by Bolli et al. (2021) exploring the effects of enrollment in school-based and dual VET finds mixed effects for school-based VET systems, which vary by outcomes and countries. By contrast, dual VET is associated with increased labor market integration and job quality outcomes. Adding to this discussion, Dustmann and Schönberg (2012) compared firm-based training in the UK and Germany and argued that the success of dual VET systems depends on the commitment of firms to training, which is influenced and supported by robust institutional structures. Exploiting the expansion of dual VET programs in Spain, Bentolila et al. (2023) show that, compared to traditional school-based VET, dual VET graduates experience increases of 25% and 42% in total days of work and earnings, respectively, in the first two years after graduating, as well as a significant increase in job retention rate in the first year. However, the authors find no significant effects on job quality measures such as access to full-time or open-ended positions. In France, a predominantly school-based system, Cahuc and Hervelin (2024) test whether work-based VET yields better results, measured by interview callbacks, than a school-based VET pathway when leading to the same qualification. They conclude that work-based VET may have limited effects in a predominantly school-based system, suggesting the need for strong collaborations with VET actors/stakeholders.[4]

[4] Kreisman and Stange (2020) also point to the importance of other institutional characteristics in VET success, showing how curricular design, namely the level of specialization and intensity of VET curriculum, is key to students' post-graduation outcomes. As such, differences between VET tracks/types reinforce how important links with firms and curricular design are to facilitate and improve youth's school-to-work transitions.

Additionally, educational attainment constitutes a key mechanism underlying the lifecycle hypothesis. A consistent finding across contexts is that VET reduces dropout risk and increases upper secondary completion. Using a regression discontinuity design in Sweden, Taghizadeh and Österman (2025) show that vocational education decreases the probability of early dropout and NEET status in early adulthood relative to academic tracks. Similar positive graduation effects are found in oversubscribed technical schools in the United States (Brunner et al., 2023; Dougherty, 2018). For Portugal, Ferreira and Martins (2026) exploit random variation in the availability of vocational courses across public schools and find substantial increases in on-time upper secondary completion (up to 50 percentage points), increasing further among low-achieving and disadvantaged students. However, vocational enrollment is often associated with a lower probability of pursuing tertiary education (OECD, 2025). General upper secondary education typically provides direct pathways to higher education, whereas some vocational programs restrict or hinder such progression (Taghizadeh and Österman, 2025). Since higher education attainment is strongly associated with improved labor market outcomes, reduced tertiary participation represents a potentially important channel through which long-run differences between tracks may arise.

Overall, the empirical literature supports the existence of dynamic trade-offs, but outcomes may depend critically on institutional settings, particularly the strength of school–firm linkages and the permeability between vocational and academic pathways. Moreover, much of the evidence focuses on medium- and long-run dynamics, leaving short-term transition outcomes comparatively underexplored, particularly in predominantly school-based systems. Portugal provides a relevant setting, as vocational programs are largely school-based and offer more limited work-based learning components (institutional context provided in the next section).

Regarding young people's transitions to the labor market, educational institutions play an important role and contribute to country differences in school-to-work transitions in Europe (Zimmermann et al., 2013; Pastore et al., 2021). Evidence suggests that Mediterranean countries tend to experience longer transitions into stable employment when compared to other European contexts. In this context, the NEET status, referring to "Not in Employment, Education or Training", has gained relevance (O'Higgins, 2025). Typically used to characterise young people aged between 15 and 34, the NEET status is associated with a heightened risk of long-term unemployment, which can lead to further consequences such as social exclusion or inactivity in the labor market (Eurofound, 2012; Simões, 2024). It emerges from an interplay of individual, family, and macroeconomic elements/characteristics (Mascherini, 2019; Rahmani and Groot, 2023; Rahmani et al., 2024). Despite the extensive literature on the determinants, causal evidence linking upper secondary track choice to NEET outcomes remains scarce, particularly in school-based systems. Using cross-country panel data, Bolli et al. (2021) find that enrollment in vocational programs (school-based or dual VET) does not significantly increase NEET incidence relative to general education. To our knowledge, quasi-experimental evidence on the effect of vocational enrollment on subsequent NEET status is limited to the Swedish context (Taghizadeh and Österman, 2025). See also Cahuc et al. (2026) for an evaluation of counsellor intervention in France (which has a school-based VET context) aimed

at vocational students who do not want to pursue further education.

3 Institutional Context

The Portuguese educational system is characterized by 12 years of mandatory education or until the student turns 18 years old. Students typically initiate their schooling at the age of 6 or 7. During the first nine years, all students follow the same structure: four years of primary education (1st to 4th grade), two of upper primary (5th and 6th-grade), and three years of lower secondary education (7th to 9th-grade). As they enrol in upper secondary school, the 10th-grade, students are required to choose between two main pathways: the general/academic track or the vocational track.

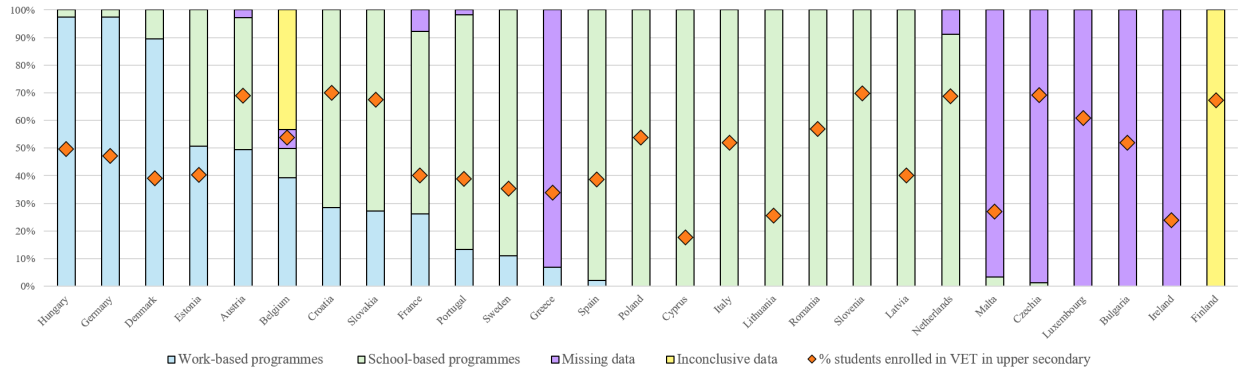
Vocational schools, established in 1989, were developed regionally by a network of local organisations and civil society institutions, and were run on a private and autonomous management model. In 2004/2005, vocational courses were introduced in pre-existing public secondary schools as a trial, and after 2006, these courses were established in secondary schools throughout the country. This major expansion in VET offering, motivated by high rates of early school leaving, led to a rise in participation in this type of courses. enrollment of upper secondary students in VET increased from 13% in 2006 to 31% in 2010[5] (DGEEC, 2025). In 2023/2024, around 39% (61%) of all students enrolled in upper secondary were in the VET (academic) track. "Professional courses" (Cursos Profissionais) correspond to the most popular option within vocational programs, accounting for 32.7% of all students enrolled in upper secondary school. "Apprenticeship Courses" (Cursos de Aprendizagem), the second most prominent option, encompassed 4.4% of students. All other VET tracks have collectively less than 1% of students (DGEEC, 2025). Academic track graduates are granted ISCED level 3, while VET graduates ISCED levels 3 and 4. Upon completion of compulsory upper-secondary education, students are typically 17 or 18 years old. Although VET graduates are formally eligible to enter higher education, progression through this route has historically been less common than among academic-track students. Nevertheless, their participation in higher education has increased substantially over the last decade, from 4.8% in 2013/2014 to 20.6% in 2022/2023, partly reflecting the expansion of professionally oriented short-cycle tertiary programs (CTeSP) (Silva et al., 2025).

At the upper secondary level, VET courses are offered in 7 distinct fields of study: "Arts and Humanities", "Business and Law", "Information and Communication Technologies", "Engineering, Manufacturing and Construction", "Agriculture, Forestry, Fisheries and Veterinary Sciences", "Health and Social Protection" and "Services"[6] (Tables A.1 and A.2 in the Annex for further details). VET courses can be found in public and private institutions. Evidence from 2023/2024 shows that 56% of all VET students in upper secondary were enrolled in public institutions (DGEEC,

[5]Calculations do not include adult-focused programs.

[6]The availability and provision of VET courses at the national and regional levels are determined by multiple criteria. These criteria include the proportion of courses offered in the previous year, the past performance of each course (e.g. employability and completion rates) and sustainability and cohesion considerations. The latter rely on regional-based aspects such as available partnerships and the avoidance of redundant provision in the area.

Figure 1: Share of upper-secondary students enrolled in VET and distribution between school-based and work-based VET programs, European Union countries, 2021



Source: Own calculations based on ISCED Mappings 2022 (European Commission, 2022) on initial VET programs at the upper secondary level. Own calculations based on the total and VET number of pupils enrolled in upper secondary (Eurostat, 2026).
Notes: Work-based programs correspond to programs identified as "apprenticeships" and "long internships" in which work-based learning takes more than 50% and 25% of the curricula, respectively. School-based VET programs correspond to short internships (less than 25% of the curricula), optional work-based component and no work-based component (OECD, 2023a). The "Inconclusive" category includes programs identified under multiple categories above. Missing reflects VET programs not identified under any category.

2025). It is important to note that private VET schools are also publicly funded and that students do not incur additional tuition fees. While public schools offer a broader number of VET courses, private institutions tend to be more dynamic in their offering, investing in underexplored and innovative fields (Barbosa, 2023).

As discussed above, VET systems differ in the extent to which training takes place in the workplace rather than in educational institutions. A common distinction is between three main models: dual systems, formal apprenticeships, and school-based VET. As Figure 1 illustrates, European VET systems vary considerably along two dimensions: their relative importance within upper-secondary education, measured by the share of students enrolled in vocational programs, and their mode of provision, measured by the distribution of enrollment between school-based and work-based VET.

Within this European context, Portugal has a well-established vocational sector, ranking around the middle of the distribution in terms of the share of upper-secondary students enrolled in vocational education. At the same time, almost 90% of Portuguese upper-secondary VET students are enrolled in school-based programs, making Portugal a particularly relevant setting in which to study school-to-work transitions in a vocational education system characterized by relatively weak school–firm integration. In Portugal, this model corresponds almost entirely to "Professional courses". According to Martins et al. (2025), students in these courses devote around 81% of their three-year training to school-based or classroom-based components: 35% to Technological subjects, 31% to Sociocultural subjects, and 15% to Scientific subjects. Workplace training accounts for the

remaining 19% of training hours. This institutional context contributes to the novelty of our analysis, since closely related studies, such as (Birkelund and van de Werfhorst, 2022; Silliman and Virtanen, 2022), examine settings with more integrated school- and work-based curricula.

4 Data and descriptive statistics

4.1 Data

The analysis draws on three linkable datasets: i) a post-secondary survey, the Observatory of Upper Secondary Students' Trajectories (OTES, Observatório de Trajetos dos Estudantes do Ensino Secundário); ii) official administrative education records (Estatísticas Oficiais da Educação); and iii) national exam scores from lower secondary education (ENEB, Exames Nacionais do Ensino Básico).

The OTES survey is coordinated by the Directorate-General for Education and Science Statistics (DGEEC) and follows students longitudinally through three different surveys in upper secondary school: 1) "Entrance to Upper Secondary Education Survey" for students in 10th-grade or equivalent; 2) "Exit from Upper Secondary Education Survey" for 12th-grade students or equivalent; and 3) "Post-Secondary Education Survey," conducted 14 months after the expected completion of upper secondary education. Not all cohorts participate in all three survey waves. The data comprise both "full cohorts", observed at entry, exit, and post-secondary follow-up, and "semi-cohorts", observed only at exit and post-secondary follow-up. The survey design alternates between "full' and "semi-cohorts" across waves[7]. Our analytical sample is drawn from respondents to the OTES post-secondary survey, conducted 14 months after the expected completion of upper secondary education. Participation in this follow-up depends on prior OTES participation and the availability of valid contact information: "semi-cohort" students are followed through the exit survey, while "full-cohort" students may be followed through the entrance and/or exit surveys. This sampling structure limits our ability to capture earlier dropout margins and may underrepresent students who are harder to follow. We assess this concern through survey-selection checks and comparisons between the weighted analytical sample and official statistics (see below).

Population-level administrative education data, compiled by the Ministry of Education, is linked to the OTES survey. These records provide individual, socioeconomic, and academic characteristics for 79,517, representative of 354,394 students[8]. We also link students to their lower-secondary national exam scores in Portuguese and Mathematics.

Based on this unique dataset, we get information on our treatment of interest - vocational or academic track selected in upper-secondary education - a decision students make at the end of 9th-

[7] See table B.1 in the Annex for detailed cohort coverage.

[8] As the survey is sample-based, statistical inference is used to estimate population totals. Each individual in the sample is assigned a sampling weight, allowing them to represent the corresponding subgroup of the population with similar characteristics. The sampling weights are calibrated by DGEEC using administrative data and are computed specifically for the post-secondary survey. The weighting factors include age, upper secondary track choice, sex, region, guardians' educational attainment, and type of institution. See annex B.2 for comparison to official statistics.

grade. We define treatment as the track selected by students on their first year of upper secondary school (10th-grade), following their last enrollment in lower secondary school (9th-grade).[9] We exclude students with missing 9th- or 10th-grade enrollment information (4.6% of the sample).

Our main instrumental variable is defined as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. The variable is calculated as a leave-out percentage, i.e, the choice of each individual is not included in the number of classmates that choose VET nor in the class size. The instrumental variable leverages variation at the class level to predict each student's own track choice in 10th-grade (peer effect). We exclude 3,012 observations (3.8%) due to missing class identifiers for the 9th-grade class. Additionally, to reduce the impact of missing values in track choice on the class-level measure, we follow a similar approach to Firmino et al. (2018) and restrict the sample by using only the non-missing information from a given class up to a maximum of 3 missing values. Students in classes with four or more missing values for 10th-grade track choice are dropped (6.5%).[10]

The dataset also includes a rich set of individual socio-demographic characteristics, measured in 9th-grade, including gender, age, nationality, social welfare status, individual academic performance, the legal guardian's educational attainment, and the guardian's labor status and occupation. At the 9th-grade class level, we compute class size and several measures of class composition, including the shares of females, students with foreign nationality, low-income students, students scoring below the national median for their cohort, students whose guardians have completed at most lower secondary education, and students whose guardians are not employed. The variables on class composition are all "leave-out percentages" as we exclude the contribution of student i when computing them.

The original dataset includes students enrolled in classes of extremely small or large size in relation to what is stipulated by law: a minimum 24 and a maximum of 30 students. Similarly to Firmino et al. (2018), we give some leeway for exceptional cases of small/large schools, and exclude classes with less than 14 students and more than 34. The number of students excluded using this threshold is marginal (1.2%).

We assess selection into the final analytical sample in two ways. First, we compare included and excluded observations using observable characteristics (refer to Table B.3 in the Annex). Although track choice, gender, age, nationality, and guardians' employment status predict attrition, the estimated differences are small in magnitude. Second, we compare weighted observable characteristics of the final analytical sample with official statistics for the corresponding student population (see Table B.4 in the Annex). The absence of large differences across key demographic, socioeconomic and track-choice variables mitigate concerns about non-response in the OTES post-secondary survey along observed dimensions. However, we cannot rule out selection on unobserved characteristics.

[9] In our main analysis, we only consider the last observation of each student in 9th-grade as students may enrol in 9th-grade more than once due to retentions.

[10] As our analysis only covers the period after the implementation of mandatory schooling until the end of upper secondary school or until age 18, missing values correspond to missing data and not to students who drop-out after lower secondary school.

The final analytical sample consists of 67,577 students (85% of initial sample), who graduated from lower secondary education (9th-grade) between 2011/12-2017/18, and enrolled in the last year of upper secondary school between 2014/15-2020/21.

4.2 Descriptive Statistics

For analytical purposes, we apply the sampling weights provided by DGEEC, making our sample representative of 296,037 upper secondary students in mainland Portugal between 2015 and 2021. Figure 2 shows how the number and distribution of students evolved in Portugal during this period. Even though the total number almost doubled , from 40,000 students to almost 80,000 a year, the share choosing the academic (vocational) track in the 10th-grade remained fairly constant at 75% (25%). We explore trends across three main post-secondary outcomes of interest: 1) being employed, 2) being in education, or 3) being NEET. In line with the literature, VET students are the majority of those working 14 months after upper secondary education, while academic students make up more than 80% of those continuing in formal education. Pupils enrolled in the vocational track consistently represented the majority of students with NEET status.

Table 1 presents descriptive statistics for the weighted sample. Regarding the main outcomes, 76% of students are in formal education, 26% are employed and 6% are NEET one year after their last enrollment in upper secondary school[11]. It is important to note that 99% of students classified as being in education are enrolled in post-secondary or tertiary education, with the remainder still in secondary school. Given this near-complete overlap, we refer to this category as "further education" throughout the remainder of the paper. Also, 97% of students classified as NEET report being unemployed rather than inactive. While the self-reported nature of the survey may lead to some overstatement of unemployment relative to inactivity as we cannot verify whether individuals are actively searching for work, this high degree of overlap suggests that NEET status in our data largely reflects unemployment.

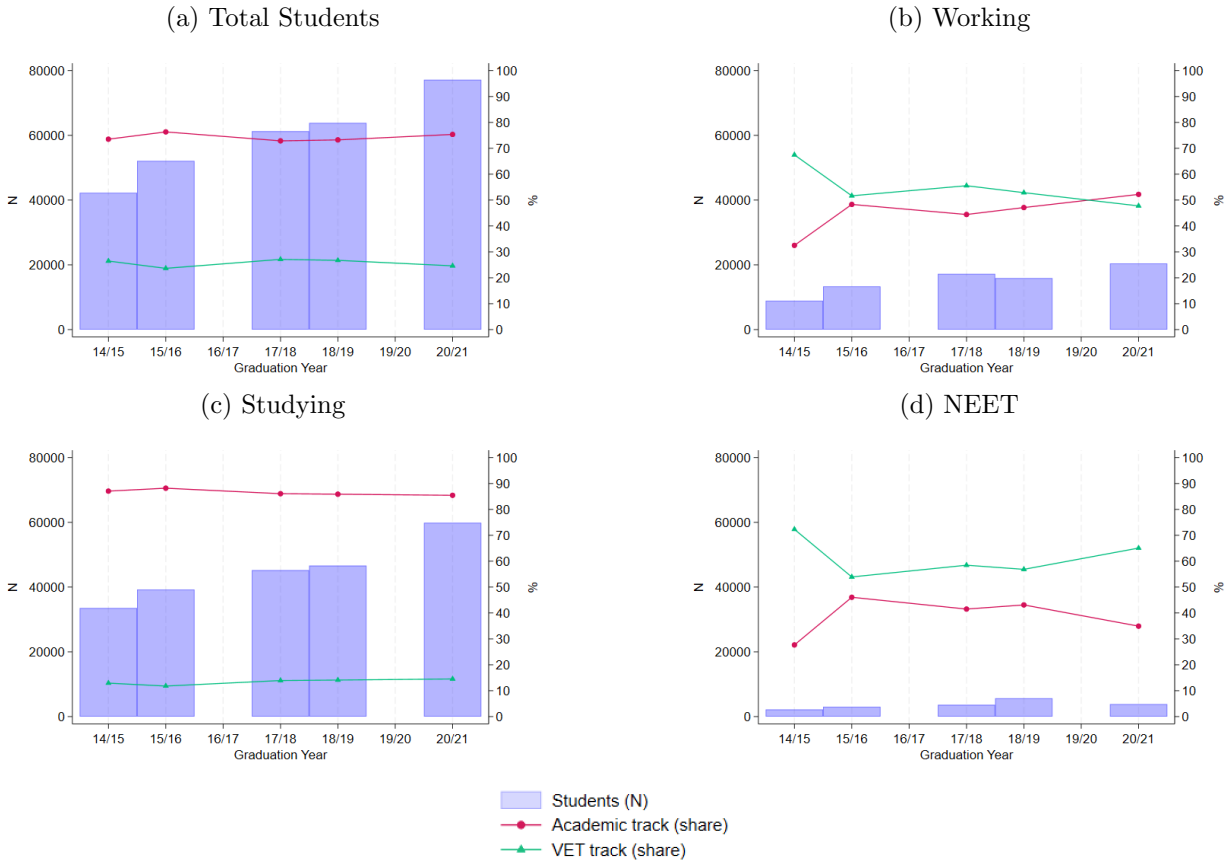
Regarding the job quality indicators, there is a higher incidence of full-time employment relative to part-time (14% and 8%, respectively), and of fixed-term contracts relative to open-ended (13% and 8% respectively). Additionally, 20% of individuals are salaried workers, 6% secured employment before graduation, and 10% report being in a job aligned with their future expectations.

On average, 26% (74%) of students had selected the vocational (academic) track when they first enrolled in upper secondary education[12]. In the sample, 57% of students are girls, the average age in 9th-grade is 14.25 years, and the majority do not receive welfare support (67%). The average score on the 9th-grade Portuguese exam is 61.56 (out of 100) and the average score on the Mathematics exam is 55.58. The mean internal grade in 6th-grade Portuguese is 3.67 (on a 5-point scale),

[11] Employment and education are not mutually exclusive outcomes, so the shares do not sum to one. We report these outcomes separately to capture both dimensions of post-secondary trajectories. The share of individuals simultaneously in employment and education is relatively small (7%).

[12] According to official statistics, 36% of students had completed vocational upper secondary education during the same period (DGEEC, 2024). The lower share observed at initial enrollment is explained by track switching during upper secondary education: in our sample, 12% of students switched from the academic track at first enrollment to the vocational track by their final enrollment.

Figure 2: Evolution of upper secondary students by post-secondary outcome and track



Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: This Figure presents the total number of students exiting/graduating from upper secondary education in Portugal between 2014/15 - 2020/21. Data is not available for 2016/17 and 2019/20. Panel (a) shows the number of students by cohort and the share of students in the academic vs vocational track according to first enrollment in upper secondary. Panels (b), (c) and (d) show the number of students by post-secondary outcome and the respective shares by upper secondary track.

whereas the corresponding mean grade in Mathematics is 3.59. Regarding the guardians' profile, 44% completed up to lower secondary, 22% up to upper secondary and 23% tertiary education. The vast majority are employed (70%), 9% are unemployed, and 11% are inactive. The average class has 23.36 students.

The Table also presents summary statistics separately for academic and vocational track students. It shows that VET students are more likely to transition to the labor market (53%) rather than to further education (40%) one year after upper secondary education, whereas academic students show a strong preference for continuing studying as opposed to working (88% vs 16%). NEET incidence is particularly larger in VET students (15% vs 3%).

The Table also underscores that the socio-demographic and economic profiles of students differ markedly across tracks. VET students are mainly male, slightly older, concentrate a higher per-

Table 1: Summary Statistics by Upper Secondary Track

	Total			Academic			Vocational		
	Mean	SD	n	Mean	SD	n	Mean	SD	n
Outcome variables, post-secondary (Survey data)									
Working	0.26		67577	0.16		54299	0.53		13278
Studying	0.76		67577	0.88		54299	0.40		13278
Work & Study	0.07		67577	0.07		54299	0.08		13278
NEET	0.06		67577	0.03		54299	0.15		13278
Full-time employment	0.14		67577	0.07		54299	0.36		13278
Part-time employment	0.08		67577	0.07		54299	0.10		13278
Salaried employment	0.20		67577	0.12		54299	0.42		13278
Open-ended contract	0.08		67577	0.05		54299	0.20		13278
Fixed-term contract	0.13		67577	0.08		54299	0.25		13278
Job secured before graduation	0.06		67577	0.05		54299	0.09		13278
Job aligned with future job expectations	0.10		67577	0.05		54299	0.23		13278
Treatment variable, first 10th-grade (Admin data)									
VET	0.26		67577	0.00		54299	1.00		13278
Individual characteristics, 9th-grade (Admin and Exams data)									
Female	0.57		67577	0.60		54299	0.48		13278
Age	14.25	0.58	67577	14.12		54299	14.63		13278
Foreigner	0.02		67577	0.02		54299	0.03		13278
Social welfare recipient	0.33		67577	0.27		54299	0.49		13278
PT exam score	61.56	16.45	65350	65.12	15.60	53182	50.45	13.88	12168
Maths exam score	55.58	25.57	65418	62.12	23.65	53231	35.25	20.03	12187
Guardian's education level									
Lower secondary	0.44		67577	0.36		54299	0.64		13278
Upper secondary	0.22		67577	0.24		54299	0.19		13278
Post-secondary/Tertiary	0.23		67577	0.28		54299	0.09		13278
Missing values	0.11		67577	0.12		54299	0.08		13278
Guardian's labor status									
Employed	0.70		67577	0.72		54299	0.66		13278
Unemployed	0.09		67577	0.08		54299	0.12		13278
Inactive	0.11		67577	0.09		54299	0.16		13278
Missing values	0.10		67577	0.11		54299	0.06		13278
Guardian's occupation									
0 - Armed Forces Occupations	0.01		67577	0.00		54299	0.01		13278
1 - Legislators, Senior Officials, and Managers	0.06		67577	0.07		54299	0.04		13278
2 - Professionals of Intellectual and Scientific Activities	0.18		67577	0.22		54299	0.07		13278
3 - Technicians and Associate Professionals	0.07		67577	0.08		54299	0.05		13278
4 - Clerical Support Workers	0.11		67577	0.12		54299	0.10		13278
5 - Service and Sales Workers; Personal and Protective Services	0.18		67577	0.17		54299	0.22		13278
6 - Skilled Agricultural, Forestry, and Fishery Workers	0.01		67577	0.01		54299	0.02		13278

Continued on next page

Table 1: Summary Statistics by Upper Secondary Track – continued

	Total			Academic			Vocational		
	Mean	SD	n	Mean	SD	n	Mean	SD	n
7 - Craft and Related Trades Workers (Industry and Construction)	0.14		67577	0.11		54299	0.21		13278
8 - Plant and Machine Operators and Assemblers	0.05		67577	0.04		54299	0.08		13278
9 - Elementary Occupations (Unskilled Workers)	0.07		67577	0.06		54299	0.12		13278
Missing values	0.11		67577	0.12		54299	0.09		13278
Individual characteristics, 6th-grade (Admin data)									
PT internal grade	3.67	0.76	52528	3.85	0.75	42007	3.16	0.53	10521
Maths internal grade	3.59	0.91	53253	3.80	0.88	42603	2.99	0.69	10650
Class composition, 9th-grade (Admin and Exams data)									
Students per class (number)	23.36	4.09	66620	23.65	4.07	53639	22.48	4.05	12981
% females	0.51	0.12	67576	0.51	0.12	54299	0.50	0.13	13277
% foreigners	0.03	0.05	67576	0.03	0.05	54299	0.03	0.06	13277
% welfare recipients	0.35	0.20	67576	0.33	0.20	54299	0.42	0.19	13277
% PT exam score below median	0.42	0.18	65350	0.40	0.18	53182	0.47	0.17	12168
% Maths exam score below median	0.42	0.20	65418	0.40	0.20	53231	0.48	0.19	12187
Average internal grade, 6th-grade PT	3.52	0.31	52528	3.56	0.31	42007	3.40	0.28	10521
Average internal grade, 6th-grade Maths	3.43	0.38	53253	3.48	0.37	42603	3.28	0.36	10650
% guardians with up to lower secondary education	0.46	0.26	67576	0.43	0.25	54299	0.55	0.24	13277
% non-employed guardians	0.22	0.15	67576	0.20	0.15	54299	0.25	0.15	13277
Instrumental variables, class-level, first 10th-grade (Admin and Exams data)									
% VET per class	0.29	0.18	67576	0.26	0.17	54299	0.38	0.19	13277
% VET per gender-class	0.25	0.19	67577	0.22	0.18	54299	0.35	0.20	13278
% VET per 9th-grade PT-class	0.25	0.24	65347	0.20	0.20	53179	0.41	0.26	12168
% VET per 9th-grade Maths-class	0.24	0.25	65414	0.19	0.21	53227	0.43	0.27	12187
% VET per 6th-grade PT-class	0.26	0.27	50707	0.20	0.24	40526	0.45	0.27	10181
% VET per 6th-grade Maths-class	0.27	0.28	51530	0.20	0.25	41171	0.46	0.29	10359
% VET per school	0.29	0.13	67577	0.28	0.13	54299	0.35	0.13	13278

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: "n" denotes the unweighted sample. "Academic" and "Vocational" refer to students who enroll in the academic and vocational tracks, respectively, in their first year of upper secondary school. Outcomes are dummy variables indicating the student's occupation one year after upper secondary school, and zero otherwise. "Working" and "Studying" are not mutually exclusive. "VET" is the treatment dummy variable equal to one if the student enrolls in vocational education and training in their first upper secondary enrollment. "Individual characteristics" refer to students and their parents/guardians in 9th grade; if guardian variables are missing, values from the previous school year are used when available. Randomness tests for missing values are reported in Table B.5 in the Annex. "Class characteristics" are measured at the class-school-cohort level in grade 9. "Proportion VET per class", the main instrumental variable, is the share of a student's grade 9 classmates who enroll in VET in the first year of upper secondary school. Other instrumental variables are described in Figure D.8 in the Annex.

centage of social welfare beneficiaries, and have lower academic performance. On average, their guardians have lower formal education, are more likely to be unemployed or inactive, and are in lower qualification jobs. The individual characteristics are also reflected at the class level. VET students therefore tend to come from classes characterised by higher shares of welfare recipients, guardians with lower levels of formal education, and guardians who are not employed, as well as from smaller classes.

We note that, on average, the share of classmates choosing the vocational track in upper secondary is larger for VET students as compared to academic (38% vs 26%), providing initial support for the relevance of our instrumental variable. The same applies to variations of the instrumental variable, by gender, grades or at the school-level.

The descriptive analysis supports our main hypotheses: (1) vocational education facilitates an early transition into the labor market, at the expense of participation in further education; and (2) VET students are more prone to becoming NEET. However, it is clear that the pool of students entering each track differs in terms of observable (and potentially unobservable) characteristics, which need to be accounted for in order to make any causal claims regarding these hypotheses.

5 Identification and Estimation Strategy

5.1 Identification

We are interested in estimating the causal effect of track choice at the upper secondary level on early post-secondary outcomes. Causal interpretations are frequently threatened by self-selection in educational choices. In other words, students' educational choices likely correlate with unobserved traits and preferences that also determine post-secondary outcomes (ability, motivation or socio-economic background). In the Portuguese setting, upper-secondary enrollment and admission are fully decentralised, meaning that there are no admission cut-offs that can be exploited for identification, unlike in Silliman and Virtanen (2022). Thus, to identify a causal effect, we use an instrumental variable (IV) approach, similar to Birkelund and van de Werfhorst (2022) and exploit the variation in lower secondary peer groups to isolate the effect of vocational education on post-secondary outcomes (see Figure C.1 in the Annex for a graphical representation).

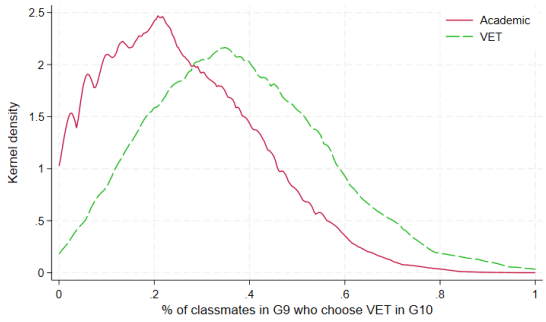
Specifically, we consider the proportion of classmates in a pupil's 9th-grade class electing the vocational track in their first 10th-grade as our instrumental variable. To obtain consistent estimates, we make the following assumptions on the instrument: (a) it is associated with the endogenous regressor — individual track choice; (b) it has no direct causal relationship with the outcomes except through its effects on the individual track choice; and (c) it does not share confounders with potential outcomes and treatment choices (Angrist and Pischke, 2009). In other words, we argue that educational decisions of lower secondary peers influence the individual student's concurrent upper secondary choice but not their post-secondary outcomes four years later. Additionally, the variation the instrumental variable shares with individual track choice is likely uncorrelated with the error term, i.e., it is not confounded by unobserved characteristics.

5.2 Identification Assumptions

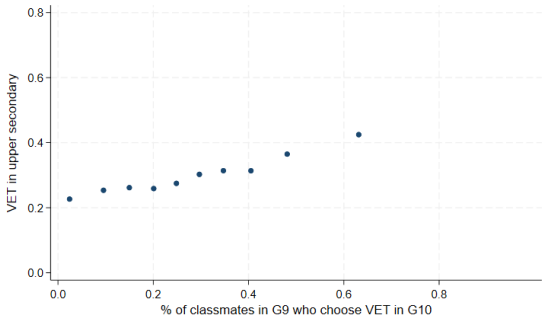
Our research design is only feasible if peer educational choices are a strong predictor of individual choices. Empirical research using quasi-experimental estimation techniques finds large and significant effects of school peers' educational decisions on the decision of the individual student (Rosenqvist, 2018; Fletcher, 2015; Luppino and Sander, 2015). We investigate support for the assumption in our sample. Table 1 shows that on average VET students come from classes in which a higher proportion of their peers also pursue the vocational track, supporting the relevance of this instrument in this context. This is further corroborated by the distribution of the instrumental variable separately for both tracks. Figure 3, panel (a) shows a pronounced shift in the percentage of peers pursuing VET for students who themselves choose VET in their upper secondary education. Figure 3, panel (b) visually shows that conditional on individual and class observable characteristics, vocational enrollment increases monotonically and approximately linearly with the percentage of lower secondary peers choosing vocational education in upper secondary education.

Figure 3: Individual track choice and peer choices

(a) Distribution



(b) Binscatter of first-stage estimation



Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: Panel (a) plots the kernel density (Epanechnikov kernel) of the instrumental variable, separately for academic and VET students. Panel (b) plots the first-stage relationship between treatment choice and the peer effect instrument through a binscatter least squares estimation (Cattaneo et al., 2024, 2025). It shows the average proportion of students choosing VET in upper secondary within quantile-spaced bins of the relevant instrument, while controlling non-parametrically for the full control set.

The exclusion restriction requires that peer effects in lower secondary affect post-secondary outcomes only through track choice. In this respect, identification could be a concern if peer networks affect outcomes directly, for example in the case of persistent networks or shared environments. We argue this concern is mitigated in the Portuguese institutional context because the peer network immediately preceding the post-secondary transition, at the end of upper secondary education, typically differs from the lower secondary network used to construct the instrument. In our sample, peer networks exhibit substantial turnover: in an average 9th-grade class of 23 students, only

around 2 students (7.4%) remain in the same 12th-grade class [13], and overlap at the school district level[14] declines from 50% in first 10th-grade to 30% in the last 12th-grade. Additionally, in the sensitivity analysis, we relax this assumption by focusing on students who are effectively required to form new networks because their lower secondary school does not offer an upper secondary program.

Nonetheless, the instrument still needs to be as good as randomly assigned with respect to students' potential outcomes and treatment choices, conditional on the implicit control set. Concerns arise if the estimated first-stage peer effects are confounded by unobserved factors that correlate with post-secondary outcomes. The main threats relate to the endogeneity of peer effects in relation to educational choices (Manski, 1993; Sacerdote, 2011) and the sorting of students between and within schools, which we discuss next in further detail.

A central challenge, well-documented in the peer effects literature and first formalised by Manski (1993), is the reflection problem which arises because peers simultaneously influence one another, making it difficult to disentangle the direction of causality (group to individual or individual to group). This concern is mitigated by the relatively large size of the peer group — classes contain on average 23 students — so that the mechanical influence of any single individual on the peer measure is limited (Birkelund and van de Werfhorst, 2022).

A related challenge is the presence of correlated effects, whereby peers' educational choices are correlated with underlying characteristics, such as socioeconomic background or prior achievement, that may themselves directly influence individual outcomes (Manski, 1993). For instance, classmates from more advantaged backgrounds may both be more likely to choose the academic track and contribute to a more favorable learning environment, thereby affecting student i's performance and subsequent track decision independently of peers' choices (Birkelund and van de Werfhorst, 2022). To isolate the effect of peers' educational decisions in the empirical analysis, we control for a range of pre-determined class characteristics. We include leave-out measures of class composition, including demographic characteristics, socioeconomic background, and performance, to account for any reflection bias and correlated peer effects. The demographic and socioeconomic class variables, while measured in 9th-grade, are predetermined with respect to upper secondary track choice (individual and peers) and are not affected by peers' upper secondary track decisions. While they are correlated with the instrument by construction, conditioning on them does not violate the exclusion restriction.[15] Instead, it helps to isolate variation in peers' vocational choices that is orthogonal to observable peer characteristics.

A final challenge derives from the potential non-random allocation of students between and within schools — unobservable factors that affect sorting into classes and schools and also affect track choice and outcomes. In this context, idiosyncratic features at the school and class-levels, such as principal and teacher characteristics, are a potential source of bias. A common tool to account for sorting between schools is to include school fixed effects. These control for selectivity that is

[13] Defined as class-school-cohort.
[14] Defined as school-cohort.
[15] Balance tests are presented in Table C.3 in the Annex.

school specific and constant over time, namely the profile of students it attracts, but also school specific policies with respect to class formation. Including school fixed effects helps to interpret the estimated effect as if students had been randomly allocated across schools[16].

The non-random allocation of students to classes may induce a backdoor association between peer effects and student's post-secondary outcomes. We argue that the entities responsible for class assignment are likely to have taken into account students' individual characteristics during the class formation process, such as gender, nationality, socioeconomic background and prior academic achievement (Firmino et al., 2018). We account for this by including a rich set of individual variables which aim to control for possible correlations between 9th-grade class assignment and pre-determined factors.

Finally, Tables C.1 to C.3 in the Annex assess the plausibility of the conditional exogeneity assumption by means of balance tests on observed pre-determined covariates. This way we assess covariate balance with respect to conditional changes in the share of students within each 9th-grade class choosing VET in upper secondary. The results suggest some imbalances along observed dimensions. Some of the covariates may also be directly related to post-secondary transitions, and could therefore confound the relationship between the instrument and the outcome of interest[17]. To address this concern, our preferred specifications condition on a rich set of individual and leave-out class-level controls. Additionally, section 6.3 provides several sensitivity analyses designed to assess whether the estimated effects are robust to alternative control sets, fixed effect structures, and restrictions on the identifying variation. While these tests cannot fully replicate experimental variation, they provide a transparent assessment of the extent to which the results are driven by observed class sorting. In sum, conditional on the set of observable individual characteristics and peer composition measures, one is closer to isolating the effect of vocational education on post-secondary outcomes.

5.3 Estimation Strategy

The benchmark model to estimate the effect of upper secondary track choice on post-secondary outcomes is given by:

$$Y_i = \beta VET_i + \gamma_1 X_i + \gamma_2 X_{i,(-i)} + \lambda_s + \tau_{rt} + u_i \tag{1}$$

where Y_i is a binary indicator for the post-secondary outcome of student i, who attended school s in region r and cohort t in 9th-grade; β is the causal estimate of interest; VET_i is a dummy equal to one if individual i registers in a VET course in their first year of upper secondary school, and zero if they register in an academic course; X_i is a vector of control variables at the student-level in 9th-grade, and $X_{i,(-i)}$ is a vector of control variables at the 9th-grade class-level, excluding individual i from the calculation. Finally, λ_s and τ_{rt} are, respectively, school and region-by-year

[16] We include 9th-grade school fixed effects in the main specification, but also test robustness across 9th-grade school-cohort fixed effects.

[17] Annex C.1 provides further discussion.

fixed effects, while u_i is the error term. The school and region-year fixed effects seek to capture systematic differences in outcomes across schools, regions, and time that may be correlated with peer choices and also influence individual outcomes. Moreover, since the period considered is long enough to include different stages of the business cycle, region-year fixed effects are also important to capture the schooling effects of fluctuations in local economic conditions.

In the baseline specification, X_i includes sex, age, foreign nationality, socioeconomic status (proxied by welfare support status), legal guardian's education level, employment status and occupation. In turn, $X_{i,(-i)}$ includes class size and a set of class-level composition measures, namely the shares of girls, welfare recipients, foreign students, students whose guardians have no more than lower secondary education, and students whose guardians are not employed.

The model is estimated using a two-stage IV approach, where the variation in the endogenous regressor, VET_i, is instrumented with the variation in lower secondary peers' track choice. The arguably idiosyncratic variation used to predict an individual's track choice is the difference in the choice of their classmates which varies across classes, within the same school. The IV approach identifies a local average treatment effect (LATE) for students who comply by conforming to peers' educational decisions, namely students at the margin between choosing the academic and the vocational track (Angrist and Pischke, 2009). Consequently, this strategy identifies the effect of upper secondary track on students whose choices are sensitive to peer behaviour, not the effects for all students. The interpretation of the IV estimates therefore speaks most directly to policies that affect track choice through information, peer exposure, or school environments, rather than to policies that mechanically change access to vocational programs.

6 Results

6.1 Main Results

Table 2 starts by presenting the OLS regressions (columns 1-3) followed by IV estimates (columns 4-6). Tables D.1, D.2, D.3 in the Annex show the estimates on the full model, including on the control variables. As aforementioned, the OLS estimates on the impact of upper secondary track represent a mixture of causal effects and selection. As a first step towards approximating causal returns, we estimate OLS regressions with a rich control set — model (2) adds individual-level controls and model (3) includes individual- and class-level controls. The results support the initial hypothesis: VET enrollment, as opposed to academic, significantly increases the probability of employment one year after upper secondary education; at the same time, VET enrollment significantly decreases the probability of participating in further education. We also find support for the second hypothesis: there is a positive and significant impact of VET enrollment on the probability of becoming NEET one year after upper secondary education. However, due to self-selection and despite the elaborate control set, the remaining omitted variable bias in the controlled OLS estimates might well be substantial.

The IV estimates use the share of lower-secondary classmates who subsequently enrol in vo-

Table 2: Impact of VET enrollment on post-secondary outcomes

Estimation Method:		**OLS**			**IV**	
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.: 1 - Working; 0 - Otherwise						
VET	0.356***	0.280***	0.279***	0.533***	0.403***	0.337***
	(0.006)	(0.007)	(0.007)	(0.031)	(0.046)	(0.052)
[$Mean = 0.209$]						
Dep. Var.: 1 - Studying; 0 - Otherwise						
VET	-0.457***	-0.359***	-0.357***	-0.676***	-0.510***	-0.397***
	(0.006)	(0.007)	(0.007)	(0.030)	(0.044)	(0.050)
[$Mean = 0.806$]						
Dep. Var.: 1 - NEET; 0 - Otherwise						
VET	0.108***	0.082***	0.081***	0.168***	0.126***	0.093***
	(0.004)	(0.004)	(0.004)	(0.020)	(0.030)	(0.034)
[$Mean = 0.055$]						
G9 School FE	Yes	Yes	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls		Yes	Yes		Yes	Yes
Class-level controls			Yes			Yes
First-stage coefficient	.	.	.	0.542***	0.358***	0.343***
Cragg-Donald Wald F statistic	.	.	.	2002.6	1007.4	740.5
Kleibergen-Paap F statistic	.	.	.	901.1	464.9	345.2
n (unweighted)	64521	64521	64521	64521	64521	64521
N (weighted)	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The table reports OLS estimates in Models (1)–(3) and IV estimates in Models (4)–(6) of the effect of VET enrollment on three post-secondary outcomes measured one year after upper secondary school: "Working", "Studying", and "NEET". Outcomes are dummy variables; "Working" and "Studying" are not mutually exclusive. Controls are added as indicated. The mean of the dependent variable is reported in square brackets. "VET" equals one if a student enrolls in VET at first upper-secondary enrollment. The IV is "Proportion VET per class", defined as the share of classmates in the student's 9th-grade class choosing the vocational track in the first year of upper secondary school. All regressions include 9th-grade (G9) school and region-year fixed effects. Standard errors, clustered at the G9 class level, are in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Romano-Wolf adjusted p-values for Specification (6) are 0.001 for all outcomes. Full results are in Annex Tables D.1, D.2, and D.3.

cational programs in upper secondary school to isolate variation in individual track choice. The first-stage remains strong as additional controls are introduced: model (2) adds individual characteristics, while model (3) further includes class-composition controls. This indicates that sufficient identifying variation remains in peers' VET choices after conditioning on the main observable determinants of track choice.

The IV estimates are aligned with the OLS results in terms of sign and statistical significance across all outcomes and specifications, but are larger in magnitude. This difference should be interpreted in light of the estimand identified by each approach. While OLS estimates combine treatment effects with remaining selection into tracks, the IV strategy identifies a local average treatment effect for marginal students whose track choice responds to their peers' educational de-

cisions. These students may experience larger changes in post-secondary trajectories when induced to enrol in VET than the average student.

In the preferred specification (6), VET enrollment increases the probability of employment by 34 percentage points and reduces the probability of studying by 40 percentage points one year after upper secondary school. The reduction in further education is statistically larger than the employment gain, implying an increase in NEET incidence of 9 percentage points. Relative to academic-track students, these estimates imply that VET students are around 2.5 times as likely to be working, about 50% less likely to be studying, and 2.5 times as likely to be NEET one year after upper secondary school.

Overall, we find that VET enrollment, in a predominantly school-based VET system, shifts marginal students from further education towards earlier labor market entry. This trade-off is observed even in a system that formally allows vocational graduates to progress to higher education. At the same time, VET is associated with a higher probability of becoming NEET one year after upper secondary school, consistent with short-run frictions during the school-to-work transition.

6.2 Sensitivity analysis

We proceed with several sensitivity analyses designed to assess the robustness of our results across four main concerns: (i) persistence of peer effects and track-choice exogeneity; (ii) sorting and pre-existing academic differences; (iii) measurement and distribution of peer exposure; and (iv) model specification and data choices.

First, we test whether peer effects persist among students whose lower-secondary school district did not offer upper secondary schooling in the year after lower secondary completion. This is a setting in which upper-secondary track choices are less likely to reflect the continuation of the same peer group. Second, we add controls for individual ability and peer academic performance[18], since vocational enrollment is strongly associated with prior achievement (Table 1; see also Ferreira and Martins, 2026). Third, we use alternative peer-exposure measures, including peer networks measured in 6th-grade, subgroup-specific peer shares, and specifications that exclude extreme peer-VET shares. These exercises assess whether the results are sensitive to the definition of the relevant peer group or to influential values of the instrument. Fourth, we assess robustness to specification and data choices using track choice at the end of upper secondary school (12th-grade), school-cohort fixed effects, an unweighted sample, and administrative outcome data.

Table 3 summarises the results. Each row reports a separate robustness exercise, while the columns identify the main identification concern addressed (column 1), report the estimated effects on the three main outcomes (columns 2 to 4), together with first-stage diagnostics (column 5) and sample size (column 6). Overall, the results support the main interpretation: vocational enrollment shifts marginal students from further education into earlier labor market entry. This trade-off is stable in sign, statistically significant, and broadly comparable in magnitude across alternative samples, model specifications, and peer-exposure definitions.

[18] These measures have important limitations and are therefore excluded from the baseline specification.

Table 3: Sensitivity analyses for the baseline IV specification

Sensitivity test	Identification Concern	Dependent variable			CD Wald F statistic	N
		Working	Studying	NEET		
	(1)	(2)	(3)	(4)	(5)	(6)
Baseline (specification 6, Table 2)		0.337***	-0.397***	0.093***	740.5	280661
		(0.052)	(0.050)	(0.034)		
Without local upper secondary provision	(i)	0.385***	-0.455***	0.120*	169.5	79113
		(0.103)	(0.093)	(0.072)		
School performance controls (6th-grade)	(ii)	0.255***	-0.301***	0.060	586.3	224715
		(0.059)	(0.057)	(0.038)		
School performance controls (9th-grade)	(ii)	0.224***	-0.245***	0.019	579.9	270666
		(0.061)	(0.057)	(0.036)		
Peer effects in 6th-grade (IV)	(iii)	0.054	-0.309**	0.151	75.4	124303
		(0.167)	(0.145)	(0.098)		
School-grade VET share (IV)	(iii)	0.314***	-0.333***	0.081***	1507.3	280757
		(0.040)	(0.038)	(0.022)		
Same-gender classmate VET share (IV)	(iii)	0.357***	-0.383***	0.041	907.7	280661
		(0.047)	(0.044)	(0.029)		
(9th-grade) Portuguese-peer VET share (IV)	(iii)	0.330***	-0.354***	0.062	698.8	270666
		(0.062)	(0.058)	(0.039)		
(9th-grade) Maths-peer VET share (IV)	(iii)	0.369***	-0.452***	0.068**	1087.1	270899
		(0.050)	(0.047)	(0.031)		
(6th-grade) Portuguese-peer VET share (IV)	(iii)	0.369***	-0.452***	0.086***	920.9	217003
		(0.050)	(0.048)	(0.032)		
(6th-grade) Maths-peer VET share (IV)	(iii)	0.462***	-0.511***	0.062	547.7	217640
		(0.069)	(0.064)	(0.042)		
Remove top/bottom 1% peer-VET shares	(iii)	0.314***	-0.386***	0.109***	602.2	277356
		(0.056)	(0.053)	(0.035)		
Remove top/bottom 5% peer-VET shares	(iii)	0.281***	-0.369***	0.092**	352.7	248277
		(0.071)	(0.067)	(0.045)		
Track choice in 12th-grade	(iv)	0.424***	-0.498***	0.112***	424.7	279369
		(0.065)	(0.061)	(0.042)		
School-cohort FE	(iv)	0.610***	-0.587***	0.075	141.4	271801
		(0.114)	(0.106)	(0.068)		
Unweighted sample	(iv)	0.388***	-0.498***	0.122***	585.9	64521
		(0.045)	(0.042)	(0.028)		
Administrative outcome data	(iv)		-0.602***		1224.2	553876
			(0.030)			

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data. *Notes*: The table reports IV estimates from alternative specifications designed to assess the robustness of the preferred model. Identification concerns are: (i) persistence of peer effects and track-choice exogeneity; (ii) sorting and pre-existing academic differences; (iii) measurement and distribution of peer exposure; and (iv) model specification and data choices. The baseline instrument is the share of 9th-grade classmates who subsequently enroll in vocational education, except where alternative peer-exposure instruments are explicitly indicated. All specifications include the baseline controls and fixed effects unless otherwise stated. Estimates and "N" are weighted using survey weights, except in the unweighted specification and the model with administrative outcome data. Standard errors are reported in parentheses. The CD Wald statistic reports the first-stage weak-identification statistic. The administrative outcome specification uses higher-education enrollment from administrative records and is therefore reported only for the studying outcome. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The results are robust to restricting the sample to students who are required to change schools after lower secondary education, which mitigates concerns that the estimates are driven by persistent peer networks in upper secondary school. Similarly, redefining peer exposure using 6th-grade classmates yields estimates with the same signs as the baseline specification. Although the first-stage is weaker and the estimates are less precise, partly due to the shorter panel available, this

exercise suggests that the main results are not driven solely by the persistence of 9th-grade peer groups or by the specific timing at which peer networks are measured.

Adding controls for prior academic performance reduces the magnitude of the employment and studying effects, consistent with negative selection into vocational tracks and suggesting that the baseline specification may partly reflect pre-existing differences in academic achievement. However, the employment–education trade-off remains present after conditioning on prior performance.

Including school-cohort fixed effects provides a more demanding specification by restricting identification to variation between classes within the same school and cohort. This absorbs unobserved factors common to students in the same school-year environment, such as school policies, counselling, course availability, and local shocks. As expected, the first-stage is smaller when this more restrictive source of variation is used, but it remains sufficiently strong. The estimated employment–education trade-off is larger in magnitude, indicating that the baseline results are not driven by broad differences across schools and cohorts.

The effect on NEET status is positive across specifications but less stable in magnitude and statistical precision, particularly once prior performance controls or more demanding fixed effects are included. We therefore interpret the NEET results more cautiously than the effects on employment and further education.

Taken together, the sensitivity checks indicate that the employment–education trade-off is robust, while the magnitude of the estimates - especially for NEET - should be interpreted as subject to some residual sensitivity to sorting and specification choices. Full results and additional discussion are reported in Annex D.2.

6.3 Outcome Decomposition

To clarify the nature of post-secondary transitions, we then decompose students' status one year after upper secondary school into five mutually exclusive and exhaustive categories: studying only, working only, working while studying, unemployed and not studying, and inactive and not studying. This decomposition is useful because the main outcomes, "Working" and "Studying", are not mutually exclusive.

The results, reported in Table 4, show that the employment gain associated with VET is primarily driven by an increase in working only, rather than by an increase in combining work and study. At the same time, VET substantially reduces the probability of studying only. This pattern is consistent with VET accelerating the transition out of education and into the labor market, rather than encouraging students to combine employment with further study.

The decomposition also clarifies the interpretation of the NEET effect. When NEET status is split into unemployment and inactivity among non-students, the positive effect of VET is driven by unemployment rather than inactivity. Consistent with this interpretation, we remind that 97% of individuals classified as NEET in the OTES post-secondary survey report being unemployed rather than inactive. Moreover, descriptive evidence among students who have left education suggests no significant difference in NEET probabilities between VET and academic-track students (Table E.3

Table 4: Impact of VET enrollment on mutually exclusive outcomes

Dependent variable:	Work only	Study only	Work & Study	Unemployed & not studying	Inactivity & not studying
VET	0.305***	-0.429***	0.032	0.098***	-0.005
	(0.048)	(0.051)	(0.033)	(0.034)	(0.004)
First-stage coefficient	0.343***	0.343***	0.343***	0.343***	0.343***
Cragg-Donald Wald F statistic	740.5	740.5	740.5	740.5	740.5
Kleibergen-Paap F statistic	345.2	345.2	345.2	345.2	345.2
Mean Dep. Var.	0.140	0.736	0.069	0.053	0.002
R-squared	0.188	0.230	0.002	0.047	-0.003
n (unweighted)	64521	64521	64521	64521	64521
N (weighted)	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The table presents the IV estimates of VET enrollment on mutually exclusive post-secondary outcomes. The dependent variables are dummy variables equal to one if the student has that outcome. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. "Proportion VET per class" is the instrumental variable in the IV regressions and it is calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions include individual and class-level controls, and school and region-year fixed effects. Standard errors are clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

in the Annex). Taken together, these findings suggest that the overall positive effect of VET on NEET is largely driven by VET students' earlier exit from education and earlier exposure to labor market risk. The NEET effect therefore appears to reflect short-run unemployment frictions during the school-to-work transition, rather than greater inactivity or worse employment prospects among comparable non-students.

6.4 Job Quality Indicators

Given the positive effects of vocational education on early market entry, we also assess the quality of such transitions. We explore several job quality dimensions, particularly the type of work arrangement, type of contract, time to employment, and future job expectations. Figure 4 plots the impacts of VET enrollment on different job quality measures, both unconditionally and conditional on being employed.

The unconditional estimates provide the main evidence on job-related outcomes. These include both employed and non-employed youth and therefore capture the overall effect of VET enrollment on the probability of different labor market transitions. Relative to academic enrollment, VET increases the probability of full-time work, salaried employment, having an open-ended contract, holding a fixed contract, and having a job aligned with future job expectations.

We also report estimates conditional on employment to describe how job characteristics differ among those who are working. These results have a descriptive nature, since employment itself is affected by VET enrollment and conditioning on it may introduce post-treatment selection. With this caveat, VET students exhibit more favorable employment conditions than academic-track

Figure 4: Impact of VET enrollment on job quality



Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The figure reports IV estimates and 90% confidence intervals for the effect of VET enrollment on job-quality outcomes, both unconditionally and conditional on employment. Outcomes are binary indicators measured one year after upper secondary completion. "Full-time", "Part-time", "Salaried employee", "Open-ended contract", "Fixed-term contract", "Aligned with future expectations", and "Found before graduation" are equal to one if the corresponding condition holds, and zero otherwise. "VET" is a treatment indicator equal to one if the student enrolls in a vocational track in their first upper secondary enrollment. The instrument is the share of 9th-grade classmates enrolling in VET in the first year of upper secondary education. All regressions include individual and class-level controls, school fixed effects, and region-year fixed effects. Standard errors are clustered at the G9 class level. Further details are reported in Table D.11 in the Annex.

students who do not continue in education. They are more likely to work full-time, to be salaried employees, and to hold open-ended contracts, and less likely to work part-time or under fixed-term contracts. The magnitudes of these effects are sizable, with point estimates consistently around 25 percentage points across outcomes.

The results suggest that VET students have less precarious job conditions than academic students one year after upper secondary school, characterized by having a full-time job, being a salaried employee and having an open-ended contract. We suspect the results are also related to the motivations behind employment for both groups. While VET students aim for permanent transitions into the job market, academic students are more likely to combine both employment and further education — 45% of academic students in employment are also studying, while this percentage is only 15% for VET students employed. This would also explain the negative effect of VET enrollment on finding a job before graduation, conditional on employment.

We first examine the effect of VET on progression to and completion of 12th-grade, two key

milestones for completing mandatory schooling and accessing both tertiary education and better labor market opportunities. The results, reported in Tables E.1 and E.2 in the Annex, show that VET students are less likely to reach 12th-grade and, conditional on reaching it, less likely to complete upper secondary education than students in the academic track. This pattern confirms that VET is associated with lower educational attainment and an earlier exit from schooling.

7 Heterogeneity analysis

The results indicate that VET shifts marginal students from further education toward earlier labor market entry, which is consistent with the design of vocational programs. At the same time, VET is associated with a higher probability of being NEET one year after upper secondary school. In this section, we examine whether this latter effect primarily reflects earlier exposure to labor market risk and short-run school-to-work transition frictions, rather than greater detachment from both education and employment among VET students. We then explore whether these transition patterns vary across school- and program-level characteristics.

7.1 Pre-determined characteristics

The IV estimates are most informative about students whose initial track choices are responsive to changes in peer VET exposure. Specifically, the relevant margin is the variation in the degree to which students' VET enrollment responds to changes in the share of 9th-grade classmates enrolling in VET. Following the logic of Angrist (2014), we use heterogeneity in first-stage coefficients to describe which pre-determined groups are more strongly affected by the instrument. These estimates should therefore be interpreted as subgroup-specific first-stage responsiveness. The results in Table 5 indicate that peer VET exposure is more strongly predictive of VET enrollment among male students, older students, welfare recipients, lower-performing students, and students from families with lower formal education, non-employment, or blue-collar occupational backgrounds. This suggests that the IV estimates are primarily informative about students from more vulnerable or academically at-risk backgrounds whose educational choices are more sensitive to peer environments. From a policy perspective, this is an important margin: students whose track choices respond more strongly to peer exposure may also be particularly affected by interventions that shape information, aspirations, or the composition of school peer groups.

Figure 5 presents heterogeneous effects by cohort [panel (a)], by gender [panel (b)], and by social welfare support status [panel (c)] [19]. The cohort-specific estimates are broadly stable across outcomes [panel (a)]. This stability is notable given the rising share of VET students continuing in education over the period, from 39% in 2014/15 to 46% in 2020/21. The estimated local average treatment effects are also broadly similar by welfare support status, suggesting that the main employment–education trade-off and NEET effects are not concentrated among either welfare recipients or non-recipients. In panel (b) of Figure 5, we find that the effect of VET enrollment

[19] Table D.12 in the Annex presents an F-test on the equality of the heterogeneous effects.

Table 5: First-stage responsiveness to peer VET exposure by subgroup

	First-stage coefficient standard error (1)	Relative first-stage responsiveness (2)	n (unweighted) (3)
Baseline (specification 6, Table 2)	0.343***	1.000	64521
	(0.018)		
Male	0.410***	1.193	21984
	(0.030)		
Female	0.297***	0.865	41482
	(0.022)		
Age 14 or less	0.302***	0.879	55910
	(0.020)		
Age more than 14	0.419***	1.219	8479
	(0.045)		
Non-recipient of social welfare	0.291***	0.846	43636
	(0.022)		
Social welfare recipient	0.401***	1.166	20821
	(0.030)		
6th-grade average score 4 or above	0.040**	0.116	13209
	(0.019)		
6th-grade average score below 4	0.360***	1.048	38066
	(0.026)		
Guardian with more than lower secondary	0.282***	0.821	36655
	(0.023)		
Guardian with up to lower secondary	0.382***	1.112	27800
	(0.026)		
Guardian employed	0.325***	0.945	45461
	(0.035)		
Guardian not employed	0.359***	1.045	18999
	(0.031)		
Guardian in white collar occupation	0.256***	0.746	39947
	(0.023)		
Guardian in blue collar occupation	0.449***	1.308	17334
	(0.032)		

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The table reports an analysis of complier characteristics for peers' choice influence. Column (1) presents the first-stage coefficient and respective standard error of regressions estimated separately by the pre-determined characteristic on the left. Column (2) reports the ratio between the subgroup coefficient [column (1)] and the main specification first-stage coefficient [first line of column (1)]. Regression specification is identical to specification (6) in Table 2. Significance levels: ** p¡0.05, *** p¡0.01. 6th-grade average score is measured on a scale from 1 to 5.

on the probability of becoming NEET is more than double for girls compared to boys and the difference is statistically significant. At the same time, treatment effects on the other two outcomes are not statistically different across genders. Despite the fact that upper-secondary VET is mostly selected by male students (Table 1), the analysis suggests that VET enrollment is riskier for girls, as it exacerbates the propensity to become NEET one year after upper secondary school.

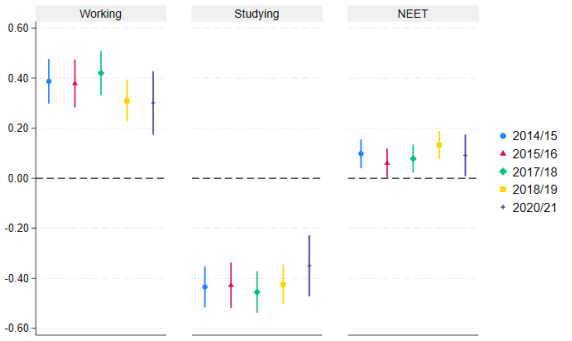
7.2 Institutional and program heterogeneity

7.2.1 Institutional setting

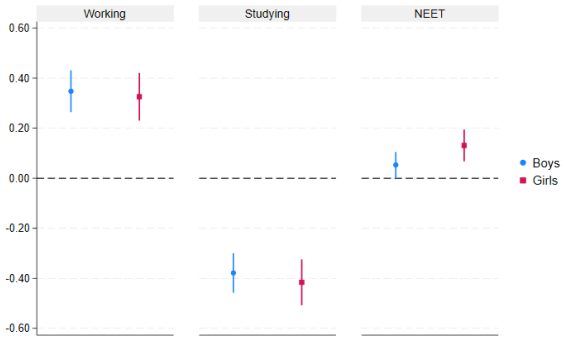
We next explore whether these transition frictions vary with school- and program-level characteristics. As discussed in Section 2, the success of vocational pathways may depend on the extent to

Figure 5: Heterogeneous effects of VET enrollment on post-secondary outcomes

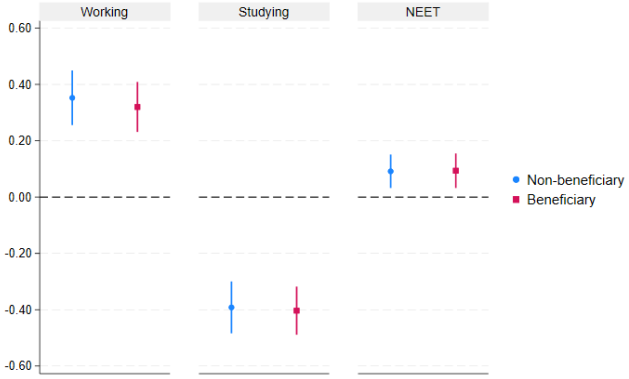
(a) Cohort



(b) Gender



(c) Social welfare support[21]



Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The figure reports IV estimates and 90% confidence intervals for the effect of VET enrollment on Working, Studying, and NEET, by cohort [panel (a)], gender [panel (b)], and social welfare status [panel (c)]. Subgroup-specific effects are obtained from specifications interacting VET enrollment with the corresponding subgroup indicator. Outcomes are binary indicators measured one year after upper secondary completion. Working and Studying are not mutually exclusive. "VET" is a treatment indicator equal to one if the student enrolls in a vocational track in their first upper secondary enrollment. The instrument is the share of 9th-grade classmates enrolling in VET in the first year of upper secondary education. All regressions include individual and class-level controls, school fixed effects, and region-year fixed effects. Standard errors are clustered at the G9 class level. Further details are reported in Table D.12 in the Annex.

which training is aligned with labor market needs (Hanushek et al., 2017; Hampf and Woessmann, 2017; Matthewes and Ventura, 2022). We examine this channel by estimating heterogeneous effects by type of institution and field of specialization. These results should be interpreted as suggestive evidence on potential mechanisms, since students may select into specific institutions and fields [20].

[21]Students receiving ASE-A or ASE-B support are classified as social welfare beneficiaries; all others are classified as non-beneficiaries. ASE income brackets follow those of the *abono de família* and are indexed to the Indexante dos Apoios Sociais (IAS), annualized over 14 monthly payments. ASE-A applies to reference income up to 0.5 of the annualized IAS and ASE-B to income between 0.5 and 1 annualized IAS. Using the 2016 IAS value of EUR 419.22, applicable to the 2017 application cycle and therefore to the final 9th-grade cohort in the sample, the corresponding thresholds are EUR 2,934.54 and EUR 5,869.08, respectively.

[20]Because institution type and field of specialization are chosen jointly with VET enrollment, these heterogeneous effects should not be interpreted as causal effects of attending a specific type of institution or choosing a specific field. Rather, they describe how the estimated effect of VET varies across the institutional and program settings in which

We begin by comparing VET effects across public and private institutions. Panel (a) of Figure 6 shows that the main pattern — higher employment, lower further education, and higher NEET incidence — is present in both types of institutions. However, the employment–education trade-off is larger for private VET schools, while the effect on NEET is larger for public VET schools.[22] This suggests that private VET schools may be more effective at moving students directly into employment, while public VET provision appears to be associated with more difficult school-to-work transitions.

A potential concern is that these differences reflect selection into specific institutions. Comparing students in public and private VET schools, we do not find sizable differences across observed individual and class-level characteristics (Table E.5 in the Annex). If anything, students in public VET schools display a lower incidence of several characteristics positively associated with NEET status. Although this does not rule out selection on unobservables, it suggests that observable composition alone is unlikely to fully account for the heterogeneous effects. The results are therefore consistent with institutional features, such as course design, resources, or employer links, playing a role in post-secondary transitions.[23]

We then examine whether institutional specialization matters. In the absence of a pre-existing distinction based on the degree of specialization, we classify schools as "specialized VET" schools, those in which students are enrolled exclusively in VET programs over the period analyzed[24]; and "non-specialized VET" schools, which have students enrolled in both VET and academic programs. This distinction largely overlaps with the public–private divide: 90% of private VET schools offer only vocational courses, while 89% of public VET schools offer both academic and vocational courses.[25] Panel (b) of Figure 6 shows similar effects on employment and further education across specialized and non-specialized schools. However, the effect on NEET is significantly larger for non-specialized schools.[26] This pattern is consistent with specialized VET environments providing some protection against unsuccessful school-to-work transitions.

7.2.2 Fields of specialization

We then turn to heterogeneity by field of specialization. If school-to-work transitions depend on the specificity of acquired skills and their alignment with labor demand, effects should vary across fields. In the estimation sample, "Services" is the most common VET field (28.5%), followed by "Information and Communication Technologies" (15.9%) and "Engineering, Manufacturing and

VET is delivered.

[22] These differences are statistically significant; see Table E.4 in the Annex.

[23] Evidence on differences between public and private VET providers in Portugal remains limited. Barbosa (2023) documents differences in course offerings across public and private institutions, with private providers more likely to offer niche or innovative programs. Preliminary evidence from interviews with vocational education stakeholders also suggests that private VET schools may have stronger links to local employers, reflected in more tailored curricula and the involvement of industry professionals in the delivery of specific modules. By contrast, teachers in public schools are more likely to be full-time employees teaching both academic and vocational courses.

[24] Based on administrative data, not the final sample.

[25] This pattern is consistent with the expansion of vocational education in Portugal described in Section 3.

[26] See Table E.4 in the Annex for tests of differences in heterogeneous effects.

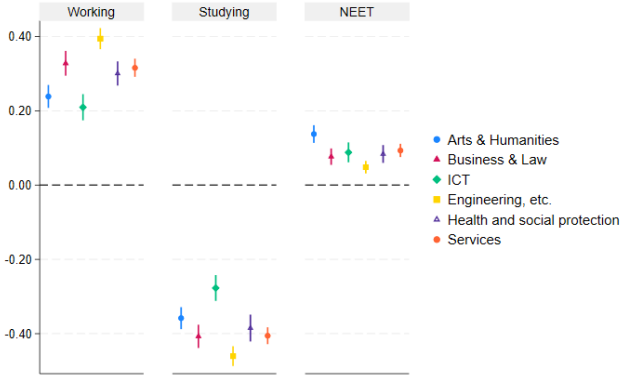
Figure 6: Impact of VET enrollment on post-secondary outcomes by heterogeneous VET characteristics

(a) Type of institution

(b) Degree of specialization



(c) Field of specialization



Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The Figure reports IV estimates and 90% confidence intervals for the effect of VET enrollment on post-secondary outcomes ("Working", "Studying", "NEET"), by 10th-grade school type. Sub-group effects are estimated through interactions between VET enrollment and the corresponding school-type indicator. Further details are reported in Table E.4 in the Annex. All regressions include individual and class-level controls, as well as school and region-year fixed effects. Outcomes are dummy variables measured one year after upper secondary school; "Working" and "Studying" are not mutually exclusive. "VET" equals one if the student enrolls in VET in their first upper secondary enrollment. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. Standard errors are clustered at the G9 class level.

Construction" (15.5%).

Figure 6 shows that the broad pattern of higher employment, lower further education, and higher NEET incidence is present across fields, but the magnitude of these effects differs substantially. "Engineering, Manufacturing and Construction" displays a strong work–study trade-off together with relatively low NEET incidence. This is consistent with occupation-specific technical skills facilitating direct labor market absorption, particularly relevant during a period (2015-2022) marked by economic recovery and expansion in construction and export-oriented manufacturing. By contrast, "Business and Law", "Health and Social Protection", and "Services" display a less pronounced work–study trade-off but higher NEET incidence, suggesting smoother transitions for some students but less direct absorption into employment for others. "Information and Communication Technologies" shows a smaller work–study trade-off and mild NEET effects, consistent with

stronger incentives to continue education in a sector where skills evolve rapidly. Finally, "Arts and Humanities" is associated with higher NEET incidence, suggesting weaker short-term labor market absorption in this field. In fact, the Portuguese economy is not particularly strong in this field, which is associated with high NEET and unemployment rates also for individuals with higher educational attainment (see Table E.7 in the Annex). Overall, these patterns suggest that field composition is a key source of heterogeneity in the effects of VET: programs linked to sectors with stronger labor demand and more occupation-specific skills appear to facilitate direct employment, whereas fields with weaker short-term absorption or stronger incentives for further study generate more mixed transitions.[27]

Overall, the evidence in this section indicates that VET primarily changes the timing and composition of students' post-secondary transitions. By reducing progression to further education, VET brings students into the labor market earlier, increasing both employment and exposure to unemployment risk. The NEET effect is therefore best interpreted as a short-run school-to-work transition margin, rather than as evidence of greater inactivity among comparable non-students. The heterogeneity analysis further suggests that these transition margins vary across institutional settings and fields of specialization. While these patterns should be interpreted cautiously, given potential selection into institutions and fields, they are consistent with the idea that program design, occupational specificity, and employer links can shape the effectiveness of vocational pathways.

8 Conclusions

This paper examines how upper-secondary vocational enrollment shapes young people's transitions. Specifically, we quantify the trade-off between early labor market entry and participation in further education. We draw on administrative education data linked to a post-secondary survey and estimate causal effects for students at the margin between vocational and academic tracks, using the share of lower-secondary classmates who subsequently choose VET as an instrument.

The results reveal a pronounced trade-off between early labor market entry and further education. Vocational enrollment significantly increases the probability of employment by 26-34 percentage points (approximately 2.5 times the rate of academic students) and improves several job quality indicators, such as full-time employment, salaried employment and holding an open-ended contract. Conversely, VET reduces participation in tertiary education by 30-40 percentage points (roughly half the rate of participation among academic students). These results confirm that

[27] We also examine whether field-specific patterns differ across public and private providers by estimating triple interactions between VET enrollment, institution type, and field of specialization. Figure E.1 shows that field heterogeneity remains important after allowing effects to differ by institution type. For "Arts and Humanities", "Information and Communication Technologies", and "Health and Social Protection", we do not find statistically significant differences between public and private institutions (Table E.8 in the Annex). In "Business and Law", "Engineering, Manufacturing and Construction", and "Services", private VET schools are associated with better post-secondary outcomes, with statistically significant differences relative to public providers. These results suggest that both program field and institutional setting matter for early VET outcomes. In some fields, private providers appear to reduce the risk of NEET relative to public schools, consistent with the role of institutional specialization and employer links in shaping school-to-work transitions.

track choice in upper secondary plays a decisive role in shaping access to tertiary education, even within a system that formally allows progression from vocational pathways. We consistently find positive effects of vocational education on job market integration, with VET students exhibiting less precarious job conditions than academic students.

We also find that VET enrollment is associated with higher NEET incidence by 6-9 percentage points (around 2.5 times the rate of their academic counterparts), although this finding is sensitive to certain specifications. We argue that VET affects early post-secondary trajectories mainly by changing the timing and composition of students' transitions. VET students leave formal education earlier and enter the labor market sooner, which generates sizeable employment gains but also increases exposure to short-run unemployment risk. We show that the positive effect on NEET is primarily driven by unemployment rather than inactivity.

The heterogeneity analysis further shows that these effects vary across institutions and fields of specialization, with smoother transitions in settings more closely associated with occupation-specific skills, institutional specialization, and potentially stronger links to employers. Private VET and/or specialized schools are associated with smoother transitions into the labor market. "Engineering, Manufacturing and Construction" emerges as the field of specialization with more favorable outcomes. These findings suggest that the effectiveness of vocational education depends not only on access to VET, but also on program design, curricular content, and institutional organization — dimensions that can be shaped by policy.

Notwithstanding its contributions, this study is subject to some limitations. First, the identification strategy relies on an instrumental variable approach, for which the exclusion restriction cannot be tested directly. Although we provide supporting evidence — including robustness to alternative specifications, to individual and peer performance, and limited persistence of peer networks — residual concerns remain that peer composition may affect outcomes through channels other than track choice. Second, the analytical sample is based on students observed in the survey's post-secondary follow-up. Although weighted comparisons with official statistics do not reveal large differences along observed characteristics, the survey design may underrepresent students who are harder to follow, and the analysis is less suited to capturing earlier dropout margins. Thirdly, the analysis relies on self-reported outcomes collected up to 14 months after upper secondary education. We validate the results against administrative higher education data, but are unable to do so for the labor market outcomes.

Taken together, these findings have important implications for public policies. The results speak directly to policies that affect track choice through information, peer exposure, or school environments. From an education-equity perspective, the sizable reduction in further education participation suggests that expanding VET may unintentionally reinforce stratification unless bridging mechanisms are strengthened. Clearer articulation pathways, recognition of prior learning, and targeted support for VET graduates wishing to enter higher education may therefore improve equity in access. From a labor perspective, discussions on vocational education and school-to-work transitions should account for institutional characteristics, the design of curricula, and linkages to

local labor markets. Policy responses may be most effective when focused on transition support immediately after school completion, including placement services, internships, wage subsidies, or stronger employer intermediation targeted at VET graduates. Future research could expand on these findings by adopting a similar trade-off perspective, allowing a more comprehensive assessment of VET by jointly considering the labor market gains and the potential implications for progression to further education. It would also be relevant to extend the analysis to school-to-work transitions of higher education graduates and assess whether the positive employment (quality) results of VET students are primarily driven by their earlier entry into the labor market.

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Annex - Online Appendix

A Institutional Context

Table A.1: Education and training fields (CNAEF 2013) of youth-oriented VET courses in the upper secondary education (academic year 2023/2024)

	CNAEF 2013 (2 digits)	Education and training fields of VET programs at upper secondary level
01	Education	-
02	Arts and Humanities	General Arts, Performing Arts, Crafts, Audiovisuals and Media Production, Design, History and Archaeology
03	Social sciences, Journalism and Information	-
04	Business and Law	Library, Archive and Information Science, Commerce, Accounting and Taxation, Law, Organizational Studies, Finance, Banking and Insurance, Management and Administration, Marketing and Advertising, Secretarial and Administrative work
05	Natural sciences, Mathematics and Statistics	-
06	Information and Communication Technologies	Computer Sciences
07	Engineering, Manufacturing and Construction	Architecture and Urban Planning, Construction and Civil Engineering, Motor Vehicle Construction and Repair, Electricity and Energy, Electronics and Automation, Food Industry, Textile, Clothing, Footwear and Leather Industries, Materials (Wood, Cork, Paper, Plastic, Glass and Other Industries), Metallurgy and Metalworking, Chemical Process Technology
08	Agriculture, Forestry, Fisheries and Veterinary Sciences	Floriculture and Gardening, Crop and Animal Production, Forestry and Hunting
09	Health and Social Protection	Dental Sciences, Pharmaceutical Sciences, Health – Programs Not Classified Elsewhere, Child and Youth Support Services, Diagnostic and Therapeutic Technologies, Social Work and Guidance
10	Services	Beauty Care, Sports, Hospitality and Catering, Protection of People and Goods, Environmental Protection – General Programs, Occupational Safety and Health, Transport Services, Tourism and Leisure

Source: Official Statistics for Education, DGEEC (2025).
Notes: CNAEF - National Classification for Education and Training Fields (2013). In the academic year 2023/2024, there were not VET programs offered in the following areas: "01 - Education", "03 - Social sciences, Journalism and Information" e "05 - Natural sciences, Mathematics and Statistics"; The analysis includes only "Youth-oriented educational programs" within "Cursos profissionais", "Cursos de aprendizagem", "Cursos artísticos especializados", "Cursos de Educação e Formação" e "Cursos com Planos Próprios".

Table A.2: VET students enrolled in 12th-grade (academic year 2023/2024)

	VET field		Most attended subfield	
	CNAEF 2 digits	%	CNAEF 3 digits	% in most attended field
01	Education			
02	Arts and Humanities	13.4	Audiovisuals and Media Production	69.9
03	Social Sciences, Journalism and Information			
04	Business and Law	11.7	Commerce	42.8
05	Natural Sciences, Mathematics and Statistics			
06	Information and Communication Technologies	15.7	Computer Sciences	100.0
07	Engineering, Manufacturing and Construction	17.8	Electronics and Automation	32.5
08	Agriculture, Forestry, Fisheries and Veterinary Sciences	1.8	Crop and Animal Production	94.2
09	Health and Social Protection	12.6	Health – Programs Not Classified Elsewhere	44.6
10	Services	27.1	Sports	36.9
	Total	(100)		

Source: Official Statistics for Education, DGEEC (2025).
Notes: CNAEF - National Classification for Education and Training Fields (2013). In the academic year 2023/2024, there were no VET programs offered in the following areas: "01- Education", "03- Social sciences, Journalism and Information" e "05- Natural sciences, Mathematics and Statistics"; The analysis includes only "Youth-oriented educational programs" within "Cursos profissionais", "Cursos de aprendizagem", "Cursos artísticos especializados", "Cursos de Educação e Formação" e "Cursos com Planos Próprios".

B Dataset

Table B.1: OTES implementation

	Survey		
	Entrance	Exit	Post-secondary
Cohort	2013/2014	2015/2016	2017
Semi-cohort	-	2014/2015	2016
Cohort	2016/2017	2018/2019	2020
Semi-cohort	-	2017/2018	2019
Semi-cohort	2019/2020∗	2020/2021	2022

Source: OTES, DGEEC

Notes: ∗ Implementation was suspended for this Entrance survey.

Table B.2: Sample by cohort

	Official Statistics	OTES Survey respondents		Linked Admin–Survey Data		Cleaned Analytical Sample		Final Regression Sample	
	N	n	N	n	N	n	N	n	N
12th-grade Cohort									
2014/15	66477	16177	65913	15046	65253	10726	42107	9706	36654
2015/16	67364	22174	67104	19960	65806	16358	51894	15427	48234
2017/18	72282	17724	70100	16848	69651	15131	61059	14774	59426
2018/19	74688	23664	71774	22012	70828	20067	63813	19503	61943
2020/21	85750	5843	84599	5651	82846	5295	77164	5111	74404
Total	366561	85582	359490	79517	354394	67577	296037	64521	280661

Source analytical sample: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Source Official Statistics for Education: DGEEC (2024).

Notes: n - unweighted sample; N - weighted sample. Official Statistics represent the reference population data. "OTES Survey Respondents" identifies the raw survey-based sample. "Linked OTES–Administrative Data" is the subset successfully matched to administrative records. "Cleaned Analytical Sample" is the sample after exclusions and cleaning procedures. "Final Regression Sample" identifies the estimation sample after imposing all model-specific restrictions.

We find some differences across observable characteristics when comparing included and excluded observations. VET and female students are marginally more likely to be excluded. Older individuals are also more likely to be excluded from the estimation sample, plausibly due to lower availability of administrative data for earlier cohorts and/or students with grade retention. Foreign students are also more likely to be dropped, as they are less likely to have complete administrative records dating back to lower secondary school. We also find that students whose guardians are inactive are also more likely to be excluded from the sample relative to those with employed guardians. This may be associated with higher attrition from socioeconomically vulnerable households. In the end, although some characteristics predict attrition, the estimated differences are small in magnitude.

Table B.3: Test for sample attrition based on observable individual characteristics

Dependent Variable:	1: excluded; 0: 'in final sample'
VET	0.009***
	(0.003)
Female	0.004**
	(0.002)
Foreigner	0.022**
	(0.009)
Social welfare recipient	0.002
	(0.002)
Age	0.018***
	(0.003)
Guardian's education level	
Up to lower secondary	-0.001
	(0.004)
Upper secondary	-0.008**
	(0.003)
Missing values	-0.012**
	(0.006)
Guardian's labor status	
Unemployed	0.006
	(0.004)
Inactive	0.008**
	(0.004)
Missing values	0.001
	(0.006)
Guardian's occupation (CPP 2010)	
1 - Legislators, Senior Officials, and Managers	-0.005
	(0.013)
2 - Professionals of Intellectual and Scientific Activities	-0.009
	(0.013)
3 - Technicians and Associate Professionals	0.002
	(0.013)
4 - Clerical Support Workers	-0.001
	(0.013)
5 - Service and Sales Workers; Personal and Protective Services	0.000
	(0.013)
6 - Skilled Agricultural, Forestry, and Fishery Workers	-0.002
	(0.015)

7 - Craft and Related Trades Workers (Industry and Construction)	0.002
	(0.013)
8 - Plant and Machine Operators and Assemblers	0.003
	(0.013)
9 - Elementary Occupations (Unskilled Workers)	0.002
	(0.013)
Missing values	0.001
	(0.014)
Constant	0.058^{***}
	(0.013)
R-squared	0.209
n (unweighted)	72755
n (weighted)	316425

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The Table presents the estimates across observable individual characteristics on the probability of an observation being excluded from the final sample, calculated with the OLS model. All estimates include school and region-year fixed effects and have standard errors clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Table B.4: Comparison of Summary Statistics, as of 9th-grade (2011/12 - 2017/18)

	Final sample		Official Statistics	
	Mean	n	Mean	n
Treatment variable, first 10th-grade				
VET	0.26	67577	0.29	553887
Individual characteristics, 9th-grade				
Female	0.57	67577	0.51	553887
Age	14.25	67577	14.35	553887
Foreigner	0.02	67577	0.03	553887
Social welfare recipient	0.33	67577	0.35	553887
Guardian's education level				
Lower secondary	0.44	67577	0.46	553887
Upper secondary	0.22	67577	0.24	553887
Post-secondary/ Tertiary	0.23	67577	0.21	553887
Missing values	0.11	67577	0.09	553887
Guardian's labor status				
Employed	0.70	67577	0.71	553887
Unemployed	0.09	67577	0.10	553887
Inactive	0.11	67577	0.12	553887
Missing values	0.10	67577	0.07	553887
Guardian's occupation (CPP 2010)				
0 - Armed Forces Occupations	0.01	67577	0.00	553887
1 - Legislators, Senior Officials, and Managers	0.06	67577	0.06	553887
2 - Professionals of Intellectual and Scientific Activities	0.18	67577	0.17	553887
3 - Technicians and Associate Professionals	0.07	67577	0.08	553887
4 - Clerical Support Workers	0.11	67577	0.11	553887
5 - Service and Sales Workers; Personal and Protective Services	0.18	67577	0.20	553887
6 - Skilled Agricultural, Forestry, and Fishery Workers	0.01	67577	0.01	553887
7 - Craft and Related Trades Workers (Industry and Construction)	0.14	67577	0.14	553887
8 - Plant and Machine Operators and Assemblers	0.05	67577	0.05	553887
9 - Elementary Occupations (Unskilled Workers)	0.07	67577	0.08	553887
Missing values	0.11	67577	0.09	553887

Source analytical sample: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Source Official Statistics for Education: Administrative education data.
Notes: "n" refers to the unweighted sample. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment, and zero otherwise. "Individual characteristics" describes the student (or their parents/guardians) in 9th-grade. Guardian-related variables take the non-missing value of the previous school year if unavailable in the relevant (grade 9) school year.

Table B.5: Tests on randomness of missing values

Dependent Variable:	Guardian's		
	Education level = Missing	Labour status = Missing	Occupation = Missing
% VET per class	0.036***	0.011*	0.015*
	(0.008)	(0.006)	(0.008)
Female	-0.004**	0.002	-0.005**
	(0.002)	(0.001)	(0.002)
Foreigner	0.051***	-0.013*	0.013
	(0.011)	(0.007)	(0.008)
Social welfare recipient	-0.006***	-0.012***	0.006**
	(0.002)	(0.002)	(0.002)
Age	0.003	-0.002	0.002
	(0.002)	(0.002)	(0.002)
Guardian's education level			
Upper secondary		-0.000	-0.004
		(0.002)	(0.002)
Post-secondary/ Tertiary		0.005	-0.014***
		(0.003)	(0.003)
Missing values		0.313***	0.180***
		(0.009)	(0.009)
Guardian's labor status			
Unemployed	-0.007**		0.052***
	(0.003)		(0.004)
Inactive	-0.008**		0.075***
	(0.003)		(0.005)
Missing values	0.520***		0.633***
	(0.012)		(0.012)
Guardian's occupation (CPP 2010)			
1 - Legislators, Senior Officials, and Managers	0.035**	0.043**	
	(0.018)	(0.021)	
2 - Professionals of Intellectual and Scientific Activities	0.018	0.039*	
	(0.017)	(0.021)	
3 - Technicians and Associate Professionals	0.037**	0.043**	
	(0.018)	(0.021)	
4 - Clerical Support Workers	0.038**	0.048**	
	(0.017)	(0.021)	
5 - Service and Sales Workers; Personal and Protective Services	0.050***	0.050**	
	(0.017)	(0.021)	
6 - Skilled Agricultural, Forestry, and Fishery Workers	0.043**	0.061***	
	(0.019)	(0.021)	
7 - Craft and Related Trades Workers (Industry and Construction)	0.057***	0.054**	
	(0.018)	(0.021)	
8 - Plant and Machine Operators and Assemblers	0.058***	0.051**	

	(0.018)	(0.021)	
9 - Elementary Occupations (Unskilled Workers)	0.058***	0.054**	
	(0.018)	(0.021)	
Missing values	0.258***	0.468***	
	(0.020)	(0.024)	
Students per class (log)	-0.022***	0.004	-0.004
	(0.007)	(0.005)	(0.007)
% females	0.020**	-0.001	-0.010
	(0.008)	(0.006)	(0.008)
% foreigners	-0.042*	0.022	-0.022
	(0.024)	(0.018)	(0.025)
% welfare recipients	0.038***	0.031***	0.024***
	(0.009)	(0.007)	(0.009)
% guardians with up to lower secondary	-0.136***	-0.069***	-0.025***
	(0.009)	(0.007)	(0.009)
% guardian not employed	-0.000	-0.024***	-0.047***
	(0.010)	(0.008)	(0.011)
Constant	0.094***	-0.021	0.048**
	(0.028)	(0.026)	(0.022)
R-squared	0.634	0.758	0.695
n (unweighted)	64521	64521	64521
n (weighted)	280661	280661	280661

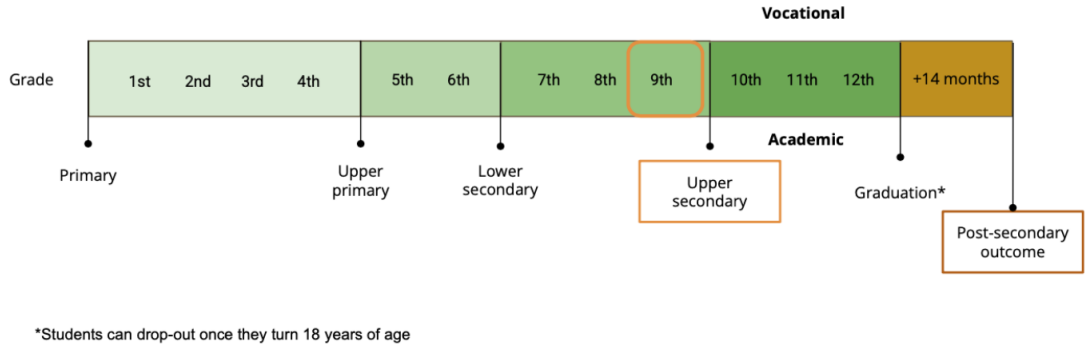
Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table presents the estimates of "Proportion VET per class" on the three variables with the most missing values ("Guardian's education level", "Guardian's labor status", "Guardian's occupation"). Each column represents a model calculated separately with an OLS regression. All estimates include school and region-year fixed effects and have standard errors clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

C Identification and Estimation Strategy

We estimate the impact of VET enrollment on transition outcomes observed 14 months after students enroll in the 12th-grade. In the Portuguese education system, students are required to choose between the general/academic and vocational tracks upon entry into upper secondary education in the 10th-grade. To identify the causal effects of VET enrollment, we exploit variation in peers' track choices in the 9th-grade as a predictor of individual track choice in the 10th-grade.

Figure C.1: Identification Strategy and Institutional Setting



C.1 Balance Tests

The balance tests indicate that the instrument is not orthogonal to all observed pre-treatment characteristics. Peer-VET share is positively associated with age and 6th-grade internal scores, and negatively associated with guardian education. These patterns suggest non-random class composition before the transition to upper-secondary education. The positive age gradient is consistent with higher peer-VET classes containing relatively older students, potentially reflecting previous grade retention. The negative association with guardian education points to socioeconomic sorting, while the positive association with 6th-grade scores indicates that this sorting is not simply along a single low-achievement dimension. The latter may also reflect class- or school-specific grading practices. High peer-VET classes therefore appear to combine lower parental education and more delayed school trajectories with stronger measured internal performance.

We interpret these balance results as evidence that the instrument may capture both peer exposure and systematic class sorting along dimensions related to prior achievement, school progression, and family background. This may hinder identification if these characteristics, or correlated unobserved factors, directly affect post-secondary transitions. Our preferred specifications therefore condition on rich individual and leave-out class-level controls, including prior achievement and socioeconomic composition. We also conduct sensitivity analyses using alternative control sets, fixed-effect structures, and restrictions on the identifying variation. Although these tests cannot fully replicate experimental variation, they help assess whether the estimates are sensitive to observed class sorting.

Table C.1: Balance Tests - individual characteristics

					Guardian's education level				Guardian's labor status			
Explanatory Variable:	Female	Age^{+}	Foreigner	Welfare recipient	L.Sec.	U.Sec	Tertiary	Missing	Employed	Unemployed	Inactive	Missing
% VET per class	-0.022	0.286***	-0.005	0.030	0.017	-0.005	-0.041***	0.029***	-0.011	0.004	-0.011	0.019***
	(0.021)	(0.028)	(0.005)	(0.019)	(0.017)	(0.018)	(0.013)	(0.008)	(0.017)	(0.014)	(0.013)	(0.006)
R-squared	0.063	0.162	0.082	0.264	0.441	0.201	0.574	0.575	0.314	0.100	0.183	0.685
n (unweighted)	64521	64521	64521	64521	55458	55458	55458	55458	55458	55458	55458	55458
N (weighted)	280661	280661	280661	280661	244894	244894	244894	244894	244894	244894	244894	244894

Source: Authors' analysis of OTES and administrative data. Data aggregation relies on sampling weights, calibrated specifically for the post-secondary survey with administrative data.

Notes: The Table presents the balance tests for each variable in the control set used in the main model specification. Each covariate is excluded from the control set and regressed on the peer effect instrument and the remaining controls at the individual- and class-level. Following this logic the individual control set includes: sex, age, nationality, welfare support status, and guardian's education level, labor status, and occupation. The class-level control set includes: class size (log), share of females, share of foreigners, share of welfare beneficiaries, share of guardians with up to lower formal education, and share of guardians not-employed. All estimates include school and region-year fixed effects. All regressions have standard errors clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$. Legend: L.Sec. - lower secondary; U.Sec - upper secondary.

Table C.2: Balance Tests - controlling for student and peer's performance

	6th-grade scores			9th-grade exams		
Explanatory Variable:	PT exam score (log)	Maths exam score (log)	Age^{+}	PT exam score (log)	Maths exam score (log)	Age^{+}
% VET per class	0.139***	0.174***	0.179***	-0.012	-0.029	0.127***
	(0.024)	(0.030)	(0.030)	(0.010)	(0.025)	(0.025)
6th-grade scores controls	Yes	Yes	Yes			
9th-grade scores controls				Yes	Yes	Yes
Individual controls	Yes	Yes	Yes	Yes	Yes	Yes
Class controls	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.590	0.592	0.239	0.460	0.458	0.259
n (unweighted)	51403	51403	51403	62642	62642	62642
N (weighted)	224715	224715	224715	270666	270666	270666

Source: Authors' analysis of OTES and administrative data. Data aggregation relies on sampling weights, calibrated specifically for the post-secondary survey with administrative data.

Notes: The Table presents the balance tests for the performance and age variables. Each covariate presented is excluded from the control set and regressed on the peer effect instrument and the remaining controls at the individual- and class-level. Following this logic the individual control set includes: sex, age, nationality, welfare support status, and guardian's education level, labor status, and occupation. The class-level control set includes: class size (log), share of females, share of foreigners, share of welfare beneficiaries, share of guardians with up to lower formal education, and share of guardians not-employed. The specification related to 6th-grade scores also includes as controls Portuguese and Maths internal scores, the share of students scoring below the cohort median in the 6th-grade Portuguese scores and Maths when not used as the dependent variable. The specification related to 9th-grade scores applies a similar logic to 9th-grade scores. All estimates include school and region-year fixed effects and have standard errors clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Table C.3: Balance Tests - class composition

Explanatory Variable:	Students per class	% girls	% foreigners	% welfare recipients	% guardians with up to lower secondary	% guardians not employed
% VET per class	-0.127***	-0.138***	0.010***	0.162***	0.241***	0.040***
	(0.010)	(0.008)	(0.003)	(0.008)	(0.008)	(0.006)
R-squared	0.498	0.152	0.451	0.731	0.812	0.686
n (unweighted)	64521	64521	64521	64521	64521	64521
N (weighted)	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table presents the balance tests for each variable in the control set used in the main model specification. Each covariate is excluded from the control set and regressed on the peer effect instrument and the remaining controls at the individual- and class-level. Following this logic the individual control set includes: sex, age, nationality, welfare support status, and guardian's education level, labor status, and occupation. The class-level control set includes: class size (log), share of females, share of foreigners, share of welfare beneficiaries, share of guardians with up to lower formal education, and share of guardians not-employed. All estimates include school and region-year fixed effects and have standard errors clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

D Results

D.1 Main results

Table D.1: Impact of VET enrollment on the probability of employment 14 months after expected graduation

Estimation method:	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: 1 - Working; 0 - Otherwise						
VET	0.356***	0.280***	0.279***	0.533***	0.403***	0.337***
	(0.006)	(0.007)	(0.007)	(0.031)	(0.046)	(0.052)
Female		-0.038***	-0.038***		-0.029***	-0.034***
		(0.004)	(0.004)		(0.006)	(0.006)
Age+		0.084***	0.084***		0.054***	0.070***
		(0.005)	(0.005)		(0.012)	(0.014)
Foreigner		0.066***	0.064***		0.075***	0.068***
		(0.019)	(0.019)		(0.020)	(0.020)
Social welfare recipient		0.031***	0.030***		0.022***	0.026***
		(0.005)	(0.005)		(0.006)	(0.006)
Guardian's Education Level						
Lower secondary		0.084***	0.081***		0.072***	0.076***
		(0.008)	(0.008)		(0.009)	(0.009)
Upper secondary		0.019***	0.018**		0.015**	0.016**
		(0.007)	(0.007)		(0.007)	(0.007)
Post-secondary & Higher Education		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
Missing		0.046***	0.048***		0.042***	0.046***
		(0.012)	(0.012)		(0.012)	(0.012)
Guardian's Labor Status						
Employed		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
Unemployed		-0.001	-0.002		-0.001	-0.001
		(0.008)	(0.008)		(0.008)	(0.008)
Inactive		-0.018**	-0.018**		-0.019**	-0.019**
		(0.008)	(0.008)		(0.008)	(0.008)
Missing		-0.017	-0.014		-0.014	-0.013
		(0.014)	(0.014)		(0.014)	(0.014)
Guardian's Occupation						
0 - Armed Forces Occupations		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
1 - Legislators, Senior Officials, and Managers		0.097**	0.096**		0.120**	0.107**
		(0.044)	(0.044)		(0.054)	(0.049)
2 - Professionals of Intellectual		0.051	0.051		0.075	0.062
and Scientific Activities		(0.045)	(0.044)		(0.054)	(0.049)
3 - Technicians and Associate Professionals		0.074*	0.073*		0.097*	0.084*
		(0.044)	(0.044)		(0.054)	(0.049)
4 - Clerical Support Workers		0.067	0.066		0.087	0.076
		(0.044)	(0.044)		(0.054)	(0.049)
5 - Service and Sales Workers;		0.101**	0.100**		0.119**	0.108**
Personal and Protective Services		(0.044)	(0.044)		(0.053)	(0.048)

6 - Skilled Agricultural, Forestry,		0.137^{***}	0.135^{***}		0.144^{**}	0.139^{***}
and Fishery Workers		(0.048)	(0.048)		(0.056)	(0.052)
7 - Craft and Related Trades Workers		0.127^{***}	0.125^{***}		0.139^{***}	0.131^{***}
(Industry and Construction)		(0.044)	(0.044)		(0.053)	(0.048)
8 - Plant and Machine Operators and Assemblers		0.123^{***}	0.121^{***}		0.139^{**}	0.129^{***}
		(0.045)	(0.045)		(0.054)	(0.049)
9 - Elementary Occupations (Unskilled Workers)		0.117^{***}	0.115^{***}		0.128^{**}	0.121^{**}
		(0.045)	(0.044)		(0.054)	(0.049)
Missing		0.095^{**}	0.094^{**}		0.108^{**}	0.101^{**}
		(0.046)	(0.045)		(0.055)	(0.050)
Students per class (log)			0.010			0.014
			(0.016)			(0.016)
% females			0.002			0.004
			(0.018)			(0.018)
% foreigners			0.056			0.058
			(0.059)			(0.060)
% welfare recipients			0.017			0.011
			(0.019)			(0.020)
% guardians with up to lower education			0.063^{***}			0.058^{***}
			(0.018)			(0.019)
% guardians not employed			0.003			0.002
			(0.023)			(0.024)
First-stage Coefficient	.	.	.	0.542^{***}	0.358^{***}	0.343^{***}
Cragg-Donald Wald F statistic	.	.	.	2002.6	1007.4	740.5
Kleibergen-Paap F statistic	.	.	.	901.1	464.9	345.2
Mean Dep. Var.	0.209	0.209	0.209	0.209	0.209	0.209
R-squared	0.122	0.154	0.154	0.091	0.142	0.152
n (unweighted)	64521	64521	64521	64521	64521	64521
N(weighted)	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports estimates of the effect of VET enrollment on the probability of "working" one year after upper secondary school. Columns (1)–(3) use OLS, while columns (4)–(6) use IV; within each method, specifications differ by the controls included. The dependent variable equals one if the student is employed, and zero otherwise. "VET" equals one if the student enrolls in VET in their first upper secondary enrollment. In the IV models, the instrument is "Proportion VET per class", defined as the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. "Age+" is student's age in 9th-grade centered around 14. All regressions include school and region-year fixed effects. Standard errors are clustered at the G9 class level and reported in parentheses .Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Table D.2: Impact of VET enrollment on the probability of studying 14 months after expected graduation

Estimation method:	**OLS**			**IV**		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: 1 - Studying; 0 - Otherwise						
VET	-0.457***	-0.359***	-0.357***	-0.676***	-0.510***	-0.397***
	(0.006)	(0.007)	(0.007)	(0.030)	(0.044)	(0.050)
Female		0.032***	0.032***		0.021***	0.029***
		(0.004)	(0.004)		(0.005)	(0.005)
Age+		-0.119***	-0.118***		-0.082***	-0.108***
		(0.005)	(0.005)		(0.012)	(0.013)
Foreigner		0.010	0.012		-0.002	0.009
		(0.018)	(0.018)		(0.018)	(0.018)
Social welfare recipient		-0.040***	-0.039***		-0.030***	-0.036***
		(0.005)	(0.005)		(0.006)	(0.006)
Guardian's Education Level						
Lower secondary		-0.088***	-0.085***		-0.073***	-0.081***
		(0.007)	(0.007)		(0.008)	(0.008)
Upper secondary		-0.008	-0.007		-0.002	-0.005
		(0.006)	(0.006)		(0.007)	(0.006)
Post-secondary & Higher Education		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
Missing		-0.047***	-0.048***		-0.042***	-0.046***
		(0.011)	(0.011)		(0.011)	(0.011)
Guardian's Labor Status						
Employed		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
Unemployed		-0.009	-0.008		-0.009	-0.008
		(0.008)	(0.008)		(0.008)	(0.008)
Inactive		-0.001	0.000		0.002	0.001
		(0.007)	(0.007)		(0.007)	(0.007)
Missing		0.042***	0.040***		0.038***	0.039***
		(0.012)	(0.012)		(0.012)	(0.012)
Guardian's Occupation						
0 - Armed Forces Occupations		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
1 - Legislators, Senior Officials, and Managers		-0.030	-0.030		-0.058	-0.038
		(0.037)	(0.036)		(0.048)	(0.040)
2 - Professionals of Intellectual		-0.029	-0.030		-0.058	-0.038
and Scientific Activities		(0.036)	(0.036)		(0.049)	(0.040)
3 - Technicians and Associate Professionals		-0.040	-0.041		-0.069	-0.049
		(0.036)	(0.036)		(0.048)	(0.040)
4 - Clerical Support Workers		-0.031	-0.030		-0.056	-0.037
		(0.036)	(0.036)		(0.048)	(0.040)
5 - Service and Sales Workers;		-0.071*	-0.071**		-0.094*	-0.077*
Personal and Protective Services		(0.036)	(0.036)		(0.048)	(0.039)
6 - Skilled Agricultural, Forestry,		-0.107***	-0.105***		-0.117**	-0.108**
and Fishery Workers		(0.041)	(0.040)		(0.051)	(0.043)
7 - Craft and Related Trades Workers		-0.106***	-0.105***		-0.121**	-0.109***
(Industry and Construction)		(0.037)	(0.036)		(0.048)	(0.039)
8 - Plant and Machine Operators and Assemblers		-0.096**	-0.094**		-0.115**	-0.099**

		(0.037)	(0.037)		(0.048)	(0.040)
9 - Elementary Occupations (Unskilled Workers)		-0.111***	-0.110***		-0.125***	-0.114***
		(0.037)	(0.037)		(0.048)	(0.040)
Missing		-0.090**	-0.091**		-0.107**	-0.095**
		(0.038)	(0.037)		(0.049)	(0.041)
Students per class (log)			0.005			0.002
			(0.014)			(0.015)
% females			0.013			0.012
			(0.016)			(0.016)
% foreigners			0.029			0.027
			(0.050)			(0.051)
% welfare recipients			-0.081***			-0.077***
			(0.018)			(0.019)
% guardians with up to lower education			-0.029*			-0.025
			(0.017)			(0.017)
% guardians not employed			-0.042*			-0.041*
			(0.022)			(0.022)
First-stage Coefficient	.	.	.	0.542***	0.358***	0.343***
Cragg-Donald Wald F statistic	.	.	.	2002.6	1007.4	740.5
Kleibergen-Paap F statistic	.	.	.	901.1	464.9	345.2
Mean Dep. Var.	0.806	0.806	0.806	0.806	0.806	0.806
R-squared	0.212	0.264	0.266	0.163	0.245	0.264
n (unweighted)	64521	64521	64521	64521	64521	64521
N(weighted)	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports estimates of the effect of VET enrollment on the probability of "studying" one year after upper secondary school. Columns (1)–(3) use OLS, while columns (4)–(6) use IV; within each method, specifications differ by the controls included. The dependent variable equals one if the student is studying, and zero otherwise. "VET" equals one if the student enrolls in VET in their first upper secondary enrollment. In the IV models, the instrument is "Proportion VET per class", defined as the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. "Age+" is student's age in 9th-grade centered around 14. All regressions include school and region-year fixed effects. Standard errors are clustered at the G9 class level and reported in parentheses .Significance levels: * $p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table D.3: Impact of VET enrollment on the probability of being NEET 14 months after expected graduation

Estimation method:	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.: 1 - NEET; 0 - Otherwise						
VET	0.108***	0.082***	0.081***	0.168***	0.126***	0.093***
	(0.004)	(0.004)	(0.004)	(0.020)	(0.030)	(0.034)
Female		0.005*	0.005*		0.008**	0.006
		(0.002)	(0.002)		(0.003)	(0.004)
Age+		0.034***	0.034***		0.024***	0.031***
		(0.004)	(0.004)		(0.008)	(0.009)
Foreigner		-0.016	-0.018*		-0.013	-0.017
		(0.011)	(0.011)		(0.011)	(0.011)
Social welfare recipient		0.015***	0.015***		0.012***	0.014***
		(0.003)	(0.003)		(0.004)	(0.004)
Guardian's Education Level						
Lower secondary		0.013***	0.012***		0.008	0.011**
		(0.004)	(0.004)		(0.005)	(0.005)
Upper secondary		-0.003	-0.003		-0.004	-0.003
		(0.004)	(0.004)		(0.004)	(0.004)
Post-secondary & Higher Education		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
Missing		0.002	0.001		0.000	0.001
		(0.006)	(0.006)		(0.006)	(0.006)
Guardian's Labor Status						
Employed		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
Unemployed		0.011**	0.011**		0.011**	0.011**
		(0.005)	(0.005)		(0.005)	(0.005)
Inactive		0.008*	0.008*		0.008	0.008
		(0.005)	(0.005)		(0.005)	(0.005)
Missing		-0.015*	-0.015**		-0.014*	-0.015*
		(0.008)	(0.008)		(0.008)	(0.008)
Guardian's Occupation						
0 - Armed Forces Occupations		0.000	0.000		0.000	0.000
		(.)	(.)		(.)	(.)
1 - Legislators, Senior Officials, and Managers		-0.004	-0.004		0.004	-0.002
		(0.021)	(0.021)		(0.023)	(0.022)
2 - Professionals of Intellectual		0.006	0.006		0.014	0.008
and Scientific Activities		(0.021)	(0.021)		(0.023)	(0.022)
3 - Technicians and Associate Professionals		0.008	0.008		0.017	0.010
		(0.021)	(0.021)		(0.023)	(0.022)
4 - Clerical Support Workers		0.007	0.007		0.014	0.008
		(0.021)	(0.021)		(0.023)	(0.022)
5 - Service and Sales Workers;		0.019	0.019		0.025	0.021
Personal and Protective Services		(0.021)	(0.021)		(0.022)	(0.022)
6 - Skilled Agricultural, Forestry,		0.019	0.019		0.022	0.020
and Fishery Workers		(0.024)	(0.024)		(0.025)	(0.024)
7 - Craft and Related Trades Workers		0.024	0.024		0.029	0.025
(Industry and Construction)		(0.021)	(0.021)		(0.022)	(0.022)
8 - Plant and Machine Operators and Assemblers		0.011	0.011		0.017	0.012

		(0.022)	(0.022)		(0.023)	(0.022)
9 - Elementary Occupations (Unskilled Workers)		0.034	0.034		0.038*	0.035
		(0.022)	(0.022)		(0.023)	(0.022)
Missing		0.032	0.032		0.037	0.034
		(0.022)	(0.022)		(0.023)	(0.022)
Students per class (log)			-0.009			-0.008
			(0.009)			(0.009)
% females			-0.004			-0.004
			(0.010)			(0.010)
% foreigners			0.031			0.032
			(0.032)			(0.032)
% welfare recipients			0.044***			0.042***
			(0.012)			(0.013)
% guardians with up to lower education			-0.014			-0.015
			(0.010)			(0.011)
% guardians not employed			0.017			0.017
			(0.014)			(0.014)
First-stage Coefficient	.	.	.	0.542***	0.358***	0.343***
Cragg-Donald Wald F statistic	.	.	.	2002.6	1007.4	740.5
Kleibergen-Paap F statistic	.	.	.	901.1	464.9	345.2
Mean Dep. Var.	0.055	0.055	0.055	0.055	0.055	0.055
R-squared	0.035	0.047	0.048	0.024	0.043	0.048
n (unweighted)	64521	64521	64521	64521	64521	64521
N(weighted)	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports estimates of the effect of VET enrollment on the probability of being NEET one year after upper secondary school. Columns (1)–(3) use OLS, while columns (4)–(6) use IV; within each method, specifications differ by the controls included. The dependent variable equals one if the student is NEET, and zero otherwise. "VET" equals one if the student enrolls in VET in their first upper secondary enrollment. In the IV models, the instrument is 'Proportion VET per class', defined as the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. "Age+" is student's age in 9th-grade centered around 14. All regressions include school and region-year fixed effects. Standard errors are clustered at the G9 class level and reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.2 Sensitivity analyses

D.2.1 Persistence of peer effects and track-choice exogeneity

Table D.4 reports IV estimates for students from lower-secondary school districts that did not offer upper-secondary education in the year after lower-secondary completion. This subsample represents 28% of the final sample and captures students who were required to change school district to continue their studies at the upper-secondary level, independently of track choice. Peer-network persistence is lower in this group: 39% remain in the same school district in 10th-grade, compared with 50% in the full sample, falling to 24% by the last 12th-grade enrollment, compared with 30% in the full sample. This restriction therefore provides a useful check on the exclusion restriction, since lower-secondary peers are less likely to remain part of the same upper-secondary environment and to affect later outcomes directly. As expected, the first-stage weakens substantially, although the Cragg–Donald Wald statistic remains well above conventional weak-instrument thresholds (>100). The IV estimates remain similar in sign and magnitude to the baseline results, supporting the interpretation that the main findings are not driven by the persistence of lower-secondary peer networks into upper secondary education, and more importantly into post-secondary outcomes.

Table D.4: Impact of VET enrollment on post-secondary outcomes, among students without local upper secondary provision

Dependent variable:	Working	Studying	NEET
VET	0.385***	-0.455***	0.120*
	(0.103)	(0.093)	(0.072)
First-stage coefficient	0.324***	0.324***	0.324***
Cragg-Donald Wald F statistic	169.5	169.5	169.5
Kleibergen-Paap F statistic	94.6	94.6	94.6
Mean Dep. Var.	0.237	0.773	0.064
R-squared	0.150	0.269	0.046
n (unweighted)	18183	18183	18183
N (weighted)	79113	79113	79113

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table presents the IV estimates of VET enrollment on the three indicated post-secondary outcomes ("Working", "Studying", "NEET"), for the restricted sample of students who attended 9th-grade in a school district that did not offer upper secondary programs at the time of their transition to upper secondary education. The dependent variables are dummy variables equal to one if the student has that outcome one year after upper secondary school. The outcomes "Working" and "Studying" are not mutually exclusive. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. "Proportion VET per class" is the instrumental variable in the IV regressions and it is calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions include individual and class-level controls, and school and region-year fixed effects. Standard errors are clustered at the G9 level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

D.2.2 Pre-existing academic differences

We assess the sensitivity of our estimates to controls for individual ability and peer academic performance across two main subjects — Portuguese and Mathematics — measured at two points in time: 6th-grade, which predates the peer interactions directly relevant for upper-secondary track choice, and 9th-grade, which is contemporaneous with those choices.

Table D.5 introduces pre-determined measures of ability, captured by 6th-grade internal grades in Portuguese and Mathematics. One important limitation is that data availability for 6th-grade internal grades is skewed towards students in public schools - 90% coverage for public schools compared to 9% for private schools. Conscious of this limitation, we first restrict the sample to students with non-missing grades [model (2)], and then include individual- and class-level achievement controls [model (3)]. The estimates of VET enrollment on the employment–education trade-off remain statistically significant but decline in magnitude relative to the baseline specification. VET enrollment is associated with an increase of approximately 26 percentage points in employment, a decrease of approximately 30 percentage points in further education participation. The effect on the NEET status is 6 percentage points, although not statistically significant. This attenuation is consistent with negative selection into VET based on prior academic achievement. In particular, higher-achieving students are less likely to be employed shortly after upper secondary education, more likely to continue studying, and less likely to become NEET. Since VET students have lower prior achievement on average, omitting these controls is likely upward-biasing, in absolute terms, the effects of vocational education. When statistically significant, class-level achievement controls point in the same direction, suggesting that both own prior ability and peer academic composition matter for post-secondary transitions.

Table D.6 repeats the exercise using 9th-grade exam scores in Portuguese and Mathematics, together with corresponding class-level measures. It follows a similar structure, with models (2)–(4) progressively incorporating these additional controls. These variables require careful interpretation, as they are jointly determined with both individual and peer track choices. In contrast to the 6th-grade measures and baseline class composition controls - which are pre-determined - 9th-grade performance may be influenced by contemporaneous peer environments (used to construct the instrument) and may itself affect track choice. Conditioning on these variables therefore risks introducing endogeneity and may absorb part of the mechanism through which peers affect track choice and later outcomes. For this reason, we interpret the 9th-grade specifications as diagnostic rather than as preferred controls.

The results are nonetheless informative. As in the 6th-grade specifications, adding academic performance controls reduces the magnitude of the estimated treatment effects. VET enrollment remains associated with a sizable increase in employment, between 22 and 25 percentage points, and a reduction in further education participation, between 25 and 28 percentage points. The estimated effect on NEET remains positive, between 2 and 4 percentage points, but is no longer statistically significant once 9th-grade performance is included. Overall, these results reinforce two conclusions. First, the main employment–education trade-off is robust to rich controls for prior and contemporaneous academic performance. Second, the magnitude of the baseline estimates, especially for NEET, is sensitive to academic sorting and should therefore be interpreted with caution.

Table D.5: Impact of VET enrollment on post-secondary outcomes while controlling for individual and peers' performance in 6th-grade

Dep. Var.:	Working			Studying			NEET		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
VET	0.337***	0.345***	0.255***	-0.397***	-0.397***	-0.301***	0.093***	0.086**	0.060
	(0.052)	(0.056)	(0.059)	(0.050)	(0.054)	(0.057)	(0.034)	(0.037)	(0.038)
Individual controls, 6th-grade									
PT individual internal grade			-0.032***			0.040***			-0.012***
			(0.007)			(0.007)			(0.005)
Maths individual internal grade			-0.037***			0.045***			-0.016***
			(0.006)			(0.006)			(0.004)
Class controls, 9th-grade									
(6th-grade) PT class-average grade			-0.037***			0.015			0.013
			(0.014)			(0.013)			(0.009)
(6th-grade) Maths class-average grade			0.004			0.011			-0.015*
			(0.012)			(0.011)			(0.007)
Restricted to available observations		Yes	Yes		Yes	Yes		Yes	Yes
First-stage Coefficient	0.343***	0.353***	0.354***	0.343***	0.353***	0.354***	0.343***	0.352***	0.354***
Cragg-Donald Wald F statistic	740.5	614.2	586.3	740.5	614.2	586.3	740.5	614.2	586.3
Kleibergen-Paap F statistic	345.2	298.9	284.7	345.2	298.9	284.7	345.2	298.9	284.7
Mean Dep. Var.	0.209	0.217	0.217	0.806	0.794	0.794	0.055	0.058	0.058
R-squared	0.152	0.154	0.169	0.264	0.271	0.288	0.048	0.051	0.056
n (unweighted)	64521	51403	51403	64521	51403	51403	64521	51403	51403
N (weighted)	280661	224715	224715	280661	224715	224715	280661	224715	224715

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table presents the IV estimates of VET enrollment on the three indicated post-secondary outcomes ("Working", "Studying", "NEET"), with four different model specifications. Model (1) shows the main model specification, as in the last column of Table 2. Model (2) restricts the sample to observations with non-missing values in 6th-grade internal grades. Model (3) adds individual 6th-grade internal grades and class-level averages. The dependent variables are dummy variables equal to one if the student has that outcome one year after upper secondary school. The outcomes "Working" and "Studying" are not mutually exclusive. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. "Proportion VET per class" is the instrumental variable in the IV regressions and it is calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions include individual and class-level controls, and school and region-year fixed effects. Standard errors are clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.6: Impact of VET enrollment on post-secondary outcomes while controlling for individual and peers' exam scores in 9th-grade

Dep. Var.:	Working				Studying				NEET			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
	0.337***	0.358***	0.253***	0.224***	-0.397***	-0.399***	-0.281***	-0.245***	0.093***	0.069**	0.035	0.019
	(0.052)	(0.052)	(0.061)	(0.061)	(0.050)	(0.051)	(0.057)	(0.057)	(0.034)	(0.031)	(0.036)	(0.036)
Individual controls, 9th-grade												
PT exam score (log)			-0.119***	-0.129***			0.138***	0.147***			-0.042***	-0.045***
			(0.022)	(0.023)			(0.021)	(0.021)			(0.013)	(0.013)
Maths exam score (log)			-0.072***	-0.075***			0.102***	0.107***			-0.039***	-0.042***
			(0.011)	(0.011)			(0.010)	(0.010)			(0.007)	(0.007)
Class controls, 9th-grade												
% low-achievers in PT			-0.015				-0.008				0.016	
			(0.018)				(0.016)				(0.011)	
% low-achievers in Maths			0.022				0.010				-0.022**	
			(0.018)				(0.016)				(0.010)	
PT class-average score (log)				0.019				0.027				-0.035*
				(0.030)				(0.028)				(0.018)
Maths class-average score (log)				-0.028*				0.002				0.013
				(0.017)				(0.015)				(0.010)
Restricted to available exam-scores		Yes	Yes	Yes		Yes	Yes	Yes		Yes	Yes	Yes
First-stage Coefficient	0.343***	0.338***	0.312***	0.324***	0.343***	0.338***	0.312***	0.324***	0.343***	0.338***	0.312***	0.324***
Cragg-Donald Wald F statistic	740.5	693.9	576.9	579.9	740.5	693.9	576.9	579.9	740.5	693.9	576.9	579.9
Kleibergen-Paap F statistic	345.2	323.2	266.2	261.9	345.2	323.2	266.2	261.9	345.2	323.2	266.2	261.9
Mean Dep. Var.	0.209	0.204	0.204	0.204	0.806	0.813	0.813	0.813	0.055	0.051	0.051	0.051
R-squared	0.152	0.152	0.174	0.174	0.264	0.255	0.286	0.285	0.048	0.041	0.051	0.049
n (unweighted)	64521	62642	62642	62642	64521	62642	62642	62642	64521	62642	62642	62642
N (weighted)	280661	270666	270666	270666	280661	270666	270666	270666	280661	270666	270666	270666

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table presents the IV estimates of VET enrollment on the three indicated post-secondary outcomes ("Working", "Studying", "NEET"), with four different model specifications. Model (1) shows the main model specification, as in the last column of Table 2. Model (2) restricts the sample to observations with non-missing values in 9th-grade final exam scores. Models (3) and (4) add individual 9th-grade exam scores and class-level performance measures in both Mathematics and Portuguese. The dependent variables are dummy variables equal to one if the student has that outcome one year after upper secondary school. The outcomes "Working" and "Studying" are not mutually exclusive. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. "Proportion VET per class" is the instrumental variable in the IV regressions and it is calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions include individual and class-level controls, and school and region-year fixed effects. Standard errors are clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

D.2.3 Measurement and distribution of peer exposure

We construct additional peer-exposure measures to assess whether the results are sensitive to alternative definitions of the relevant reference group. Firstly, we redefine the relevant peer network using classmates observed in 6th-grade rather than 9th-grade (Table D.7). The instrument is the leave-one-out share of 6th-grade classmates who subsequently enroll in VET at the first upper-secondary enrollment, and all class-level controls and school fixed effects are also measured at the 6th-grade level. This exercise provides a more conservative peer-exposure measure, since students are reshuffled after 6th-grade in schools with more than one class per cohort and these earlier peer networks are less likely to persist into the upper-secondary transition. Consistent with this interpretation, the first stage is smaller than in the 9th-grade specification, with coefficients around 0.20 compared with 0.34 in the baseline, although the instrument remains strong. The estimates are also less precise, partly because consistent 6th-grade class identifiers are only available from the 2017 cohort onward, reducing the estimation sample. Despite these restrictions, the results remain broadly consistent with the main findings: the estimated effect on working is positive but smaller and not statistically significant; the effect on studying remains negative and statistically significant; and the effect on NEET remains positive, although imprecisely estimated.

Secondly, motivated by the possibility that peer effects may operate through heterogeneous reference points across subgroups of students (Rosenqvist, 2018), we consider a broader school-grade VET share, as well as within-class peer shares defined by gender and academic performance. Additionally, we also test robustness of the results to extreme peer compositions. These alternative instruments provide a check on whether the baseline estimates are driven by the specific class-level measure or by particular segments of the peer distribution. The results are broadly consistent with the main specification (Table D.8). Across alternative peer-group definitions, VET enrollment continues to increase the probability of employment and reduce participation in further education. The estimated effects on NEET are also positive across specifications, although smaller in magnitude than in the baseline model.

Overall, the stability of the signs across outcomes suggests that the baseline results are not driven solely by the persistence of 9th-grade peer groups or by the specific definition of the peer network used in the main specification.

Table D.7: Impact of VET enrollment on post-secondary outcomes: robustness to 6th-grade peer exposure, cohorts 2017 onwards

Dep. Var.:	Working				Studying				NEET			
Peer effects:	9th-grade		6th-grade		9th-grade		6th-grade		9th-grade		6th-grade	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
VET	0.314***	0.267***	0.197	0.054	-0.361***	-0.294***	-0.411***	-0.309**	0.078*	0.040	0.156*	0.151
	(0.070)	(0.082)	(0.157)	(0.167)	(0.066)	(0.077)	(0.142)	(0.145)	(0.045)	(0.052)	(0.093)	(0.098)
Individual controls, 6th-grade												
PT individual internal grade		-0.030***		-0.048***		0.036***		0.029**		-0.013**		-0.001
		(0.010)		(0.016)		(0.009)		(0.014)		(0.006)		(0.009)
Maths individual internal grade		-0.035***		-0.052***		0.045***		0.043***		-0.018***		-0.009
		(0.008)		(0.015)		(0.007)		(0.014)		(0.005)		(0.009)
Class controls, 6th-grade												
(6th-grade) PT class-average grade		-0.047**		-0.024		0.016		0.029		0.013		-0.016
		(0.019)		(0.022)		(0.018)		(0.020)		(0.012)		(0.013)
(6th-grade) Maths class-average grade		0.006		-0.007		0.009		0.019		-0.011		-0.009
		(0.017)		(0.020)		(0.015)		(0.018)		(0.010)		(0.012)
Individual and class controls, 9th-grade	Yes	Yes			Yes	Yes			Yes	Yes		
Individual and class controls, 6th-grade			Yes	Yes			Yes	Yes			Yes	Yes
9th-grade school and region-year FE	Yes	Yes			Yes	Yes			Yes	Yes		
6th-grade school and region-year FE			Yes	Yes			Yes	Yes			Yes	Yes
First-stage Coefficient	0.337***	0.341***	0.199**	0.203**	0.337***	0.341***	0.199**	0.203**	0.337***	0.341***	0.199**	0.203**
Cragg-Donald Wald F statistic	422.6	319.7	75.8	75.4	422.6	319.7	75.8	75.4	422.6	319.7	75.8	75.4
Kleibergen-Paap F statistic	195.5	155.6	37.2	37.0	195.5	155.6	37.2	37.0	195.5	155.6	37.2	37.0
Mean Dep. Var.	0.223	0.230	0.201	0.203	0.788	0.778	0.813	0.811	0.062	0.066	0.057	0.058
R-squared	0.149	0.165	0.137	0.129	0.268	0.288	0.249	0.269	0.051	0.056	0.038	0.045
n (unweighted)	39847	31983	26994	23412	39847	31983	26994	23412	39847	31983	26994	23412
N (weighted)	198434	159667	142184	124303	198434	159667	142184	124303	198434	159667	142184	124303

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The table reports IV estimates of the effect of VET enrollment on post-secondary outcomes. The estimation sample is restricted to post-secondary cohorts from 2017 onward, for which both 9th- and 6th-grade peer-exposure measures can be constructed consistently. The dependent variables are indicators equal to one if the student is working, studying, or NEET one year after expected upper-secondary completion. The outcomes "Working" and "Studying" are not mutually exclusive. "VET" is an indicator equal to one if the student enrolls in a vocational track in the first upper-secondary enrollment. In models (1) and (2), VET enrollment is instrumented using the leave-one-out share of classmates from the student's 9th-grade class who enroll in VET in upper secondary school. In models (3) and (4), VET enrollment is instrumented using the corresponding leave-one-out share among classmates from the student's 6th-grade class. Columns (2) and (4) additionally include individual 6th-grade internal grades in Portuguese and Mathematics, as well as class-level average grades in these subjects. All specifications include the individual and class-level controls indicated in the table, school-of-origin fixed effects, and region-year fixed effects. Standard errors are clustered at the class level used to construct the instrument: the 9th-grade class in columns (1) and (2), and the 6th-grade class in columns (3) and (4). Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.8: Impact of VET enrollment on post-secondary outcomes with alternative instruments

Instrumental variable (VET share):	Baseline		Same-gender	(9th-grade)		(6th-grade)		Remove top/bottom	
	Class	School-grade	classmates	PT-peer	Maths-peer	PT-peer	Maths-peer	1%	5%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. var.: 1 - Working; 0 - Otherwise									
VET	0.337***	0.314***	0.357***	0.330***	0.357***	0.369***	0.462***	0.314***	0.281***
	(0.052)	(0.040)	(0.047)	(0.062)	(0.050)	(0.050)	(0.069)	(0.056)	(0.071)
Mean Dep. Var.:	0.209	0.209	0.209	0.204	0.204	0.217	0.218	0.207	0.208
Dep. var.: 1 - Studying; 0 - Otherwise									
VET	-0.397***	-0.333***	-0.383***	-0.354***	-0.417***	-0.452***	-0.511***	-0.386***	-0.369***
	(0.050)	(0.038)	(0.044)	(0.058)	(0.047)	(0.048)	(0.064)	(0.053)	(0.067)
Mean Dep. Var.:	0.806	0.806	0.806	0.813	0.813	0.793	0.793	0.808	0.808
Dep. var.: 1 - NEET; 0 - Otherwise									
VET	0.093***	0.081***	0.041	0.062	0.068**	0.086***	0.062	0.109***	0.092**
	(0.034)	(0.022)	(0.029)	(0.039)	(0.031)	(0.032)	(0.042)	(0.035)	(0.045)
Mean Dep. Var.:	0.055	0.055	0.055	0.051	0.051	0.059	0.059	0.054	0.054
Main individual controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Main class-composition controls	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Main school-level controls		Yes							
Individual student performance controls				Yes	Yes	Yes	Yes		
Peer's performance controls				Yes	Yes	Yes	Yes		
Region-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
G9 School FE	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage Coefficient	0.343***	0.631***	0.310***	0.217***	0.290***	0.276***	0.197***	0.324***	0.289***
Cragg-Donald Wald F statistic	740.5	1507.3	907.7	698.8	1087.1	920.9	547.7	602.2	352.7
Kleibergen-Paap F statistic	345.2	485.3	427.5	279.0	402.8	411.0	223.7	280.3	176.1
n (unweighted)	64521	64537	64521	62642	62685	49655	49778	63939	57757
N (weighted)	280661	280757	280661	270666	270899	217003	217640	277356	248277

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports the IV estimates of VET enrollment on the three indicated outcomes. Each estimate is obtained from a separate IV regression using the instrument specified in the table. Controls and fixed effects are included as indicated. Outcomes are binary indicators measured one year after upper secondary completion. "Working" and "Studying" are not mutually exclusive. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. The class-level instrument is the share of 9th-grade classmates enrolling in VET in the first year of upper secondary education. The school-grade instrument is the corresponding share among all students in the same grade and school. The gender-class instrument is the share among same-gender classmates. The Portuguese- and Mathematics-class instruments are the shares among classmates with similar prior performance in the corresponding subject. Standard errors, reported in parentheses, are clustered at the G9 class level for all specifications, except in (2) which are clustered at the G9 school level.

D.2.4 Model specification and data choices

To assess the robustness of our preferred IV specification, Table D.9 presents three supplementary tests. First, we redefine treatment using students' track at the end of upper-secondary education rather than at first enrollment in 10th-grade. This specification accounts for subsequent track switching and captures students' completed upper-secondary pathway, rather than only their initial placement. The estimates are larger in magnitude, consistent with the interpretation that sustained exposure to VET, or persistence until completion in the vocational track, is associated with stronger post-secondary effects. Second, we employ school-by-cohort fixed effects, which absorb all time-invariant factors common to a school and cohort, thereby restricting identification to variation between classes within the same school and cohort. Finally, we estimate the model on an unweighted sample to verify that our results are not driven by the survey weighting procedure. The stability of the coefficient estimates across these alternative specifications suggests that our core findings are not driven by subsequent track reclassification, omitted school-cohort factors or the use of sample weights.

Table D.9: Impact of VET enrollment on post-secondary outcomes with alternative model specifications

Specification:	Baseline	Track choice 12th-grade	School-cohort FE	Unweighted Sample
	(1)	(2)	(3)	(4)
Dep. var.: 1 - Working; 0 - Otherwise				
VET (first 10th-grade)	0.337***		0.610***	0.388***
	(0.052)		(0.114)	(0.045)
VET (last 12th-grade)		0.424***		
		(0.065)		
Dep. var.: 1 - Studying; 0 - Otherwise				
VET (first 10th-grade)	-0.397***		-0.587***	-0.498***
	(0.050)		(0.106)	(0.042)
VET (last 12th-grade)		-0.498***		
		(0.061)		
Dep. var.: 1 - NEET; 0 - Otherwise				
VET (first 10th-grade)	0.093***		0.075	0.122***
	(0.034)		(0.068)	(0.028)
VET (last 12th-grade)		0.112***		
		(0.042)		
Main individual controls	Yes	Yes	Yes	Yes
Main class-composition controls	Yes	Yes	Yes	Yes
Region-year FE	Yes	Yes	Yes	Yes
G9 School FE	Yes	Yes		Yes
G9 School-cohort FE			Yes	
First-stage Coefficient	0.343***	0.278***	0.178***	0.290***
Cragg-Donald Wald F statistic	740.5	424.7	141.4	585.9
Kleibergen-Paap F statistic	345.2	185.9	74.4	468.1
n (unweighted)	64521	64219	63599	64521
N (weighted)	280661	279369	271801	.

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The table reports IV estimates of the effect of VET enrollment on the three indicated outcomes. Each estimate is obtained from a separate IV regression. All outcome variables are binary and equal to one if the individual reports the corresponding outcome, and zero otherwise. "VET" is the treatment indicator equal to one if the student enrolls in VET in their first upper-secondary enrollment. "Proportion VET per class" is the instrumental variable, calculated as the leave-out proportion of classmates in student (i)'s 9th-grade class who enroll in the vocational track in the first year of upper secondary education. All regressions include fixed effects as specified. Standard errors are clustered at the G9 class level in models (1), (2), (4), and at the G9 class-cohort level in model (3). Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Lastly, Table D.10 assesses the robustness of our findings by comparing estimates of higher education participation from two distinct data sources: the OTES survey ("Studying") and official administrative records ("Higher or post-secondary enrollment")[28]. The estimated negative impact of VET enrollment is similar in magnitude across both data sources (columns (1) and (2)). This consistency supports the validity of the OTES survey data, enhancing the credibility of our main results — particularly for labor market outcomes, where matched administrative data are unavailable.

Furthermore, disaggregating the administrative outcomes reveals the specific educational pathways affected. Enrolling in the VET track in 10th-grade is associated with a substantively and statistically significant decrease in the probability of enrolling in a bachelor's degree program. Conversely, it increases the probability of enrolling in a short-cycle tertiary program (CTeSP). This pattern of substitution is consistent with institutional expectations, as the vocational track provides a direct pathway into these shorter, professionally oriented higher education programs.

Table D.10: Impact of VET enrollment on Higher/post-secondary education enrollment

Database:	OTES	Official Statistics		
Dependent variable:	Studying	Higher or post-secondary	Bachelor	CTeSP
	(1)	(2)	(3)	(4)
VET	-0.397***	-0.432***	-0.425***	0.081***
	(0.050)	(0.014)	(0.014)	(0.008)
First-stage coefficient	0.343***	0.353***	0.353***	0.353***
Cragg-Donald Wald F statistic	740.5	6633.8	6633.8	6633.8
Kleibergen-Paap F statistic	345.2	4370.1	4370.1	4370.1
Mean Dep. Var.	0.806	0.615	0.524	0.064
R-squared	0.264	0.311	0.247	0.033
n (unweighted)	64521	.	.	
N (weighted/population)	280661	553886	553886	553886

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The Table presents the IV estimates of VET enrollment on further studying for the OTES sample and official statistics. The outcome variables are all binary variables equal to one if the individual has that outcome, and 0 otherwise. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. "Proportion VET per class" is the instrumental variable in the IV regressions and it is calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions include school and region-year fixed effects and have standard errors clustered at the G9 class level. Significance levels: * $p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

[28] Derived from Higher Education Registry (RAIDES – *Registo de Alunos Inscritos e Diplomados do Ensino Superior*).

Table D.11: Impact of VET enrollment on job quality

Dependent Variable:	Full-time		Part-time		Salaried Employee		Open-ended		Fixed term		Job found before graduation		Aligne future exp
Model specification:	Uncond	Cond.	Uncond	Cond.	Uncond	Cond.	Uncond	Cond.	Uncond	Cond.	Uncond	Cond.	Uncond
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
VET	0.277***	0.253**	0.029	-0.193**	0.331***	0.240***	0.208***	0.295***	0.106**	-0.177*	-0.002	-0.218**	0.112***
	(0.047)	(0.101)	(0.033)	(0.091)	(0.051)	(0.089)	(0.040)	(0.105)	(0.043)	(0.107)	(0.033)	(0.090)	(0.041)
Conventional P-value	0.000	-	0.378	-	0.000	-	0.000	-	0.001	-	0.963	-	0.005
Romano-Wolf p-value	0.001	-	0.445	-	0.001	-	0.001	-	0.009	-	0.936	-	0.005
First-stage coefficient	0.343***	0.382***	0.343***	0.382***	0.343***	0.382***	0.343***	0.382***	0.343***	0.382***	0.343***	0.382***	0.343***
Cragg-Donald Wald F statistic	740.5	155.0	740.5	155.0	740.5	155.0	740.5	155.0	740.5	155.0	740.5	155.0	740.5
Kleibergen-Paap F statistic	345.2	119.0	345.2	119.0	345.2	119.0	345.2	119.0	345.2	119.0	345.2	119.0	345.2
Mean Dep. Var.	0.110	0.514	0.072	0.336	0.162	0.760	0.066	0.309	0.108	0.506	0.054	0.252	0.073
R-squared	0.139	0.076	0.008	0.075	0.112	-0.022	0.039	-0.045	0.052	-0.012	0.008	0.024	0.073
n (unweighted)	64521	13382	64521	13382	64521	13382	64521	13382	64521	13382	64521	13382	64521
N(weighted)	280661	69104	280661	69104	280661	69104	280661	69104	280661	69104	280661	69104	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The reports the IV estimates of VET enrollment on the indicated job quality outcomes, unconditionally (*"uncond."*) and conditional on employment (*"cond."*). All regressions include individual and class-level controls, and school and region-year fixed effects. The dependent variables are dummy variables equal to one if the student has that outcome one year after upper secondary school, and zero otherwise. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment, and zero otherwise. "Proportion VET per class" is the instrumental variable calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions have standard errors clustered at the G9 class level in parentheses. Conventional p-values are two-sided. Romano-Wolf p-values are step-down adjusted p-values accounting for multiple hypothesis testing. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table D.12: Heterogeneous effects of VET enrollment on post-secondary outcomes

Dependent variable:	Working			Studying			NEET		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VET x 2015	0.387***			-0.434***			0.098***		
	(0.054)			(0.050)			(0.035)		
VET x 2016	0.379***			-0.428***			0.060*		
	(0.058)			(0.055)			(0.036)		
VET x 2018	0.421***			-0.455***			0.078**		
	(0.054)			(0.050)			(0.034)		
VET x 2019	0.310***			-0.424***			0.133***		
	(0.051)			(0.048)			(0.034)		
VET x 2021	0.301***			-0.350***			0.091*		
	(0.077)			(0.074)			(0.050)		
VET x male		0.348***			-0.378***			0.053*	
		(0.051)			(0.048)			(0.031)	
VET x female		0.326***			-0.416***			0.131***	
		(0.058)			(0.056)			(0.039)	
VET x non-beneficiary			0.353***			-0.392***			0.092**
			(0.059)			(0.056)			(0.036)
VET x beneficiary			0.320***			-0.403***			0.094**
			(0.054)			(0.052)			(0.037)
p-value (equal effects by sub-group)	0.047**	0.526	0.475	0.500	0.243	0.788	0.095*	0.000***	0.947
Cragg-Donald Wald F statistic	149.1	360.3	353.2	149.1	360.3	353.2	149.1	360.3	353.2
Kleibergen-Paap F statistic	69.6	169.5	156.9	69.6	169.5	156.9	69.6	169.5	156.9
Mean Dep. Var.	0.209	0.209	0.209	0.806	0.806	0.806	0.055	0.055	0.055
R-squared	0.168	0.151	0.151	0.286	0.265	0.264	0.053	0.048	0.048
n (unweighted)	64521	64521	64521	64521	64521	64521	64521	64521	64521
N (weighted)	280661	280661	280661	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports IV estimates of the effect of VET enrollment on the indicated outcomes, by cohort, gender and social welfare status. All regressions include individual and class-level controls, as well as school and region-year fixed effects. Outcomes are dummy variables measured one year after upper secondary school; "Working" and "Studying" are not mutually exclusive. Sub-group effects are estimated through interactions between VET enrollment and the corresponding cohort, gender or social welfare status indicator. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. The p-value refers to the F-test of equality of all heterogeneous treatment effects within each specification. Standard errors are clustered at the G9 class level and reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

E Mechanisms

Table E.1 reports the impact of VET on enrollment in and completion of 12th-grade using administrative data. The sample focuses on students enrolled in 9th-grade for whom peer track choices in 10th-grade are observed, and restricting the sample to cohorts with their last 9th-grade enrollment between 2011/12 and 2017/18 (same as OTES sample). Across specifications, VET is associated with a lower probability of reaching 12th-grade and a lower likelihood of completing it, relative to students in the academic track.

Given the potential underrepresentation of students who leave school before reaching 12th-grade in the OTES survey, Table E.2 examines upper-secondary completion conditional on 12th-grade enrollment, comparing estimates from the OTES sample with those from the full administrative sample. These results have a descriptive nature, since G12 graduation itself is affected by VET enrollment and conditioning on it may introduce post-treatment selection. The Table shows that completion rates among students who reach 12th-grade are higher in OTES than in the administrative data (0.917 versus 0.837). The estimated effects of VET on graduation rates lack statistical significance in the OTES sample and the effects are negative in the administrative sample, consistent with selective coverage in the OTES follow-up.

Taken together, these findings suggest that VET students are less likely to reach 12th-grade and less likely to complete upper secondary school conditional on reaching it based on the administrative sample. The corresponding estimates in the OTES sample are not statistically significant, which is consistent with a potential underrepresentation of drop-outs in the survey.

Table E.1: Impact of VET enrollment on G12 indicators, based on administrative sample (unconditional)

Dependent variable:	Enrollment G12		Graduation G12	
	(1)	(2)	(1)	(2)
VET	-0.031***	-0.095***	-0.047***	-0.182***
	(0.009)	(0.018)	(0.014)	(0.031)
G9 School and region-year FE	Yes		Yes	
G9 School-cohort and region-year FE		Yes		Yes
First-stage coefficient	0.353***	0.177***	0.353***	0.177***
Cragg-Donald Wald F statistic	6633.8	1224.2	6633.8	1224.2
Kleibergen-Paap F statistic	4370.1	616.2	4370.1	616.2
Mean Dep. Var.	0.937	0.937	0.784	0.784
R-squared	0.074	0.043	0.074	0.031
N (population)	553886	553876	553886	553876

Source: Authors' analysis of administrative data.

Notes: The table reports IV estimates of the effect of VET enrollment on 12th-grade enrollment and graduation. "Enrollment G12" equals one if the student is registered in 12th grade at least once during the period, and zero otherwise. "Graduation G12" equals one if the student graduates in their last 12th-grade enrollment, and zero otherwise. "VET" equals one if the student enrolls in VET in their first upper secondary enrollment. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. All regressions include individual and class-level controls. Model (1) includes G9 school and region-year fixed effects, with standard errors clustered at the G9 class level. Model (2) includes G9 school-cohort and region-year fixed effects, with standard errors clustered at the G9 class-cohort level. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table E.2: Impact of VET enrollment on G12 graduation, conditional on being enrolled in G12

Dependent variable: G12 graduation	OTES sample		Administrative sample	
	(1)	(2)	(1)	(2)
VET	0.026	-0.025	-0.025*	-0.130***
	(0.030)	(0.064)	(0.014)	(0.029)
G9 School and region-year FE	Yes		Yes	
G9 School-cohort and region-year FE		Yes		Yes
First-stage coefficient	0.289***	0.156***	0.346***	0.176***
Cragg-Donald Wald F statistic	738.9	142.5	6044.1	1144.9
Kleibergen-Paap F statistic	344.7	74.7	4063.3	600.3
Mean Dep. Var.	0.918	0.918	0.837	0.837
R-squared	0.009	-0.000	0.035	0.006
n (unweighted)	64219	63296	.	.
N (weighted/population)	279369	270425	519106	519087

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The table reports IV estimates of the effect of VET enrollment on 12th-grade enrollment and graduation. "Enrollment G12" equals one if the student is registered in 12th grade at least once during the period, and zero otherwise. "Graduation G12" equals one if the student graduates in their last 12th-grade enrollment, and zero otherwise. "VET" equals one if the student enrolls in VET in their first upper secondary enrollment. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. All regressions include individual and class-level controls. Model (1) includes G9 school and region-year fixed effects, with standard errors clustered at the G9 class level. Model (2) includes G9 school-cohort and region-year fixed effects, with standard errors clustered at the G9 school-cohort level. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table E.3: Impact of VET enrollment, conditional on non-studying in post-secondary school

Dependent variable:	Working	NEET
VET	0.071	-0.071
	(0.084)	(0.084)
First-stage coefficient	0.401***	0.401***
Cragg-Donald Wald F statistic	169.5	169.5
Kleibergen-Paap F statistic	137.3	137.3
Mean Dep. Var.	0.718	0.282
R-squared	0.011	0.011
n (unweighted)	12471	12471
N (weighted)	65286	65286

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table presents the IV estimates of VET enrollment on post-secondary outcomes ("Working", "NEET") conditional on not being studying post-secondary school. The dependent variables are dummy variables equal to one if the student has that outcome. The outcomes "Working" and "NEET" are mutually exclusive as students are either employed or not, when not in education. "VET" is the treatment dummy variable equal to one if the student enrolls in VET in their first upper secondary enrollment. "Proportion VET per class" is the instrumental variable in the IV regressions and it is calculated as the proportion of classmates in a pupil's 9th-grade class electing the vocational track in the first year of upper secondary school. All regressions include individual and class-level controls, and school and region-year fixed effects. Standard errors are clustered at the G9 class level in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Table E.4: Heterogeneous effects of VET enrollment on post-secondary outcomes by type of institution

Dependent variable:	Working		Studying		NEET	
	(1)	(2)	(3)	(4)	(5)	(6)
VET X public	0.308***		-0.375***		0.105***	
	(0.059)		(0.057)		(0.039)	
VET X private	0.485***		-0.526***		0.048	
	(0.056)		(0.052)		(0.033)	
VET X non-specialized		0.329***		-0.411***		0.116***
		(0.053)		(0.050)		(0.034)
VET X specialized		0.324***		-0.381***		0.069***
		(0.020)		(0.019)		(0.013)
p-value (equal effects by sub-group)	0.001***	0.908	0.002***	0.392	0.073*	0.057 *
Cragg-Donald Wald F statistic	391.8	544.9	391.8	544.9	391.8	544.9
Kleibergen-Paap F statistic	168.7	241.8	168.7	241.8	168.7	241.8
Mean Dep. Var.	0.209	0.209	0.806	0.806	0.055	0.055
R-squared	0.149	0.152	0.262	0.264	0.048	0.048
n (unweighted)	64521	64521	64521	64521	64521	64521
N (weighted)	280661	280661	280661	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports IV estimates of the effect of VET enrollment on the indicated outcomes, by type of institution. All regressions include individual and class-level controls, as well as school and region-year fixed effects. Outcomes are dummy variables measured one year after upper secondary school; "Working" and "Studying" are not mutually exclusive. Sub-group effects are estimated through interactions between VET enrollment and the corresponding institution type. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. The p-value refers to the F-test of equality of all heterogeneous treatment effects within each specification. Standard errors are clustered at the G9 class level and reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, ***$p < 0.01$.

Table E.5: Summary Statistics by type of VET provider

	Public		Private	
	Mean	n	Mean	n
Outcome variables, post-secondary				
Work	0.51	7694	0.56	5584
Study	0.41	7694	0.39	5584
Work & Study	0.08	7694	0.08	5584
NEET	0.15	7694	0.13	5584
Full-time job	0.34	7694	0.39	5584
Part-time job	0.10	7694	0.11	5584
Salaried employee	0.40	7694	0.46	5584
Open-ended contract	0.18	7694	0.21	5584
Fixed-term contract	0.24	7694	0.26	5584
Job found before graduation	0.08	7694	0.11	5584
Job aligned with future job expectations	0.21	7694	0.27	5584
Individual variables, 9th-grade				
VET field of specialization				
Arts & Humanities	0.09	7694	0.14	5584
Business & Law	0.07	7694	0.13	5584
ICT	0.16	7694	0.09	5584
Engineering, etc.	0.11	7694	0.15	5584
Agriculture, etc.	0.02	7694	0.01	5584
Health & S.P	0.10	7694	0.11	5584
Services	0.25	7694	0.20	5584
Missing values	0.20	7694	0.17	5584
Girl	0.45	7694	0.52	5584
Age	14.60	7694	14.68	5584
Foreigner	0.03	7694	0.02	5584
Social welfare recipient	0.49	7694	0.50	5584
PT exam score	50.31	7075	50.68	5093
Maths exam score	35.64	7090	34.65	5097
Guardian's education level				
Lower secondary	0.66	7694	0.60	5584
Upper secondary	0.19	7694	0.19	5584
Post-secondary/ Tertiary	0.09	7694	0.07	5584
999	0.05	7694	0.13	5584
Guardian's labor status				
Employed	0.68	7694	0.62	5584
Unemployed	0.11	7694	0.13	5584
Inactive	0.17	7694	0.14	5584
999	0.03	7694	0.11	5584
Guardian's occupation				
0 - Armed Forces Occupations	0.01	7694	0.00	5584
1 - Legislators, Senior Officials, and Managers	0.04	7694	0.04	5584
2 - Professionals of Intellectual and Scientific Activities	0.08	7694	0.07	5584
3 - Technicians and Associate Professionals	0.04	7694	0.05	5584
4 - Clerical Support Workers	0.11	7694	0.08	5584
5 - Service and Sales Workers; Personal and Protective Services	0.22	7694	0.22	5584
6 - Skilled Agricultural, Forestry, and Fishery Workers	0.02	7694	0.02	5584
7 - Craft and Related Trades Workers (Industry and Construction)	0.23	7694	0.19	5584
8 - Plant and Machine Operators and Assemblers	0.08	7694	0.07	5584
9 - Elementary Occupations (Unskilled Workers)	0.12	7694	0.12	5584
999	0.06	7694	0.14	5584
Individual characteristics, 6th-grade				
PT internal grade	3.16	6427	3.17	4094
Maths internal grade	3.00	6505	2.97	4145

Class variables, 9th-grade				
Students per class (number)	22.43	7555	22.57	5426
% girls	0.50	7693	0.50	5584
% foreigners	0.03	7693	0.03	5584
% welfare recipients	0.42	7693	0.41	5584
% PT exam (9th-grade) score below median	0.47	7075	0.47	5093
% Maths exam (9th-grade) score below median	0.48	7090	0.48	5097
Average internal grade (6th-grade PT)	3.40	6427	3.40	4094
Average internal grade (6th-grade Maths)	3.29	6505	3.28	4145
% guardians with up to lower secondary	0.56	7693	0.53	5584
% non-employed guardians	0.26	7693	0.24	5584
Instrumental variables, class-level, first 10th-grade				
% VET per class	0.38	7693	0.38	5584

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: "n" refers to the unweighted sample. "Public" ("Private") column refers to students that enroll in a public (private) VET school in their first year of upper secondary school (10th-grade).

Table E.6: Heterogeneous effects of VET enrollment on post-secondary outcomes by VET field of specialization

Dependent variable:	Working	Studying	NEET
	(1)	(2)	(3)
VET X Arts & Humanities	0.239***	-0.358***	0.137***
	(0.019)	(0.018)	(0.014)
VET X Business & Law	0.328***	-0.407***	0.077***
	(0.020)	(0.019)	(0.013)
VET X ICT	0.209***	-0.277***	0.088***
	(0.021)	(0.021)	(0.016)
VET X Engineering, etc.	0.394***	-0.461***	0.048***
	(0.017)	(0.016)	(0.010)
VET X Agriculture, etc.	0.386***	-0.408***	0.021
	(0.051)	(0.049)	(0.029)
VET X Health & S.P.	0.300***	-0.385***	0.084***
	(0.020)	(0.022)	(0.015)
VET X Services	0.316***	-0.406***	0.093***
	(0.015)	(0.014)	(0.011)
VET X Missing field	0.288***	-0.367***	0.073***
	(0.013)	(0.013)	(0.008)
p-value (equal effects by sub-group)	0.000***	0.000***	0.000***
Cragg-Donald Wald F statistic	19968.2	19968.2	19968.2
Kleibergen-Paap F statistic	2136.8	2136.8	2136.8
Mean Dep. Var.	0.209	0.806	0.055
R-squared	0.158	0.269	0.050
n (unweighted)	64521	64521	64521
N (weighted)	280661	280661	280661

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

Notes: The Table reports IV estimates of the effect of VET enrollment on the indicated outcomes, by VET field of specialization. All regressions include individual and class-level controls, as well as school and region-year fixed effects. Outcomes are dummy variables measured one year after upper secondary school; "Working" and "Studying" are not mutually exclusive. Sub-group effects are estimated through interactions between VET enrollment and the corresponding VET field. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. The p-value refers to the F-test of equality of all heterogeneous treatment effects within each specification. Standard errors are clustered at the G9 class level and reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Table E.7: Average NEET and Unemployment Rates for young people between age 18 and 34 by Field of Specialization (2021-2025)

		NEET Rate			Unemployment Rate		
		VET US	PS non-HE	HE	VET US	PS non-HE	HE
CNAEF 2013 (2 digits)							
01	Education	0	28.8	7.1	0	28.8	7.8
02	Humanities and Arts	14.7	18.9	9.9	11.7	19.5	9.9
03	Social sciences, Journalism and Information	4.1	0	5.2	6.7	0	7.4
04	Business and Law	10.3	10	7	8.5	9.7	7.2
05	Natural sciences, Mathematics and Statistics	.	.	8	.	.	10.5
06	Information and Communication Technologies	10.4	6.7	7.7	9.7	10.1	7.2
07	Engineering, Manufacturing and Construction	6.1	8.3	3.6	6.3	8.1	5.7
08	Agriculture, Forestry, Fisheries and Veterinary Sciences	10.4	10	1.8	10.1	10	2.3
09	Health and Social Protection	12	10.5	4.3	9.9	16	3.6
10	Services	13.1	9.7	5.6	11.2	9.4	5.2

Source: Labor Force Survey, INE (2025) - National Statistics Office

Notes: CNAEF - National Classification for Education and Training Fields (2013); VET US - VET Upper Secondary; PS non-HE - Post-secondary non-higher Education; HE - Higher Education. The Table presents the average NEET and unemployment rates for young people aged between 18 and 34 years old, by field of specialization, for the period between the first quarter of 2021 and second quarter of 2025. Values are derived using calibrated weights based on the Monthly Estimates of the Resident Population, calculated specifically for the Labor Force Survey in accordance with the final results of the 2021 Census. The NEET rate is defined as the ratio of the number of young people (18-34) not in education, employment, or training to the total youth population. The unemployment rate is defined as the ratio of unemployed young people (18-34) to the total economically active youth population (i.e. the sum of employed and unemployed individuals). The reported values correspond to the average across the 18 quarters used.

Table E.8: Impact of VET enrollment on post-secondary outcomes by type of institution and VET field

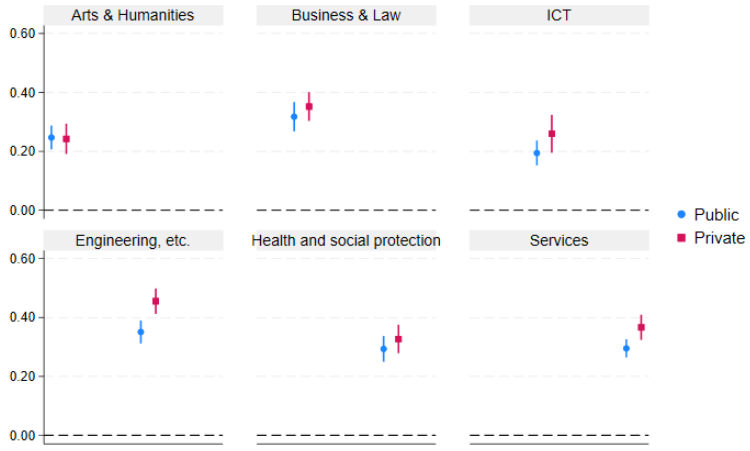
Dependent variable:	Working			Studying			NEET		
	Public	Private	p-value	Public	Private	p-value	Public	Private	p-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VET X Arts & Humanities	0.247***	0.242***	0.907	-0.381***	-0.369***	0.555	0.149***	0.123***	0.328
	(0.024)	(0.031)		(0.024)	(0.029)		(0.020)	(0.023)	
VET X Business & Law	0.318***	0.352***	0.408	-0.429***	-0.413***	0.689	0.101***	0.051***	0.065*
	(0.030)	(0.030)		(0.028)	(0.028)		(0.021)	(0.018)	
VET X ICT	0.194***	0.260***	0.161	-0.278***	-0.298***	0.674	0.101***	0.054**	0.141
	(0.026)	(0.039)		(0.025)	(0.040)		(0.020)	(0.025)	
VET X Engineering	0.351***	0.455***	0.002***	-0.428***	-0.534***	0.003***	0.068***	0.026**	0.035**
	(0.024)	(0.026)		(0.022)	(0.025)		(0.015)	(0.014)	
VET X Agriculture	0.390***	0.380**	0.939	-0.398***	-0.460***	0.597	0.025	0.006	0.794
	(0.055)	(0.124)		(0.056)	(0.103)		(0.031)	(0.066)	
VET X Health & S.P.	0.293***	0.327***	0.392	-0.383***	-0.415***	0.464	0.087***	0.077***	0.740
	(0.027)	(0.029)		(0.031)	(0.031)		(0.019)	(0.022)	
VET X Services	0.295***	0.367***	0.023**	-0.396***	-0.451***	0.050*	0.107***	0.067***	0.061*
	(0.019)	(0.026)		(0.018)	(0.023)		(0.014)	(0.016)	
VET X 999	0.267***	0.335***	0.009***	-0.340***	-0.437***	0.000***	0.071***	0.075***	0.847
	(0.015)	(0.023)		(0.016)	(0.022)		(0.010)	(0.016)	
Cragg-Donald Wald F statistic		5388.4			5388.4			5388.4	
Kleibergen-Paap F statistic		327.2			327.2			327.2	
Mean Dep. Var.		0.209			0.806			0.055	
R-squared		0.158			0.270			0.051	
n (unweighted)		64521			64521			64521	
N (weighted)		280661			280661			280661	

Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.

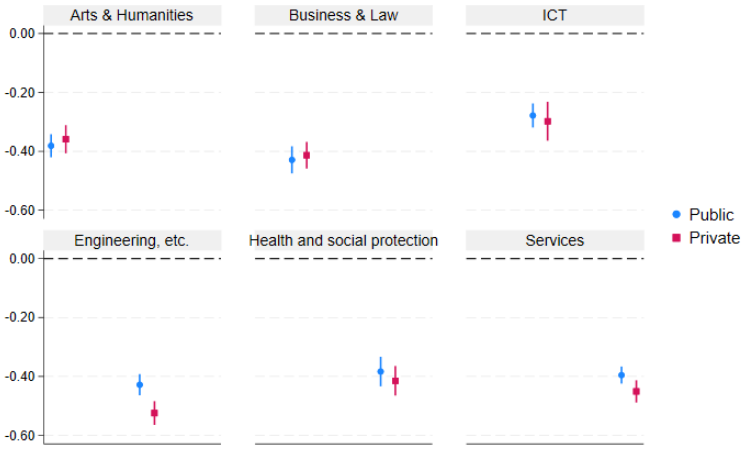
Notes: The table reports IV estimates of the effect of VET enrollment on the indicated outcomes, by type of institution and VET field of specialization. All regressions include individual and class-level controls, as well as school and region-year fixed effects. Outcomes are dummy variables measured one year after upper secondary school; "Working" and "Studying" are not mutually exclusive. Sub-group effects are estimated through interactions between VET enrollment, institution type, and VET field. The instrument, "Proportion VET per class", is the share of a student's 9th-grade classmates who enroll in VET in the first year of upper secondary school. The p-value refers to the F-test of equality between treatment effects by VET field for public and private schools. Standard errors are clustered at the G9 class level and reported in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, $^{***}p < 0.01$.

Figure E.1: Impact of VET enrollment on post-secondary outcomes by VET field of specialization and institution type

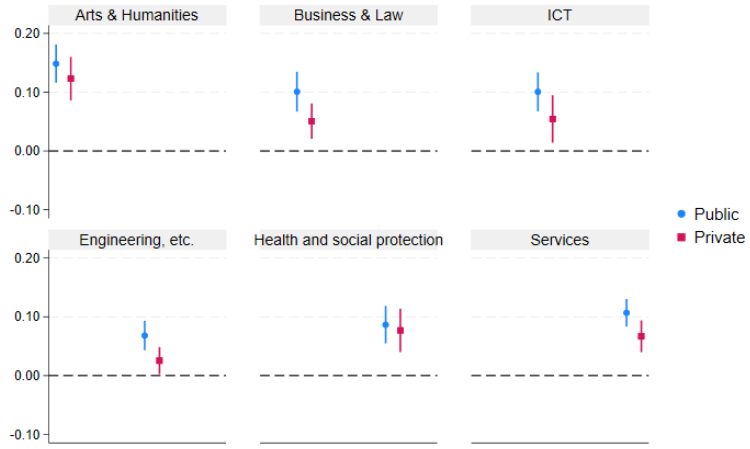
(a) Working



(b) Studying



(c) NEET



Source: Authors' analysis of OTES survey data, administrative and exams data. Data aggregation relies on sampling weights, calibrated specifically for the OTES post-secondary survey with administrative and exams data.
Notes: The Figure reports IV estimates and 90% confidence intervals for the effect of VET enrollment on post-secondary outcomes ("Working", "Studying", "NEET"), by 10th-grade school type. Sub-group effects are estimated through interactions between VET enrollment, school type, and VET field. Further details are reported in Table E.8 in the Annex. All regressions include individual and class-level controls, as well as school and region-year fixed effects. Outcomes are dummy variables measured one year after upper secondary school; "Working" and "Studying"