Work Project presented in the context of a Directed Research Internship at the Directorate-General of Statistics of the Portuguese Ministry of Education and as part of the requirements for the Award of a Masters Degree in Economics from the NOVA – School of Business and Economics

# The impact of choosing a vocational track on academic performance and college enrollment in Portugal

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**January 2017**

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## Abstract

This work assesses how the students' high school track choice affects grade progression and drop-out rate throughout high school as well as college enrollment using a logistic regression and a PSM approach. It uses students' characteristics, social background, past educational results and the students' college entrance expectation in the 10$^{th}$ grade as control and matching variables. Follows a cohort of students in the 10$^{th}$ grade in school year 2010/2011 up until 2014/2015. The main findings are that, controlling for college enrollment expectation, choosing a vocational track increases the probability of transition and high school completion, but also the dropout rate.



Keywords: Vocational Education, College Enrollment, Academic Success, Binary Dependent Model, Propensity Score Matching



## Acknowledgements

I thank Professors Luís Catela Nunes, Ana Balcão Reis and Maria do Carmo Seabra for their orientation. I also dedicate this research to my parents, colleagues and friends for standing by my side unconditionally. Lastly, I thank DGEEC – Ministry of Education for their institutional support and for providing the data used in this work.

## 1 Introduction

The OECD defines vocational education and training (VET) as "*education and training programs designed for, and typically leading to, a particular job or type of job. It normally involves practical training as well as the learning of relevant theory. It is distinct from (academic) education*" (OECD, 2009).

The decision whether to enroll in an academic track or a vocational track in high school in Portugal is usually made at 14 years old, when students' are in the 9th grade. Thus, it is crucial to measure whether students that choose the vocational track are at a disadvantage, *ceteris paribus,* vis-à-vis academic track students concerning their high school grade progression, dropout rate and college enrollment to ensure a wiser choice of which track to enroll in high school, especially due to the reportedly scarce vocational and educational counseling in Portuguese public schools.

Originally, vocational education was introduced for those students that do not desire to go to college, which is exactly the subgroup that has a higher risk of dropping out - those with low academic success. By offering an alternative path to more academically oriented courses (vocational education) it could increase the likelihood of these students to stay longer in school and hopefully complete their high school degree (Agodini, R. & Deke, J., 2004). Thus, such courses were designed as a way to develop the students' skills needed in the labor market and as a way to ease this transition, to decrease the drop-out rate by retaining in the educational system different students' profiles with different personal interests, being the focus clearly not on college enrollment (Ravitch, 2001; Bills, 2004).

However, the recent "college for all" philosophy has been adopted by society in general, emphasizing how important a college degree is for lifelong competitiveness and as the main path to achieve middle-class success (Rosenbaum, 2001). Even though there has been a declining/stable trend in the college wage premium in Europe due to the low labor demand and

high educational attainment (Crivellaro, E., 2014), Portugal yields an attractive return on the investment in college education (Cardoso, A., 2004), which could give incentives to vocational track students to postpone their entrance in the labor market. Most high school students, including many vocational course students express their desire to attend college at some point after high school graduation in the US (Rosenbaum, 2001; MacAllum, Yoder, Kim, & Bozick, 2002; U.S. Department of Education, 2004).

Research shows that high school dropouts are more frequently unemployed, on average earn less when they are employed and are more likely to receive public assistance vis-à-vis high school graduates. Thus, reducing the dropout rate should be a major concern for Governments (Agodini, R. & Deke, J., 2004).

This leads to the perception that the vocational track is a 2nd choice, tailored for those that didn't or wouldn't succeed in an academic track, the view that the former track was created for less capable or marginalized students very likely to drop-out. Fortunately, in the last decade there has been a huge improvement and an increase in both the number and diversity of vocational courses according to the needs of the Portuguese labor market. (Capucha, L. *et al*, 2005). However, many people oppose vocational education because they fear it discourages students from studying any further after high school, holding them back from achieving their full potential. Opponents argue that these courses became a dumping ground for less capable students. As a result, perhaps these courses should be improved and modernized instead of simply getting rid of (Cohen, M. & Besharov, D., 2002).

Given that recent data, from 2014, reveals that vocational tracks account for about 40% of the students enrolled in high school in Portugal, it is relevant to investigate whether the introduction of the vocational track contributes to the reduction of early-school leaving, which was, after all, the original goal of the Portuguese Government, as well as to examine if the investment in its quality improvement is justified.

To do this, a cohort of students in the academic track and the vocational track, from both public and private schools, that were in the 10th grade in school year 2010/2011 are followed up until school year 2014/2015, when this cohort is expected to be in the 2nd year of college, to examine how the students' high school track choice affect their grade transition, the likelihood to drop out throughout high school as well as their probability of enrolling into college by using students' characteristics, social background and past educational results as control and matching variables. These variables are highly important to be included to find causality between the high school track choice and the academic outcomes since these are the determinants of the self-selection into each track.

The contribution of this work to the literature is that students' expectations of continuing their studies after high school when they were in the 10th grade is also included as a control and matching variable. This is a crucial covariate since students' ambitions when starting high school are an important factor to their motivation and academic performance independently if which track they chose.

This paper is structured as follows. Section 2 surveys the relevant literature. Section 3 provides a brief history of the Portuguese education system, from 1960 to 2004, detailing the evolution of vocational tracks. The datasets used in this study are presented in section 4, as well as a brief description and analysis of the data. Section 5 explains the methodology and the econometric models used as well as the relevant findings whilst section 6 suggests further research and concludes this study.

## 2 Literature Review

While there is intensive research on the impact of vocational courses on labor market outcomes there lacks literature concerned with their impact on academic outcomes. Only recently this topic emerged in research, starting in the beginning of the 21st century.

One strand of research suggests that students drop out because of early school failure, which lowers their self-esteem, leading to persistent failure, which causes some students to disengage from school and eventually drop out. Another strand of research suggests that students who drop out have different traits than those who graduate, including lower academic ability, lower motivation, lower expectations about the benefits of graduating and greater success at jobs that are typically held by dropouts (Agodini, R., Deke, J., 2004).

For the arguments previously mentioned, there are several reasons that may explain why vocational education reduces the drop-out rate. Typically, most of the courses students take until they reach high school are academically focused. This is frustrating for those students that do not do well in academic courses, or even for students who do not find relevant such courses for the activities they want to pursue after leaving high school (Alexander *et al.*, 2000).

Vocational education could also be able to reengage these students since these courses are fundamentally different from academic ones. While academic courses focus is on providing the skills needed to succeed in college, occupational courses focus is on preparing students to succeed in the labor market. Students who are frustrated by academic courses may find such courses more appealing thus reducing their likelihood of dropping out. Therefore, vocational education may be extremely effective in reducing the drop-out rate among students who plan to work immediately after graduating in high school (Agodini, R. & Deke, J., 2004).

On the other hand, it is also possible that vocational education does not affect dropping out (null effect), or that it even increases dropping out. Vocational education may have no effect on dropping out if vocational education is introduced on a late stage in the student's educational path which may make it difficult for vocational education alone to reengage students. Vocational education may even increase dropping out, because students who take such courses early in high school may develop skills that are valued in the labor market before their graduation date, which may encourage them to drop out since their willingness to work is higher

(Gleason *et al*, 1998). This may be especially true for students who do not seek to enroll in higher education.

Two frequently cited studies that examined the relationship between vocational education and dropping out have concluded that vocational education reduces the dropout rate. The first study was conducted by Rasinski and Pedlow (1994) and found that vocational education in the first two years of high school may indirectly reduce dropping out by increasing a student's class rank. The second one was conducted by Plank (2001) and found that vocational education during the high school years directly reduces dropping out.

However, Agodini & Deke (2004) found that the average high school student's chance of dropping out is the same when following the vocational track or the academic one. The same analysis was performed for four subgroups of students: those who do not expect to go to college, those with low academic achievement, those in schools where a high proportion of students are eligible for free or reduced-price lunch and those in schools with high academic course-taking requirements for graduation. This indicates that vocational education may not reduce the dropout rate.

In the US, DeLuca *et al* (2006) found that while participation in vocational courses does not generally impede college enrollment, higher ratios of vocational courses-to-academic courses are associated with reductions of its likelihood, even after adjusting for characteristics often associated with course trajectories. After controlling for gender, race, family background, school behavior and test scores the likelihood of a student to enroll in a 4-year college degree is 0.481 if the student's CTE-to-academic ratio is higher than 0 and lower than 0.2, 0.55 if between 0.2 and 0.5 and 0.162 if between 0.6 and 3.0.

In 2013, the College & Career Readiness & Success Center, in the US, argued that high-quality vocational education addresses the goals of college and career readiness, providing learning possibilities that are appealing for students who might otherwise be at risk of leaving

high school. Such programs ensure that the coursework is simultaneously aligned to rigorous academic standards and post high school expectations and addresses the skills needed in specific career pathways.

In Portugal, Mamede *et al* (2015) using data[1] of three cohorts corresponding to the academic years 2008/2009, 2009/2010 and 2010/2011, each cohort having students enrolled in the first year of high school (10$^{th}$ grade), performed a counterfactual analysis to study students' academic performance by tracing each individual's trajectory between the previous year (t-1) and the following three years (t+3) and concluded that vocational education has a positive impact on grade transition and high school graduation, null impact on drop-out rates and a negative impact on access to higher education.

The contribution of this work is that, unlike the previous one, we included students in private institutions and we were able to control and match students that chose different high school tracks with the same college enrollment expectation, i.e., being able to examine the impact of the high school track choice on high school progression and conclusion, drop-out rate and college enrollment for students with the same willingness to go to college.

## 3 The Portuguese Education System

The transition from the sixties to the seventies is the turning point for the educational policy in Portugal. Stoer (1982) refers that the industrialization and foreign capital inflows during the 1960's led to a structural transformation of the Portuguese Government and introduction of educational policies that resulted in the expansion of participation levels and its economic importance, which resulted in the dissemination of education in Portugal.

Until the beginning of 1967, mandatory schooling in Portugal was four years of primary education. There were two tracks available for those that wished to continue studying at the

[1] *The covariates used by Mamede et al (2015) that were not included in this work are: student nationality, guardian's educational level, school social support, school's average number of students per non-teaching staff member and school's percentage of students with scholar social support*

high school level: *Ensino Liceal* and *Ensino Técnico*. While the former was largely oriented towards higher education, the latter targeted mostly students eager to learn an occupation but it was seen as less prestigious given the lower social status of its students. This division was a clear obstacle of the equal opportunities principle (Grácio, 1998).

Veiga Simão's Reform, in 1970-1973 was the result of rapid economic, social and demographic changes that led to a demand increase for education. It introduced the idea that education should be made accessible for everyone on a meritocratic basis, irrespective of one's socioeconomic background. The most significant change in this reform was the expansion from 6 years to 8 years of mandatory education and the possibility of students enrolled in vocational courses to continue their studies in high school. Although this reform wasn't fully implemented due to the fall of the Portuguese political regime in April 1974, it promoted a turning point in educational policy in the seventies (Stoer, 1982).

In June 1975, *Ensino Liceal* and *Ensino Técnico* ended to unify high school education, ending the duality between intellectual work (*Ensino Liceal*) and manual work (*Ensino Técnico*). The Portuguese education system as we know today was setup in 1986 in *Lei de Bases do Sistema Educativo*. Mandatory school increased to nine years, from 1st to 9th grade and high school with two different tracks: scientific and humanistic courses geared towards further studies and vocational courses, geared towards working life, from 10th to 12th grade.

In the beginning of the new century, Government's priority was to deal with the high dropout rate and academic underachievement. It was crucial to ensure a smooth transition from school to the labor market and to prevent students from leaving the education system early and without the necessary skills to be able to succeed in their career paths. Therefore, the vocational track for youth was created, providing professional qualification of level I, II or III and equivalence to the 6th, 9th or 12th grade, respectively. Due to the high demand for vocational

courses of level III (ANESPO, 2003), these courses were integrated in public high schools in 2004.

## 4 Data

In order to follow the previously mentioned cohort of students, five micro-databases were used: two administrative micro-databases that contains the population of students in high school (table 1, in the appendix): *MISI* includes students in the public institutions and INQ-PRIV the students in the private institutions (used from school year 2010/2011, when the cohort was in the 10th grade, up until 2012/2013), a micro-database that contains the population of students in college (used for school years 2013/2014 and 2014/2015, when the cohort is expected to be in the 2nd year of college) called *RAIDES*[2][3]. *OTES*[4], a survey never used for empirical analysis until now, was conducted on students in the 10th grade in school year 2010/2011 was used as well to enrich the set of control variables employed in the empirical models, more specifically, to include college entrance expectation and type of family structure (table 2, in the appendix). 67043 students participated in this survey (65.6% of the population), from 748 public and private schools (92.1% of the population of public and private schools in the mainland). Lastly, the students' 9th grade national exam scores in Mathematics and Portuguese were taken from a micro-database called *ENEB*[5] which includes each student's score. This last database was used to include previous school performance as a proxy for the students' academic ability as a control and matching variable.

Table 3 reports the final database descriptive statistics[6] (the one used to conduct the analysis, after merging all the previously mentioned databases and after eliminating

[2] *To follow this cohort of students throughout their academic path, these two databases had to be merged using a primary key that uniquely identifies each student in each school year*

[3] *Registo de Alunos Inscritos e Diplomados do Ensino Superior (Registration of Enrolled Students and Graduates of Higher Education)*

[4] *Observatório de Trajetos dos Estudantes do Ensino Superior (Observatory of Higher Education Students' Paths)*

[5] *Exames Nacionais do Ensino Básico (Basic Education National Exams)*

[6] *For a wider set of variables, table 4 in the appendix*

observations due to inconsistencies and missing values in the data): 77.67% of the students that were surveyed were following an academic track in high school while the remaining ones, 22.33%, were following a vocational track. The share of women is larger in the former group (58.68% and 46.55%, respectively). In the latter group students are, on average, older, have less access and usage of books, computer and internet and had lower scores in the 9$^{th}$ grade Mathematics national exam. There are also less students with Portuguese nationality, parents have lower education levels as well as lower employment rates in the group of vocational track students. As expected, students' college entrance expectation is extremely different for students enrolled in each track: 87.91% of the students in the academic track pretend to go to college while for vocational track students it's only 42.64%. This clearly shows that students in each track are different, on average, students in the vocational track are from a worse socioeconomic background, indicating self-selection bias in the sense that students select themselves into a high school track, making determination of causality more difficult. To correct for this issue, the determinants of this self-selection into each track should be included, when possible, to the set of covariates employed in the empirical models.

It's important to mention that although *OTES* is intended to be a survey representative of the population and with a high coverage, it is answered voluntarily by students and so it is possible that the ones at the bottom of the distribution were less likely to participate, which could introduce bias in the results: higher high school progression probability, lower dropout rates and higher college entrance probability when conducting this analysis using *OTES* and not the population of students. More specifically, students that participated in OTES are less material deprived (access to computer and internet) and had higher scores on the 9$^{th}$ grade Mathematics national exam, when comparing to the population.

Data on gender, age, type of track followed in high school (whether vocational or academic), 9$^{th}$ grade national exam score in Mathematics and Portuguese, material deprivation

(access and usage of computer and internet), type of family structure, college enrollment expectation and type of high school (whether it is public or private) was used to conduct the empirical analysis[7].

| | G.E. | V.E. | | G.E. | V.E. |
|---|---|---|---|---|---|
| Number of individuals | 28,296 | 8,134 | **Maths grade in 9th year (%)** | | |
| % of the sample | 77.67 | 22.33 | 1 | 2.93 | 12.34 |
| **Type of school (%)** | | | 2 | 26.25 | 56.47 |
| Public School | 91.62 | 73.79 | 3 | 32.53 | 24.26 |
| Private School | 8.38 | 26.21 | 4 | 29.45 | 6.27 |
| Women (%) | 58.68 | 46.55 | 5 | 8.85 | 0.66 |
| **Age (%)** | | | **Type of family structure (%)** | | |
| ≤ 15 years old | 1.19 | 0.34 | Nuclear family | 81.44 | 76.73 |
| 16 years old | 87.89 | 56.34 | Single parent family | 12.04 | 13.24 |
| 17 years old | 8.86 | 28.42 | Stepfamily | 4.25 | 5.99 |
| ≥ 18 years old | 2.07 | 14.89 | Other situations | 2.28 | 4.03 |
| **Material deprivation** | | | Higher education expectation (%) | 87.91 | 42.64 |
| Computer | 79.24 | 69.71 | | | |
| Internet | 72.86 | 62.16 | | | |

**Table 3.** Descriptive statistics of the final database

## 5 Econometric Models and Results

### 5.1 Baseline specification

The full set of control variables with a short description are shown in table 5. These variables were chosen based on their theoretical relevance and significance level.

The Portuguese and Mathematics 9th grade national exam scores, both of them done in school year t-1=2009/2010 were included as a proxy for the students' academic ability. The type of family structure of student i in 2010/2011: $\text{nuclear}_i$ is equal to 1 if student i lives with both biological parents, 0 otherwise, including family structures such as: single-parent families, stepfamilies and other situations (living with his/her grandparents, for instance). $\text{Computer}_i$ and $\text{internet}_i$ are equal to 1 if student i has access and uses a computer and internet, respectively, 0 otherwise.

Lastly, the reported college enrollment expectation is a crucial covariate to measure

[7] *Parents' educational level was not included in the list of covariates due to the lack of confidence in this variable, given that for students in the private institutions it had to be taken from OTES*

students' intentions and motivations regarding whether to continue studying after high school.

| Covariates | Description |
|---|---|
| $colexpect_i$ | dummy variable equal to 1 if the student i in the school year 2010/2011 pretends to enroll in college and 0 otherwise |
| $vt_i$ | dummy variable equal to 1 if student i was in a vocational track in school year 2010/2011 and 0 if he was in an academic track instead |
| $pub_i$ | binary variable equal to 1 if student i is in a public school in school year 2010/2011, 0 otherwise |
| $age_i$ | age of student i in December 2011 |
| $computer_i$ | equal to 1 if student i has access and uses a computer, respectively, 0 otherwise |
| $internet_i$ | equal to 1 if student i has access and uses internet, respectively, 0 otherwise |
| $mathsexam_i$ | student's Mathematics 9th grade national exam score, also from 0-100 |
| $ptexam_i$ | student's Portuguese 9th grade national exam score from 0-100 |
| $female_i$ | dummy variable equal to 1 if student i is female and 0 otherwise |
| $nuclear_i$ | equal to 1 if student i lives with both parents, 0 otherwise (single parent families, stepfamilies or other situations such as living with his/her grandparents) |

**Table 5.** Description of the covariates included in the econometric models

### 5.1.1 Grade transition

To study the impact of vocational education track in grade transition and conclusion of high school the following econometric models were considered:

$$y_{it} = \propto + \delta_1 colexpect_i + \beta vt_i + \delta_2 pub_i + \delta_3 age_i + \delta_4 computer_i + \delta_5 internet_i + \quad (1)$$

$$+ \delta_6 mathsexam_i + \delta_7 ptexam_i + \delta_8 female_i + \delta_9 nuclear_i + u_i$$

Three outcome variables were chosen for this purpose: $transition_{it}$ is a binary variable that assumes value equal to 1 if student i is in the 11th grade in school year t=2011/2012 and equal to zero if that student was still found in the 10th grade, i.e. failed to pass the 10th grade, $transition_{it+1}$, a binary variable that assumes value equal to 1 if student i is in the 12th grade in school year t+1=2012/2013 and equal to zero if the student was found either in the 10th grade or the 11th grade in that same school year and $conclusion_{it+1}$, a binary variable that assumes value equal to 1 if student i concluded high school in school year t+1=2012/2013, 0 otherwise. Therefore, students that dropped out in high school were excluded to compute this outcome variable.

The following models were estimated by a logistic regression. Results of the marginal effects at the mean, the slope of the probability curve relating x to $Pr(y = 1|\bar{x})$, holding all other variables constant, are found in table 6.

The coefficient of $vt_i$ is positive for all the regressions, independently of whether college entrance expectation is included as a covariate and of which high school grade is analyzed, suggesting that vocational education has a positive impact in high school grade transition and in its conclusion. Everything else constant, on average, a student in a vocational track is 13.7 p.p. more likely to complete the 10th, 26.7 p.p. more likely to complete the 11th and 34 p.p. more likely to finish high school, *ceteris paribus*, vis-à-vis academic track students, on the time period that they are supposed to do so.

Notice that college entrance expectation is always statistically significant for a significance level of 1% and, when included, increases slightly the effect of the vocational track on the transition probability throughout high school.

| VARIABLES | (A1) Finish 10th grade in 1 year | (A2) Finish 10th grade in 1 year | (B1) Finish 11th grade in 2 years | (B2) Finish 11th grade in 2 years | (C1) High school conclusion in 3 years | (C2) High school conclusion in 3 years |
|---|---|---|---|---|---|---|
| College expectation | | 0.0277*** | | 0.0402*** | | 0.0607*** |
| | | (0.00328) | | (0.00447) | | (0.00637) |
| Vocational track | 0.127*** | 0.137*** | 0.253*** | 0.267*** | 0.318*** | 0.340*** |
| | (0.00452) | (0.00469) | (0.00591) | (0.00620) | (0.00622) | (0.00667) |
| Public school | 0.0236*** | 0.0234*** | 0.0261*** | 0.0255*** | 0.179*** | 0.182*** |
| | (0.00398) | (0.00398) | (0.00560) | (0.00562) | (0.00728) | (0.00730) |
| Age | 0.00578*** | 0.00674*** | 0.00182 | 0.00270 | -0.0152*** | -0.0143*** |
| | (0.00199) | (0.00207) | (0.00226) | (0.00234) | (0.00332) | (0.00327) |
| Computer | 0.00957* | 0.0104* | 0.0236*** | 0.0248*** | 0.0642*** | 0.0660*** |
| | (0.00533) | (0.00532) | (0.00689) | (0.00687) | (0.00952) | (0.00950) |
| Internet | -0.00999** | -0.0108** | -0.0197*** | -0.0210*** | -0.00869 | -0.0111 |
| | (0.00491) | (0.00490) | (0.00633) | (0.00632) | (0.00876) | (0.00875) |
| 9th grade Maths exam score | 0.00162*** | 0.00155*** | 0.00260*** | 0.00250*** | 0.00577*** | 0.00564*** |
| | (7.30e-05) | (7.31e-05) | (9.24e-05) | (9.29e-05) | (0.000128) | (0.000129) |
| 9th grade Portuguese exam score | 0.00194*** | 0.00184*** | 0.00373*** | 0.00360*** | 0.00664*** | 0.00643*** |
| | (0.000110) | (0.000110) | (0.000142) | (0.000143) | (0.000193) | (0.000194) |
| Female | 0.0127*** | 0.0100*** | 0.0284*** | 0.0248*** | 0.0919*** | 0.0876*** |
| | (0.00262) | (0.00262) | (0.00340) | (0.00340) | (0.00471) | (0.00472) |
| Nuclear family | 0.0117*** | 0.0121*** | 0.0214*** | 0.0218*** | 0.0525*** | 0.0532*** |
| | (0.00310) | (0.00309) | (0.00408) | (0.00407) | (0.00581) | (0.00580) |
| Pseudo-$R^2$ | 0.1198 | 0.1239 | 0.1531 | 0.1561 | 0.1542 | 0.1561 |
| Number of obs. | 36,132 | 36,132 | 35,610 | 35,610 | 36,430 | 36,430 |

**Table 6.** Marginal effects of the empirical models regarding the grade transition probability
Sources: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

### 5.1.2 Dropout rate

The same econometric model was used to study the impact of the vocational track in the dropout rate, except for the inclusion of $pub_i$ since its prediction of the outcome variable is very high, caused by the extremely low number of students in public schools that dropped out. The dependent variable, $dropout_i$[8], is a binary variable that assumes value equal to 1 if student i dropped out of high school in any of the following school years: 2010/2011, 2011/2012 and 2012/2013, 0 otherwise, if student i remained in the education system.

$$dropout_i = \propto + \delta_1 colexpect_i + \beta vt_i + \delta_2 age_i + \delta_3 computer_i + \delta_4 internet_i + \quad (2)$$
$$+ \delta_5 mathsexam_i + \delta_6 ptexam_i + \delta_7 female_i + \delta_8 nuclear_i + u_i$$

Regarding the drop-out rate regressions (D1) and (D2), students in vocational tracks are, on average, 3.15 p.p. more likely to drop-out of high school, vis-à-vis their counterparts in the academic track, everything else constant. Even though the impact is small, there is evidence that the introduction of the vocational track does not contribute to the reduction of the dropout rate of its students, the original goal of the Portuguese Government.

Again, the introduction of college entrance expectation is relevant since it is highly statistically significant and, when included, increases the effect of the vocational track on the drop-out rate throughout high school, from 2.91 p.p. to 3.15 p.p..

[8] *A student is considered to dropout in the 11th and in the 12th grade if he/she is not found in MISI/INQ-PRIV in school year 2011/2012 and 2013/2014, respectively. A different approach was used for 10th grade, where a variable that determines the students' academic situation is used. This last approach wasn't used for all the high school grades due to the lack of confidence in the quality of the schools' report of this variable*

| VARIABLES | (D1) Dropout of high school | (D2) Dropout of high school |
|---|---|---|
| College expectation | | 0.00837*** |
| | | (0.00214) |
| Vocational track | 0.0291*** | 0.0315*** |
| | (0.00202) | (0.00222) |
| Age | -0.00131 | -0.00104 |
| | (0.00116) | (0.00111) |
| Computer | -0.0275*** | -0.0271*** |
| | (0.00293) | (0.00294) |
| Internet | -0.00652*** | -0.00680** |
| | (0.00291) | (0.00292) |
| 9th grade Maths exam score | -6.21e-05 | -7.75e-05* |
| | (4.46e-05) | (4.46e-05) |
| 9th grade Portuguese exam score | 9.51e-05 | 5.90e-05 |
| | (6.61e-05) | (6.56e-05) |
| Female | -0.00302* | -0.00357** |
| | (0.00159) | (0.00159) |
| Nuclear family | -0.00382** | -0.00364** |
| | (0.00185) | (0.00186) |
| Pseudo-$R^2$ | 0.1147 | 0.1170 |
| Number of obs. | 36,430 | 36,430 |

**Table 7.** Marginal effects of the empirical models regarding the drop-out rates
Sources: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

### 5.1.3 College enrollment

The same econometric model as the previous one, without $pub_i$, was used to study the impact of the vocational track in college enrollment probability. The outcome variable, $colenroll_i$, is a binary variable that assumes value equal to 1 if student i enrolls into college in any of the following school years: 2013/2014 and 2014/2015, 0 otherwise, if student i did not enroll into higher education. The exclusion of $pub_i$ was due to some restrictions in the data obtained to perform this analysis, where only students enrolled in public institutions (from MISI) were included, which explains the reduction in the number of observations[9].

$$colenroll_i = \propto + \delta_1 colexpect_i + \beta vt_i + \delta_2 age_i + \delta_3 computer_i + \delta_4 internet_i + \quad (3)$$

$$+ \delta_5 mathsexam_i + \delta_6 ptexam_i + \delta_7 female_i + \delta_8 nuclear_i + u_i$$

Regarding the college enrollment regression (E2), students in the vocational tracks are, on average, 13.4 p.p. less likely to enroll into college in any of the school years analyzed,

[9] Unlike the analysis for grade progression and dropout rate, where MISI and INQ-PRIV were used, for college enrollment only MISI could be included, thus excluding students in private institutions

2013/2014 and 2014/2015, vis-à-vis their counterparts in the academic track, everything else constant.

| VARIABLES | (E1)<br>College enrollment | (E2)<br>College enrollment |
|---|---|---|
| College expectation | | 0.189*** |
| | | (0.00602) |
| Vocational track | -0.205*** | -0.134*** |
| | (0.00632) | (0.00675) |
| Age | -0.0324*** | -0.0296*** |
| | (0.00555) | (0.00504) |
| Computer | 0.00371 | 0.00814 |
| | (0.00955) | (0.00939) |
| Internet | 0.0170** | 0.0800 |
| | (0.00862) | (0.00848) |
| 9th grade Maths exam score | 0.00523*** | 0.00478*** |
| | (0.000130) | (0.000128) |
| 9th grade Portuguese exam score | 0.00623*** | 0.00554*** |
| | (0.000200) | (0.000197) |
| Female | 0.0447*** | 0.0301*** |
| | (0.00487) | (0.00480) |
| Nuclear family | 0.0485*** | 0.0485*** |
| | (0.00599) | (0.00586) |
| Pseudo-$R^2$ | 0.2611 | 0.2853 |
| Number of obs. | 29.375 | 29,375 |

**Table 8.** Marginal effects of the empirical models regarding the college enrollment probability
Sources: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

The covariate college entrance expectation is, again, highly statistically significant and, when included, decreases the effect of the vocational track on the college enrollment probability from 20.5 p.p. to 13.4 p.p., a significant change.

Some other controls were used in the previously mentioned regressions, more specifically, regional dummies to check whether there are persistent regional effects even after controlling for other socioeconomic factors. For this purpose, we used the NUTS II regional division of the territory (excluding Madeira and Azores), where the omitted variable is Centro. One can conclude that results did not change much when introducing regions, after controlling for the selected socioeconomic variables, explaining why these were not included in the regressions above.

### 5.2 Propensity Score Matching (PSM) approach

To check the robustness of the previous results, a Propensity Score Matching approach is employed, where the same control and outcome variables are used. The main advantage of the PSM procedure is that matching focuses first on setting up the right comparison and, only then, estimate.

The first step to account for variables related to self-selection is to calculate propensity scores (Heinrich, C., Maffioli, A. & Vázquez, G, 2010). Propensity scores are "*conditional probability of exposure to a treatment given observed covariates*" (Joffe & Rosenbaum, 1999, p. 327), where the treatment variable in this case is being in a vocational track.

There are many different matching techniques that could be applied. One of them is called exact matching which is when "perfect" matches are created based on specific covariates. This technique when computed to important covariates is ideal to ensure a high-quality comparison group (Austin, 2011). However, exact matching requires a large sample dimension and homogeneous populations of students enrolled in both tracks, which is not realistic, since these two groups, as previously seen, have, on average, different socioeconomic characteristics. Therefore, it isn't commonly used since unmatched students are dropped from the sample which reduces the sample dimension. To correct this issue, a Nearest Neighbor (NN) approach is frequently used instead. Starting from the first student in the vocational track, the algorithm picks the best match in the academic track out of the pool of possible matches, then moves to the next one (Stuart, 2010).

According to Cameron & Trivedi (2005), the following 2 assumptions must be met:

1. Conditional Independence Assumption

This requires that conditional on X, the outcomes are independent of treatment:

$$y_0, y_1 \perp \mathrm{vt}|\mathrm{X}, \qquad (4)$$

where $y_0$ is the outcome for students in the academic track and $y_1$ the outcome for students in the vocational track, in other words, conditional on observed characteristics, treatment is random.

2. Overlap or Matching Assumption

This condition requires that there is a common support, i.e. for each value of x there are both treated (vocational track students) and non-treated cases (academic track students):

$$0 < \Pr[vt = 1|X] < 1 \quad (5)$$

For the conditional independence assumption to be valid we require many covariates, which leads to a dimensionality problem. To solve this issue, rather than match on the regressors, matches on the propensity score should be conducted: on one variable and not on the whole set of x variables, capturing the propensity of individuals to get treated (being in the vocational track), as a function of their covariates:

$$P(X_i) = \Pr[vt_i = 1|X_i] \quad (6)$$

$$y_0, y_1 \perp vc|X \Rightarrow y_0, y_1 \perp vc|P(X) \quad (7)$$

For the analysis using the PSM procedure the same covariates as the ones using the logistic regressions will be included.

The following tables give us the results for grade progression probability, dropout rate and college enrollment probability using this approach.

**5.2.1 Grade transition**

Using the PSM approach to examine grade progression probability during high school, we find that vocational track students are 9.59 p.p. more likely to complete the 10$^{th}$ grade in school year 2010/2011, 17.1 p.p. more likely to complete the 11$^{th}$ grade in school year 2011/2012 and 25.9 p.p. more likely to complete the 12$^{th}$ grade, i.e. conclude high school in the school year 2012/2013 (table 9). The results of the impact of choosing different high school tracks on progression likelihood using the PSM approach are smaller than the ones found when

performing a logistic regression (table 6) but the same increasing trend still verifies the higher the high school grade analyzed. The inclusion of the college entrance expectation as a matching variable increases slightly the effect of the vocational track on the outcome variables.

| EQUATION | VARIABLES | (F1) Finish 10th grade in 1 year | (F2) Finish 10th grade in 1 year | (G1) Finish 11th grade in 2 years | (G2) Finish 11th grade in 2 years | (H1) High school conclusion in 3 years | (H2) High school conclusion in 3 years |
|---|---|---|---|---|---|---|---|
| | | Excluding college expectation | Including college expectation | Excluding college expectation | Including college expectation | Excluding college expectation | Including college expectation |
| ATE | Vocational track | 0.0921*** | 0.0959*** | 0.169*** | 0.171*** | 0.251*** | 0.259*** |
| | | (0.00295) | (0.00292) | (0.00383) | (0.00431) | (0.00816) | (0.00879) |
| Number of obs. | | 36,132 | 36,132 | 35,610 | 35,610 | 36,430 | 36,430 |

**Table 9.** Estimates of the average treatment effect of the empirical models regarding grade transition probability
Source: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

### 5.2.2 Dropout rate

The results for the dropout rate show a very low impact of vocational courses on the dropout rate in high school: students enrolled in a vocational track are 1.38 p.p. more likely to drop-out throughout high school (table 10). The inclusion of the college entrance expectation as a variable to match students increase the likelihood by 0.27 p.p.. Again, as when performing the logistic regression, there is evidence that the introduction of the vocational track does not contribute to the reduction of the dropout rate of its students.

| EQUATION | VARIABLES | (I1) Dropout of high school | (I2) Dropout of high school |
|---|---|---|---|
| | | Excluding college expectation | Including college expectation |
| ATE | Vocational track | 0.0111*** | 0.0138*** |
| | | (0.00264) | (0.00309) |
| Number of obs. | | 36,430 | 36,430 |

**Table 10.** Estimates of the average treatment effect of the empirical model regarding the drop-out rates
Source: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

The estimated impacts are, again, smaller when computing the PSM procedure than the ones obtained using logistic regression (table 7).

### 5.2.3 College enrollment

The results for the college enrollment probability using a PSM approach with and without college entrance expectation as a matching variable show quite different results, if we include it, the impact of vocational courses on the outcome variable decreases significantly, by 12.4 p.p., from 25.8 p.p. to 18.4 p.p. (table 11). These results are also different when compared to the ones using the logistic regression (table 8).

| EQUATION | VARIABLES | (J1)<br>College enrollment | (J2)<br>College enrollment |
|---|---|---|---|
| | | Excluding college expectation | Including college expectation |
| ATE | Vocational track | -0.258***<br>(0.0131) | -0.184***<br>(0.0148) |
| Number of obs. | | 29,375 | 29,375 |

**Table 11.** Estimates of the average treatment effect of the empirical model regarding college enrollment probability
Source: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

We then analyze college enrollment probability for two different samples of students, the ones that expected to enroll into college and the ones that did not (table 12).

For the group of students that didn't expect to enroll into college, the ones in the vocational track are, on average, 15.6 p.p. less likely to enroll, everything else constant. For the ones that did expect, the difference increases to 17.3 p.p.. This could indicate that college enrollment probability increases much more for the academic track students than for the ones in the vocational track if they desire to enroll into college. A plausible explanation for this is due to the fact that the academic track is the one that prepares students to the high school national exams, a requirement to enroll into college.

| EQUATION | VARIABLES | (K1) College enrollment | (K2) College enrollment |
|---|---|---|---|
| | | College expectation=0 | College expectation=1 |
| ATE | Vocational track | -0.156*** | -0.173*** |
| | | (0.0128) | (0.0187) |
| Number of obs. | | 6,154 | 23,221 |

**Table 12.** Estimates of the average treatment effect of the empirical model regarding college enrollment probability
Source: *MISI, RAIDES, ENESB, OTES*
Note: All models were estimated with a constant.
Robust standard errors in parentheses. Significant at ***1%, **5%, *10%.

## 6 Conclusions and Future Research

The results found for the impact of the vocational track on the dropout rate should not be a surprise since vocational education aims to facilitate the transition from school to the labor market by developing skills that are highly valued before their graduation, encouraging students to dropout since their willingness to work is high. As well as the fact that vocational education is introduced on a late stage in the student's educational path which may make it difficult for vocational education alone to reengage students. This may be especially true for students who do not seek to enroll in higher education, precisely the ones that are enrolled in the vocational track, supporting the work of Gleason *et al* (1998), Agodini & Deke (2004) and Mamede *et al* (2015). Even though the impact that we've found is small, there is evidence that the introduction of the vocational track does not contribute to the reduction of the dropout rate of its students, the original goal of the Portuguese Government.

Regarding the results on the high school transition and college enrollment probability the results are the ones expected since vocational courses were designed as a way to develop the students' skills needed in the labor market and as a way to ease this transition, being the focus clearly not on college enrollment, supporting the work of Kreisman, D. & Stange, K. (2015) and Mamede *et al* (2015). These are good indicators towards the existence of the vocational track, given the goals that led to its creation. Students that choose this track are more likely to graduate in high school but less likely of enroll into college, which as previously

mentioned, is not its focus, demonstrated by the fact that its coursework, in Portugal, does not prepare them for the high school national exams, a college entrance requirement, but to ease their entrance to the labor market. Overall, our results point towards a beneficial contribution of the vocational track in the Portuguese education system.

Comparing our results with the ones in Mamede *et al* (2015), we've found lower but also a positive impact of choosing the vocational track on grade progression. Instead of a negative impact on the dropout rate, we've found a positive one, although both quite low. Finally, while both studies indicate a negative impact of the vocational track on college enrollment, our impact is much higher.[10] The comparison is the same with or without the inclusion of the students' reported college enrollment expectation as a covariate.

Additional research is needed to understand why students drop out. Finding ways to reduce dropping out will be a challenging task because the reasons currently hypothesized suggest that students drop out for reasons that develop early in their lives. (Agodini, R., Deke, J. (2004)).

Unfortunately, research on the specific benefits of Vocational Education and Training (VET), which has only recently started to emerge. However, for policy-making, it is crucial that decisions and actions are backed up by actual data and research evidence. The results obtained from research should inform policy-making to provide new directions of action that benefits the society as a whole and, in particular, the students, as a way of students with different backgrounds and profiles to be able to participate in the labor market.

Investing in public VET is of extreme importance in developed countries such as Portugal. As the UNESCO Revised Recommendation on Technical and Vocational Education and Training noted: "*Given the immense scientific, technological and socio-economic development, either in progress or envisaged, which characterizes the present era, particularly*

[10] *The outcome variables included in Mamede et al (2015) were: Transition in t (to the 11th grade), transition in t and t+1 (to the 12th grade), high school graduation at t+2, dropout at t or t+1 and enrollment in higher education after t+2*

*globalization and the revolution in information and communication technology, technical and vocational education should be a vital aspect of the educational process in all countries"* (UNESCO, 2001). VET programs are crucial since it improves the match between high school graduates and low-skilled jobs and promotes the inclusion thus reducing high school dropouts of students with different academic profiles and professional motivations.

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