UNIVERSIDADE CATÓLICA PORTUGUESA

Analysis of the Performance of Students

The case of UP and UCP

Trabalho Final na modalidade de Dissertação
apresentado à Universidade Católica Portuguesa
para obtenção do grau de mestre em Gestão

por

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sob orientação de
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Católica Porto Business School
Abril 2018

Agradecimentos

O meu primeiro agradecimento tem de ser obrigatoriamente à Professora Conceição Silva, não só por me ter dado a oportunidade de trabalhar neste projeto tão interessante, mas também pelo constante apoio e disponibilidade apresentados ao longo deste percurso.

À minha família e amigos que sempre me apoiaram, o meu muito obrigado.

Também não posso deixar de mencionar a equipa de Planeamento e Controlo de Gestão da NOS pelo interesse demonstrado no trabalho e as constantes palavras de apoio. E um obrigado especial à Claudia Dias, que sempre me deu a disponibilidade e o à vontade necessário para que conseguisse terminar este projeto.

Resumo

O principal propósito desta tese consiste em analisar os determinantes de sucesso dos alunos universitários, focando no primeiro ano em que estes frequentam a universidade. O enfoque no primeiro ano universitário permite-nos fazer a ligação com o ensino secundário e perceber, entre outros factores a importância da escola de origem na preparação dos alunos. Assim, construímos um indicador compósito que nos permite fazer uma análise comparativa entre escolas secundárias tendo em conta o seu desempenho na forma como preparam os alunos para o sucesso universitário. Utilizamos a metodologia de Data Envelopment Analysis (DEA) para construir o indicador agregado de performance, análise de regressão para analisar determinantes de sucesso, e estatística descritiva para análise exploratória dos dados.

As principais conclusões apontam para a importância do desempenho no secundário, do género e do tipo de escola frequentado na explicação dos resultados dos alunos no ensino superior. De notar que o tipo de curso superior dos alunos também tem impacto na forma como cada variável determina o sucesso dos alunos. Relativamente às escolas secundárias verifica-se que no topo do ranking se encontram escolas publicas que parecem contribuir mais para o sucesso universitário dos alunos do que as escolas privadas.

Palavras-chave: Desempenho, Universidade, Ensino Secundário, DEA, Regressão Linear, Regressão Linear Múltipla

Abstract

This thesis main purpose consists in the analysis of determinants of success for students at University, specifically for those attending the first year.

The focus on the first year allows us to make the connection with secondary school and understand, among other factors, the importance of the preparation of the students' school of origin. As such, we built a composite indicator which allows a comparative analysis between secondary schools taking into account the way in which they prepare their students for academic success.

We used Data Envelopment Analysis (DEA) methodology to construct the aggregated indicator of performance, regression analysis to analyse the determinants of success and descriptive statistics for the exploratory analysis of the data.

Our main findings point to the importance of the performance at secondary school, gender and type of school attended when explaining the results of students at University. Denote that the degree at University also has an impact on how these variables determine academic success. Regarding secondary schools we verify that at the top of the ranking are found public schools, which seem to contribute more to the academic success of students than private schools do.

Keywords: Performance, University, High School, DEA, Linear Regression, Multiple Linear Regression

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Introduction

Schools play a major role in human development, as it lays down the basis with which every child will look upon their future and the impact they will be able to have on the world. In a less grandiose scale, school is also important as it prepares students for the next big step in their academic life, University.

The literature regarding school evaluation is vast, Glewwe, et al. (2011) reviewed the literature for the years 1990 to 2010 to understand if specific school and/or teacher characteristics had impact on the students learning. Finding from that review that schools which provide better basic conditions such as quality roofs and desks, as well as teachers with greater knowledge lead to better student learning. Though the main point of this article to focus on is that the skills that high quality education may endow the students can have a very positive impact on their lives and on countries economic growth.

The entrance in university, in most countries, is defined by the students' ability to perform well in national exams and also to perform well during their high school years. Given this, it becomes extremely important to distinguish schools from one another. Although in theory for each country schools have a program they must follow and students should have the same opportunities

regardless of the school they attend, in reality this does not happen. Hanushek (2002) pointed out that school quality has a strong impact on individual earnings, on the distribution of income, and on overall economic growth. This statement assumes there is disparity amongst schools, otherwise quality would be equal for all schools and the statement would not make sense.

Based on that disparity, this thesis will analyse the performance of students during their first year at the Universidade do Porto and Universidade Católica do Porto for the years of 2013, 2014 and 2015.

The objective is mainly to understand what are the main predictors of success at the university and in particular to understand the role that exam grades on entry play on that success, and the role that secondary schools play on students' success. Grades from national exams at the end of secondary education are the main criteria for entrance at Portuguese universities (each university decides on the exams that shall be considered as entry criteria). As a result, secondary schools place a high importance on the preparation of students for these exams since it is one of the factors that determines the choice of students in high education studies. However, it is relevant to understand the extent to which this criterion is appropriate and predicts in fact success at a higher level of schooling.

In this study we will analyze the state of these two Portuguese Universities regarding their students' performance. These results will prove useful for the Universities as it will allow them to compare the different degrees they offer. The same analytics will be computed for the schools allowing for their direct comparison.

Our main goal is to construct a ranking of the schools, with the emphasis being those that best prepare their students. To do so we will use a DEA model.

In recent years DEA (Data Envelopment Analysis) has seen a wide variety of applications to evaluate efficiency performance in different sectors, which operate very distinctively from each other. Such examples are performance of banks, military equipment maintenance, universities research and schooling performance. The reason for this increase in popularity is that this type of analysis removes the complex implication of relations between input and output variables, which makes them less suitable for other types of analysis (such as regression) (Cooper, Seiford and Zhu, 2004)).

1. Previous studies

This thesis is inserted into two strands of the literature. That analysing and comparing secondary schools' effectiveness and that analysing the performance of university students. Not many studies in the literature have attempted to link both strands and analyse them at the same time. The following are examples of such type of studies.

Smith and Naylor (2005) studied the difference of the attended school on students' outputs at university for UK students. This study is based on previous findings by the same authors, where they concluded that a student who attends a private school is less likely to achieve higher grades than his public schooled peers.

The main inputs of the dataset used by the authors consisted in Personal Information (date of birth, sex, marital status, county of prior residence and occupation of parent or guardian), Academic History Information (last full-time school attended, other education, GCE A-level record and course for which admitted), Annual Information (University, subject, type and duration of course, enrolment date, qualification aimed for and type of term-time accommodation) and Leavers Information (qualification obtained and class of degree). These were studied using a regression model

Their findings conclude that on average a student who attended a private school is 6,9% to 5,4% less likely to be awarded a "good" (First- or Upper Second-class degree which correspond to the best two categories available) degree compared to a public school student. Their findings also include that performance at university is influenced by the students' grades prior to

university and their social class background.

Birch and Miller (2007) proposed to find if entry grades were a strong determinant of success at university, they studied the impact that attending a private school might cause on students by analysing their first year grades at university.

They used two models of analysis in this work, OLS (ordinary least squares) and a quantile regression approach.

The dataset used contained information regarding the students at the University of Western Australia. The data contained information regarding, entrance scores, personal characteristics (gender and home location) and characteristics of secondary school attended (school type and school size). The students in the data set were all first year students enrolled in that University.

The authors conclude that first year grades are positively influenced by the students entry grade and being female. They also find that students are negatively influenced by studying at larger schools and particularly influenced by coming from a private school (with these students scoring 3% lower than public ones).

Regarding the placement of students at University Cyrene and Chan (2010), created a model to analyse the evolution of the students throughout university and by doing so they mix both the influence of high school and university preparation. They studied the influence of entry grades and other student characteristics on university performance for 5136 students of the University of Winnipeg for the years 1997 to 2002.

For their analysis they used a variety of estimation approaches, including Least Squares Dummy Variable and Hierarchical Linear Model.

In their work they found significant school effects in university performance. Although, as expected, they also find that school influence diminishes over time.

In regards to private school effect they found that students coming from this kind of institution would on average score 0,10 points higher on their GPA scores.

Their findings include that high school has a significant effect on the students' performance at university, by associating that the students high school grade will be a good measure of their university grade.

The variables used in the literature to determine academic success are many, such as grades, socioeconomic values, emotional intelligence etc.

Danilowicz-Gösele, Kamila, et al (2017) proposed to determine which were the main predictors of success at university.

To address this issue, their study took into account the students high school leaving grade and other students characteristics, mostly related to social background. Success is measured by the students ability to achieve good grades and the completion of studies in the chosen field, the authors find it important to mention that the students high school grade and the performance at university are two measures of academic performance taken at different points in time and by different institutions. Both being possibly influenced by cognitive, emotional, social, parental or schooling environment.

The dataset was provided by Göttingen University in Germany and contained information on over 12 000 students. The data being collected on two parts, first at the moment of the students enrolling, which collected high school leaving certificate, parental address, gender and type of health insurance. The

other part contains information regarding field of study, degree that the student finished, and, in case the student abandoned the degree, the reason why.

To conduct the study the authors would always start with High school grade as the independent variable and continue by adding other variables.

The graduation effect is analyzed using probit models. For the university grade an OLS model is used.

The conclusions for this study show that high school leaving grade is the best way to predict if the student will graduate and his/her final grade, with factors like gender and social origin playing a minor part. Regarding this finding the authors mention that the high school grade is stronger at predicting if the student will graduate than at predicting success regarding university grades.

Another conclusion is that faculties have different grading and graduation policies, they give the example of Humanities and Social Science faculties, where students rate of graduation is low, but grades for those that graduate are high regardless of the high school grade, and other faculties, such as Economic Sciences, the graduation rate is high, but grades are moderate and in this case more related to the high school grades.

Cabral and Pechincha (2014) characterized the students of Universidade do Porto for the years of 2008, 2009 and 2010. Their analysis focused on dropout, ECTS completion and Score (which is the normalized grade, computed by the difference of the students grade with the average grade of the degree he/she is inserted in and divided by the degree´s standard deviation).

For students which had completed more than 75% of their available ECTS at the end of the third year the authors performed a linear regression using Entry grades to explain the score, their model was Score = -2,225 + 0,0132*Entry

Grade. With this model they found out that Entry grades are not a good indicator to explain performance at University (R^2=0,045). Then followed this with a multiple regression analysis for the score with variables entry grade, option (if the student entered the degree in first option or not), the type of school and gender. The model they achieved was Score = -2,186 + 0,0136*Entry Grade – 0,102*option – 0,257*type of school – 0,043*gender.

From this regression the author could conclude that Entry grade is the variable which least influences the score and the type of school the one that influences the most.

As the variables type of school and gender assumed values of 1 when the school was private and the student was male these characteristics lower the students' score.

For dropout the authors find a 17% rate for the first year with that rate decreasing for the consequent years, they also state a pattern that the lower the entry grade, the more probability there is of finding students abandoning their degrees.

Regarding ECTS completion, they find that only 64% of students are able to complete at least 75% of the total of ECTS available, with that rate increasing for the following years, with the authors concluding that after the first year the students go through a period of adaptation to University.

They conclude that entry grades are not a good indicator of students' performance at university.

Portela and Camanho (2017) used data analytics to benchmark Portuguese schools.

They used data from 2075 students in the first year of Faculdade de Engenharia do Porto (FEUP) and Católica Porto Business School (CPBS) for the years of 2013/2014 and 2014/2015.

They use only data from students enrolled in the first year to prevent influence from the Faculty on the students. To classify the students they computed with their grades the percentiles on entry and after the first year. By comparing the students' percentiles on entry and at the end of the first year they were able to understand the evolution of the student throughout the year. Being able to conclude that when a student lowered his/her percentile position it could mean that he/she was over evaluated by the school he/she belonged and under evaluated when the opposite happened.

They also consider the influence of the type of school (private or public) and conclude than on average public students perform better than private students do.

Regarding percentiles on entry they find the students from both schools to be similar, whereas that public students complete on average 42,61 ECTS and private students 38,69 ECTS on the first year at university. The percentile at the end of the first year found is of 0,54 for public students and 0,44 for those from private schools. Regarding the percentile difference they also find students from public schools (0,06) performing better than private students (-0,08).

In the last part of this thesis we will use Data Envelopment Analysis (DEA) to find out which schools are the most efficient at producing outputs in University and rank the schools as best to worst in this aspect. This approach of using DEA for Education, although becoming more popular in recent years, has already seen use some decades ago, before this era where massive amounts of data are available.

Bessent, A.M., & Bessent, E. W. (1980), applied DEA in order to identify which elementary schools were efficient and which were inefficient, at a time when assessment methods consisted mainly of least square regression.

In more recent years other studies have applied DEA to compare performance amongst Higher Education institutions. Abbott, M., & Doucouliagos, C. (2003) applied DEA to evaluate technical and scale efficiency in Australian Universities. Technical efficiency being the amount of teaching and research output at a certain quality level of universities, scale efficiency measures the size of the institution and its outputs as to optimize its ideal size.

2. Methodology

This thesis will use a quantitative methodology.

We will focus initially on descriptive statistics of the variables in our Dataset. Descriptive statistics make use of averages from the data, graphical visualization and tables, as to aid in its comprehension.

Linear Regression will also be of extreme importance in this work as we intend to predict variables of academic success.

Linear Regression models the relationship between a dependent variable and one or more explanatory variables, where dependent variables must be continuous and explanatory (or independent) may also be continuous or binary.

In this work we will make use of univariable linear regression as well as multivariate linear regression.

Univariate linear regression studies a linear relation between two variables (one independent and one explanatory) and assumes the following equation:

$Y = a + b*X$, where Y is the dependent variable, X the explanatory variable, a is the value where the y is intercepted when x=0 and will be later on described as "Intercept" in our work and b is the slope.

The slope (b) describes the overall relationship between the two variables.

Multivariate linear regression, like univariate linear regression, explains the dependent variable but instead computes more than one explanatory variable, as to allow the comprehension of the behavior of several variables at the same time. It assumes the following equation: $Y = a + b_1*X_1 + b_2*X_2 + b_n*X_n$, where Y is the dependent variable, X_i the explanatory variables, a the intercept of the y axis and b_i the slope of the variable X_i.

Both of these regressions always return the R^2 which is the coefficient of determination, this value shows the amount of data that is described by the model, an R^2 of 1 would mean that all the data is explained while one of 0,5 means that 50% of the data is explained.

The main focus of this thesis is to construct a ranking of the schools that place students at Universidade do Porto and Universidade Católica do Porto, to do that we will use Data Envelopment Analysis (DEA).

DEA is a tool to measure efficiency, this technique compares Decision Making Units (DMU´s) while considering all of their inputs and outputs, it identifies the most efficient DMU´s (which are in the frontier of efficiency) and the inefficient one´s. It then compares the inefficient ones only to the best DMU´s.

This method assumes that if one DMU is able to produce X with a certain input Y then another DMU should also be able to produce X given it has as input Y, if the second DMU was producing X-1 then it would be considered inefficient.

By identifying all the efficient units we can create the efficiency frontier, this frontier defines the maximum outputs that can be produced by a given set of inputs.

3. Data

The data used was provided by Reitoria da Universidade do Porto, and by Católica Porto, and contains information regarding 10274 students. For these students several variables are available and others were constructed. The list of variables available is the following:

Table 1: Variables available

Student characteristics	**Grades Entry**	**University performance**
Birth year	Entry grades (from national exams)	Nº ECTS done
Gender	Faculty where student registered	Average of first year grades
School of origin	Course	
Type of school of origin (private; public)		

From the above variables a set of other variables were constructed for each student:

- 0 ECTS – Binary variable with a value of 1 when the student has 0 credits done at the university;
- Adjusted 1st year grade – average at the end of first year multiplied by the number of ECTS done divided by 60 (the number of regular ECTS a student does on his first year). When the number of ECTS done was greater than 60 the corrected average is equal to the average.

- Entry Score – Variable constructed from the entry grades, where entry grades for each student were normalized by the mean of the course where the student registered and the standard deviation of entry grades in that course for each year of analysis. This score shall be interpreted as the number of standard deviations that the student differs from the mean of the entry grades in his course in his year.
- 1st year Score – Variable constructed from the average grades obtained at the first year at the university, where grades were normalized by the weighted mean of the grades (to take into account the credits made) on that course and the weighted standard deviation of grades in that course for each year of analysis. This score shall be interpreted as the number of standard deviations that the student differs from the mean of the grades at the first year at the university in his course in his year.
- Top student – a binary variable taking the value of 1 when the 1st year score is equal or higher than 1,5 and the student completed 50 ECTS or more.
- Bottom student – a binary variable taking the value of 1 if the student did less than 30 ECTS in the first year at the university.

3.1 Characterization of Sampled Students

The students in this study enrolled in courses from Universidade do Porto and Universidade Católica do Porto which will be designated by UP and UCP respectively. UP currently has 14 faculties and UCP has 7 faculties, to make a total of 21 faculties, in the percentages shown in Table 2.

A total of 10274 first year students were analyzed in the years of 2013, 2014 and 2015. Of this total, 1728 (17%) students are from UCP while the remaining 8546 (83%) are from UP. Table 2 provides information regarding the number and percentage of students enrolled in each faculty, discerning of those which are females and the ones coming from private schools.

Table 2: Representation of students at the Faculties.

University/Faculty	Nº Students	% Students	% Females	% Private
UCP	1728	16,8%	62,8%	47,6%
Escola das Artes	144	1,4%	41,0%	34,0%
Escola do Porto da Faculdade de Direito	555	5,4%	65,2%	45,8%
Escola Superior de Biotecnologia	291	2,8%	75,9%	41,6%
Faculdade de Economia e Gestão	440	4,3%	49,8%	62,3%
Faculdade de Educação e Psicologia	167	1,6%	85,6%	42,5%
Faculdade de Teologia	37	0,4%	0,0%	48,6%
Instituto de Ciências da Saúde	94	0,9%	86,2%	37,2%
UP	8546	83,2%	56,0%	28,5%
FADEUP	294	2,9%	32,0%	35,4%
FAUP	267	2,6%	66,3%	24,3%
FBAUP	279	2,7%	77,4%	14,3%
FCNAUP	137	1,3%	93,4%	35,0%
FCUP	1311	12,8%	48,4%	20,8%
FDUP	384	3,7%	74,2%	22,9%
FEP	743	7,2%	55,3%	33,4%
FEUP	1878	18,3%	29,8%	31,9%
FFUP	407	4,0%	81,6%	32,4%
FLUP	1279	12,4%	66,8%	15,6%
FMDUP	133	1,3%	68,4%	50,4%
FMUP	533	5,2%	60,0%	46,2%
FPCEUP	336	3,3%	88,4%	20,2%
ICBAS	565	5,5%	68,5%	46,2%
Total	**10274**	**100%**	**57,2%**	**31,7%**

There are some conclusions to draw from this table, UP has the majority of the students enrolling in its Faculties (83,2%). The four faculties with most students from UP, have over 50% of the population. In regard to gender UCP (62,8%) sees more women enrolling than UP (56%), although in both cases women are more present than men. For students coming from private schools UCP (47,6%) sees nearly half of its students coming from private schools, whereas in UP (28,5%) this number is close to 30%.

Table 3 shows the degrees available in each of the Faculties of UP and UCP. The 7 faculties from UCP offer 11 degrees and the 14 faculties from UP offer 53 degrees. This amounts to 21 faculties and 64 degrees in total.

Table 3: Degrees available by University and Faculty with number of students

University/Faculty/Degree	Nº Students
UCP	1728
Escola das Artes	144
Arte, Conservação e Restauro	29
Som e Imagem	115
Escola do Porto da Faculdade de Direito	555
Direito UCP	555
Escola Superior de Biotecnologia	291
Bioengenharia	99
Ciências da Nutrição	123
Microbiologia	69
Faculdade de Economia e Gestão	440
Economia UCP	149
Gestão	291
Faculdade de Educação e Psicologia	167
Psicologia	167
Faculdade de Teologia	37
Teologia	37
Instituto de Ciências da Saúde	94
Enfermagem	94
UP	8546
FADEUP	294
Ciências do Desporto	294
FAUP	267
Mestrado Integrado em Arquitetura	267
FBAUP	279
Artes Plásticas	180
Design de Comunicação	99
FCNAUP	137
Licenciatura em Ciências da Nutrição	137
FCUP	1311
Licenciatura em Arquitectura Paisagista	54
Licenciatura em Astronomia	2
Licenciatura em Biologia	335
Licenciatura em Bioquímica	178
Licenciatura em Ciência de Computadores	87
Licenciatura em Ciências de Engenharia	24
Licenciatura em Ciências e Tecnologia do Ambiente	88
Licenciatura em Física	80
Licenciatura em Geologia	58
Licenciatura em Matemática	111
Licenciatura em Química	61
Mestrado Integrado em Engenharia de Redes e Sistemas Informáticos	162
Mestrado Integrado em Engenharia Física	71
FDUP	384
Criminologia	78
Direito	306
FEP	743
Economia	497
Licenciatura em Gestão	246
FEUP	1878
Licenciatura em Ciências de Engenharia - Engenharia de Minas e Geo-Ambiente	35
Mestrado Integrado em Bioengenharia	129
Mestrado Integrado em Engenharia Civil	229
Mestrado Integrado em Engenharia do Ambiente	76
Mestrado Integrado em Engenharia e Gestão Industrial	157
Mestrado Integrado em Engenharia Electrotécnica e de Computadores	449
Mestrado Integrado em Engenharia Informática e Computação	247
Mestrado Integrado em Engenharia Mecânica	338
Mestrado Integrado em Engenharia Metalúrgica e de Materiais	70
Mestrado Integrado em Engenharia Química	148
FFUP	407
Mestrado Integrado em Ciências Farmacêuticas	407
FLUP	1279
Licenciatura em Arqueologia	63
Licenciatura em Ciência da Informação	86
Licenciatura em Ciências da Comunicação: Jornalismo, Assessoria, Multimédia	163
Licenciatura em Ciências da Linguagem	50
Licenciatura em Estudos Portugueses e Lusófonos	45
Licenciatura em Filosofia	83
Licenciatura em Geografia	142
Licenciatura em História	142
Licenciatura em História da Arte	60
Licenciatura em Línguas Aplicadas	101
Licenciatura em Línguas e Relações Internacionais	85
Licenciatura em Línguas, Literaturas e Culturas	176
Licenciatura em Sociologia	83
FMDUP	133
Mestrado Integrado em Medicina Dentária	133
FMUP	533
Mestrado Integrado em Medicina - FMUP	533
FPCEUP	336
Licenciatura em Ciências da Educação	100
Mestrado Integrado em Psicologia	236
ICBAS	565
Licenciatura em Ciências do Meio Aquático	65
Mestrado Integrado em Medicina - ICBAS	364
Mestrado Integrado em Medicina Veterinária	136
Total	**10274**

To give a contextualization of the students' entry grades who enroll in each Faculty two boxplots are presented next.

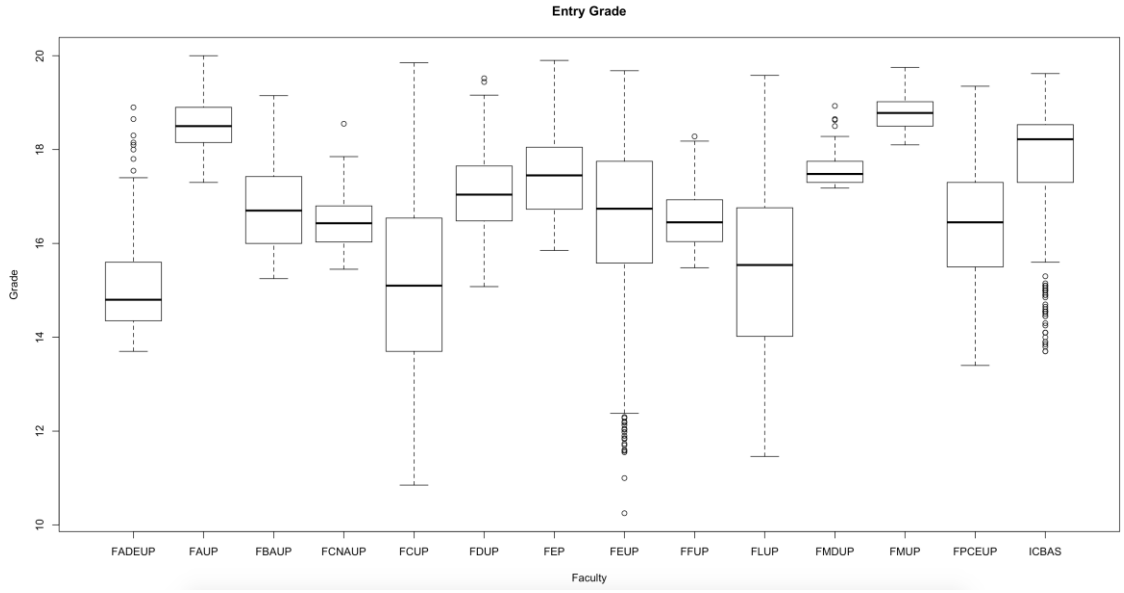


Figure 1: Boxplot of Entry grades regarding UP Faculties

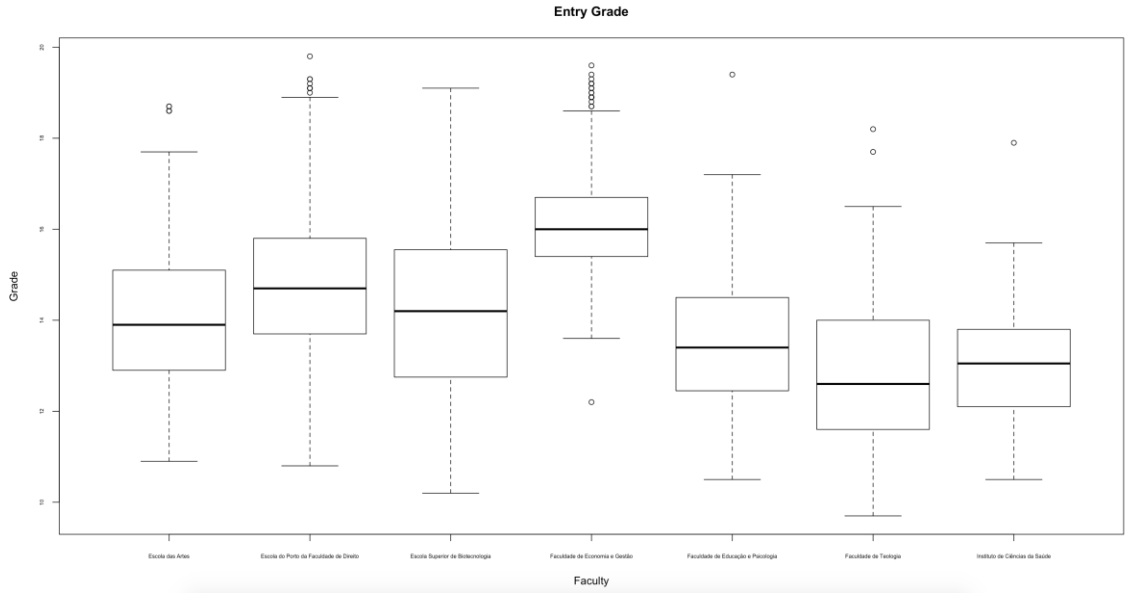


Figure 2: Boxplot of Entry grades regarding UCP Faculties

The boxplots show that for UP there is a large variability in the distribution of entry grades per faculty with FCUP and FLUP clearly having the wider range of entry grades and FADEUP, FEUP and ICBAS with the most outliers. For UCP there is higher similarity between distributions of entry grades per

faculty, with the only clear exception being Faculdade de Economia e Gestão, both in terms of entry grade spectrum and outliers.

The different distributions in entry grades justify the use of scores on entry (entry grades normalized by the mean and standard deviation) whenever one wishes to make comparisons between students that entered in different courses in different years. There is one factor to take into account that may explain the higher values of dispersion for some of these faculties: the number of courses they provide. Take for instance FLUP and FMDUP, the first with major dispersion values provides thirteen courses, while the second which has very small dispersion levels only provides one.

The same is valid for 1st year grades, whose box plots are shown below:

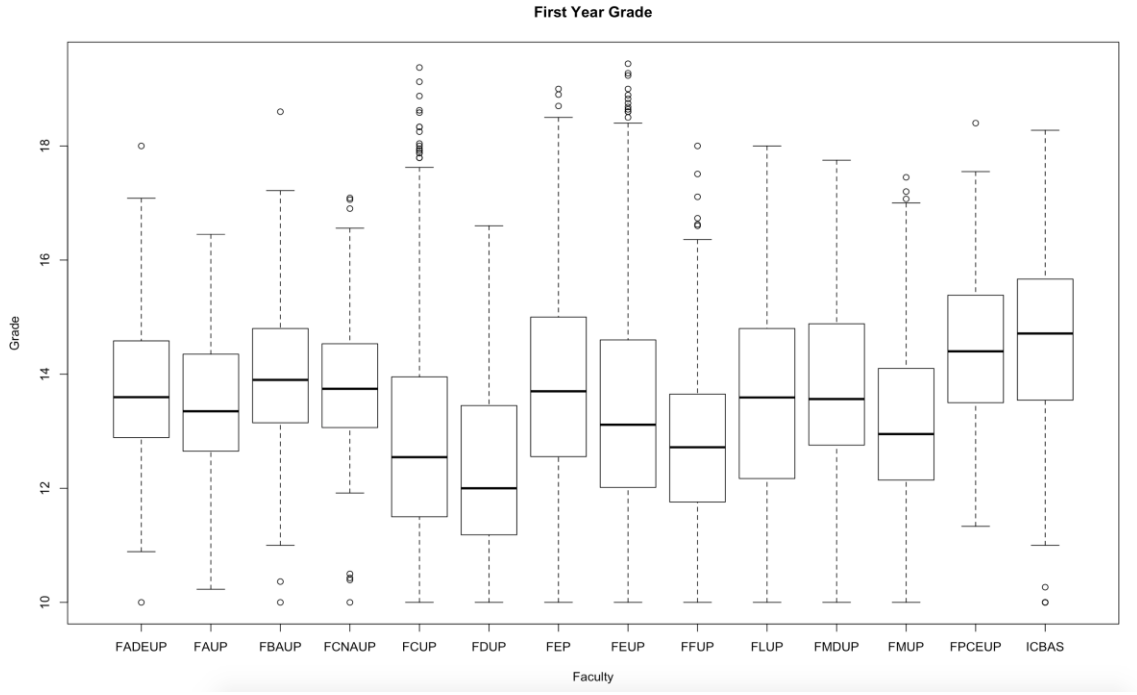


Figure 3: Boxplot of First year grades regarding UP faculties

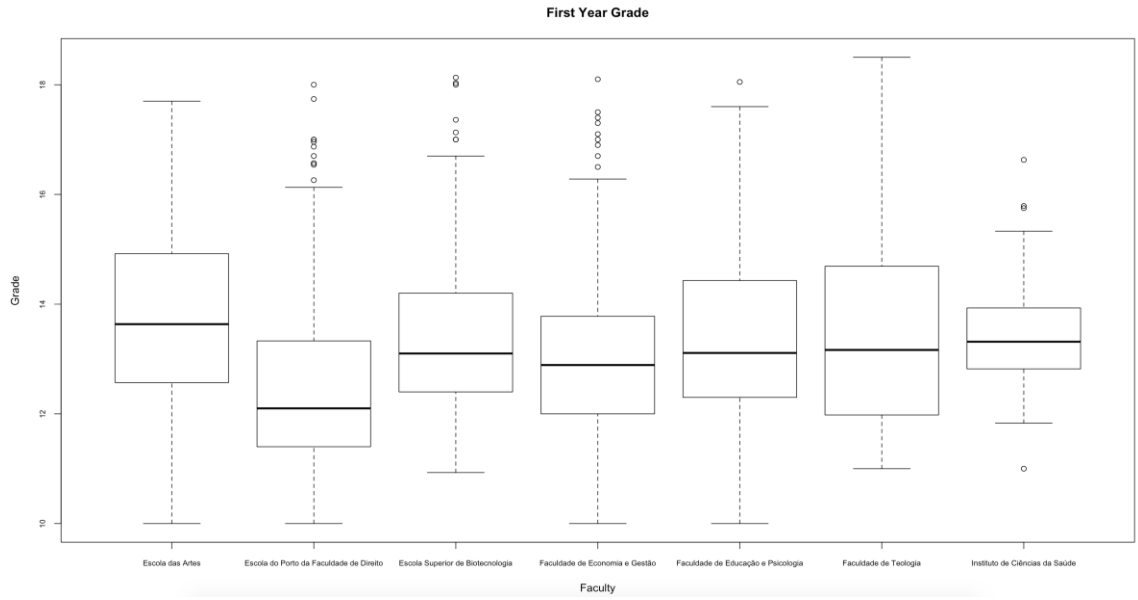


Figure 4: Boxplot of First year grades regarding UCP faculties

Looking at Figure 3 we see FCUP and FEUP as having the most outliers. FADEUP, FAUP, FCNAUP and FBAUP have a smaller range of 1st year grades than the rest of the faculties, while the ones with the highest range are FCUP, FDUP, FEP, FEUP and FLUP.

There is also clear evidence of FDUP achieving the median lowest results.

Figure 4 shows overall more balanced 1st Year grades in between the different faculties of UCP. Escola do Porto da Faculdade de Direito being the one to stand out as having less favorable 1st year grades. Also, this faculty, Escola Superior de Biotecnologia and Faculdade de Economia e Gestão are the ones with the most outliers.

In terms of spectrum of 1st Year grades Faculdade de Teologia is the one with the biggest range and Instituto de Ciências da Saúde is the one with the lowest dispersion in 1st Year grades.

Figures 2 to 4 allow the conclusion that Entry grades exhibit higher dispersion than 1st Year grades. We also notice a more even median across

faculties, for UCP this phenomenon, although happening, is not as noticeable due to their students not being as dispersed on Entry as those in UP.

Take the example of FCUP, which on entry assumed the biggest dispersion values and for the same students, after the first year, their dispersion level assumes similar values to many other faculties, such as FDUP and FEP.

This motivates this study even further as it becomes clear that students are very different when they enter a University and become more similar when they conclude their first year.

4. Analysis of Some Key Perfomance Indicators

Having characterized the students´ sample the next logical step is to analyze key performance indicators, and as previously mentioned this will be made by having in consideration as the core variables for analyses the students entry grade, first year conclusion grade and ECTS completion. Also very important for these analyses will be the type of school attended, the faculty, and the school frequented by the students.

Of these we consider two KPI of outputs: ECTS completion and first year conclusion grade. These two outputs can also be looked at simultaneously in the adjusted 1st year grade. Note that average grades are not directly comparable between courses. As a result, whenever the analysis is performed within course we consider the average grade as is, when the analysis is performed between courses the 1st year score is considered instead (the average grade normalized).

The model implicit in the analysis undertaken is that 1st year outputs are a function of:

- Student characteristics – such as gender, innate abilities (represented by entry scores);
- Secondary school characteristics – type of school, size of the school;
- University characteristics – Course attended, size of the course;

In what follows we will first proceed with a univariate analysis of the outputs with some of these variables and later on we will consider some multivariate analysis of the most likely determinants of success. Note that

we are particularly interested in understanding the role of the school of origin in the students' success and as a result we will dedicate a section to a more detailed analysis of this issue.

4.1 University first year outputs (ECTS and 1st Year Grades)

This first part of the KPI analysis will focus on students' output performance, therefore it will have a focus on their ability to complete ECTS and their 1st year grade.

The performance of a student is often judged by the grades he/she obtains, but the number of courses done successfully is also an important measure of success. Typically, a number of courses corresponding to 60 ECTS are required in all faculties in each academic year.

With that in mind, we will first look at ECTS completion. Table 4 shows the average ECTS students from Public and Private schools achieve each year.

Table 4: Average ECTS completed by type of school

Type	ECTS
Private	41
Public	45
Total	**43**

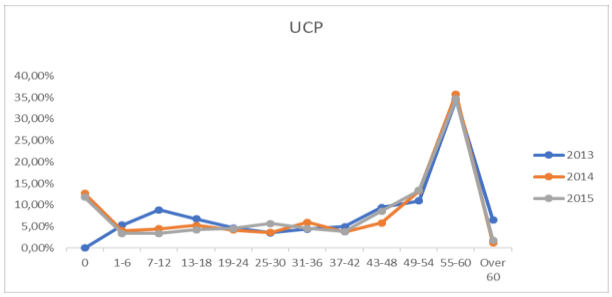
In the next table students are put into a category of consequent increments of 6 ECTS. This happens due to the fact that usually a curricular unit corresponds

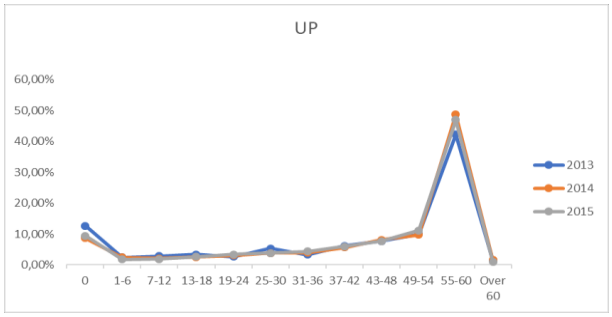
to 6 ECTS and representing the data this way allows the understanding of how many curricular units the students are able to complete.

A graphical representation is shown, in percentage, to better aid the comprehension of the data (percentages are computed per year).

Table 5: ECTS categories by University and Year

University / ECTS category	2013	2014	2015
UCP	339	688	702
0		87	83
1-6	18	28	24
7-12	30	31	24
13-18	23	36	30
19-24	16	29	32
25-30	12	25	40
31-36	15	41	32
37-42	17	26	27
43-48	32	40	61
49-54	37	91	94
55-60	117	246	243
Over 60	22	8	12
UP	2870	2842	2834
0	363	245	268
1-6	69	68	51
7-12	82	58	53
13-18	96	73	75
19-24	75	86	95
25-30	152	107	107
31-36	94	110	122
37-42	176	160	170
43-48	221	231	217
49-54	287	276	316
55-60	1213	1385	1330
Over 60	42	43	30





The number of students in each category for each year is shown in Table 5.

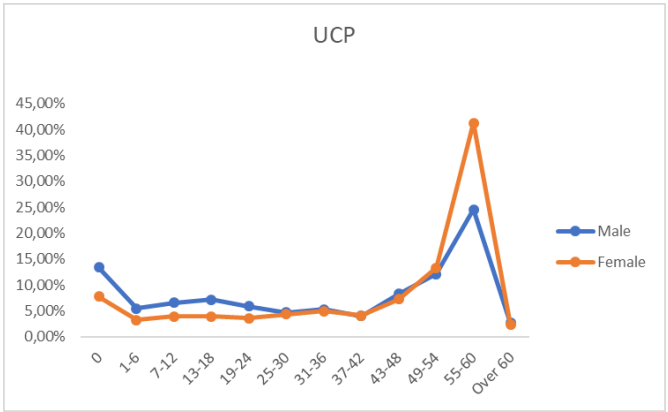
The graphics provide an easier read on the data as it becomes clear that there is a pattern for UP which shows no significant change for all three years. This pattern shows that as the number of ECTS completed increases so does the number of students in those categories, with the category of students who complete 55 to 60 ECTS containing the majority (around 45%) of the students. We also see that the number of students completing 0 ECTS is one of the categories with most students (around 10%).

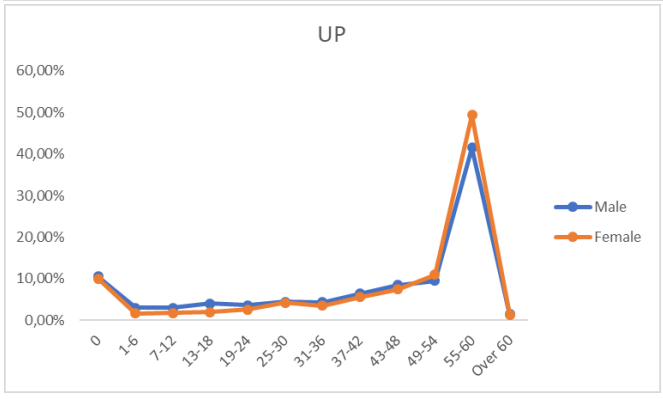
The case for UCP shows differences between the 3 years of analysis. 2013 in particular appears as an abnormal year in the number of students completing 0 ECTS (which is very low). Aside from that the other two years are comparable to those from UP.

As females are more present in both Universities, and as the literature shows (Birch and Miller, 2007)) that they tend to outperform males, it is important to distinguish the outputs of the two genders. Regarding ECTS completion by gender, Table 6 shows the same categories as in Table 5, but this time the number of students in each category is separated by gender, and the 3 years are aggregated. Graphs show the values in percentage within gender.

Table 6: ECTS categories by University and Gender

University / ECTS category	Male	Female
UCP	644	1085
0	86	84
1-6	35	35
7-12	42	43
13-18	46	43
19-24	38	39
25-30	30	47
31-36	34	54
37-42	26	44
43-48	54	79
49-54	78	144
55-60	158	448
Over 60	17	25
UP	3759	4787
0	397	479
1-6	112	76
7-12	112	81
13-18	150	94
19-24	136	120
25-30	165	201
31-36	161	165
37-42	239	267
43-48	316	353
49-54	355	524
55-60	1563	2365
Over 60	53	62





When comparing the ECTS category by gender it is clear that females perform better than males, as there are percentage-wise more women in the higher categories of ECTS completed. For UCP it becomes evident that from the 25-30 category the number of females increases more than the number of males. For UP this tendency is not as clear.

What can be easily observed though, is that for both Universities males are more present in the lower categories (0 up to 19-24).

In the next section we will look at the ability of students to complete ECTS for different entry grades, given that Entry grades are what distinguishes the students on entry we find this analysis may prove interesting as it is expected students with better entry grades achieve better results. Figure 5 shows the average number of ECTS completed for different entry grades of students by University.

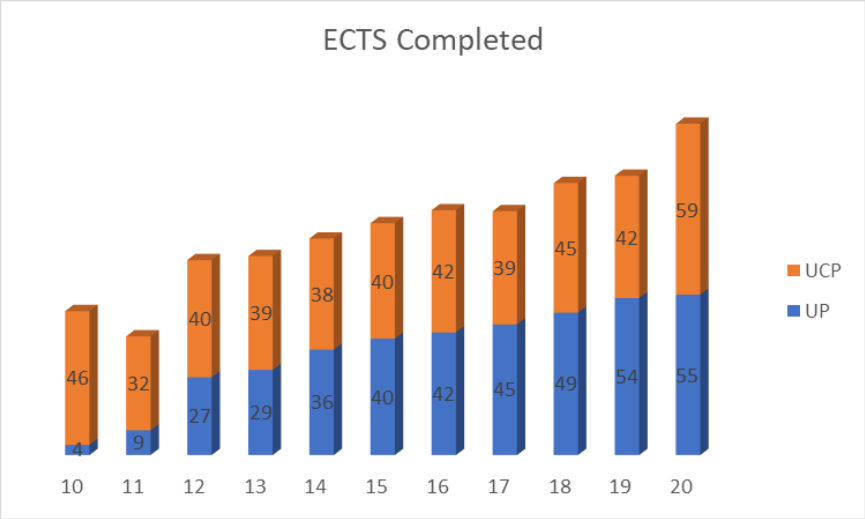


Figure 5: Average ECTS completed by Entry Grade and University

The expectation that students with lower entry grades fared worse at university, given that their performance in national exams (Entry grade) was worse than that of their peers is observable for UP (since the number of ECTS completed increases as the entry grade increases). The case is different for UCP as students from the entire grade spectrum are able to achieve close to 40 ECTS, with the differences observed for UP not being noticed in this case.

Take the case of students who entered with grade 12, on average they achieved 40 ECTS at UCP and only 27 at UP, looking at those with an Entry grade of 17, they complete 39 ECTS at UCP and 45 at UP.

What is seen here is students who entered with low Entry grades completing the same ECTS as students who entered with much higher grades.

Another variable that is to be studied is the effect of the school attended (public and private), to understand if the type of school has any effect when it comes to completing ECTS this variable will be added to determine the difference between the average number of ECTS completed by students who come from a public school and those from private schools.

This effect will be studied for students at UP and UCP. In order to understand how the students from each type of school in perform in these two Universities we will look at the number of ECTS the students are able to complete regarding their entry grade and the type of school attended.

Table 7: Average ECTS completed by University, Entry Grade and Type of School

Entry Grade	Private	Public
UCP	38	42
10	40	59
11	29	34
12	33	43
13	36	41
14	35	41
15	35	44
16	40	44
17	41	36
18	46	41
19	40	55
20	59	
UP	41	45
10		4
11	8	9
12	18	28
13	25	30
14	34	37
15	34	42
16	34	45
17	39	47
18	46	50
19	53	54
20	57	54

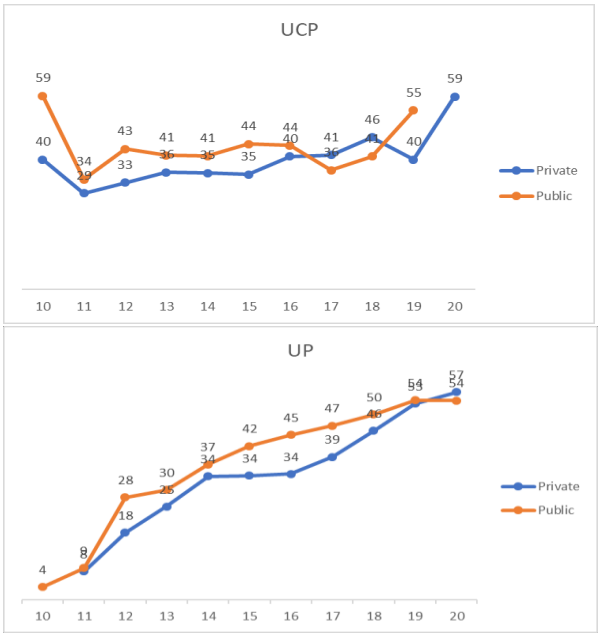


Table 7 shows that students who enroll in UP have a more linear tendency to perform better as the entry grade increases, both for students coming from private and public schools. The results for students who enroll in UCP are different, in this case the ECTS achieved do not seem to be as influenced by the Entry grade (as previously seen in Figure 5). In both Universities students from public schools complete on average more ECTS than students from private schools (for the same entry grade).

As this section is focused on the outputs of the first year at University we will now look at the 1st year grade and how it evolves coupled with other variables.

Table 8: Average 1st Year grade by University

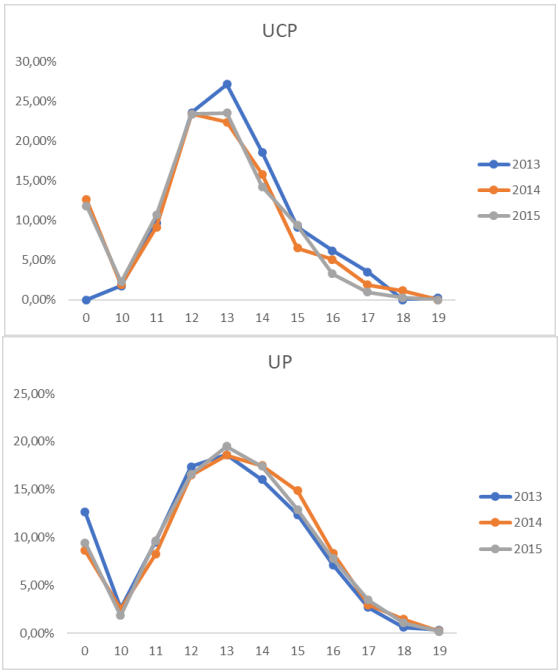
University	1st Year Grade
UCP	13,1
UP	13,5
Total	**13,4**

As shown in Table 8 the average grades achieved in both Universities are very similar with UP students achieving just slightly higher grades.

Looking at the ratio of students in each grade for all the years analysed may prove useful in understanding if there is a pattern of distribution of students across the grade spectrum as there was for ECTS.

Table 9: Number of students by 1st year grade

University 1st Year Grade	2013	2014	2015
UCP	339	688	701
0		87	83
10	6	13	16
11	33	63	75
12	80	161	164
13	92	154	165
14	63	109	100
15	31	45	66
16	21	35	23
17	12	13	7
18		8	2
19	1		
UP	2870	2842	2834
0	363	245	268
10	75	73	53
11	273	235	274
12	499	469	470
13	534	528	553
14	460	497	494
15	355	423	366
16	205	238	221
17	78	85	98
18	18	42	31
19	10	7	6



As seen in Table 9, the distribution of students follows a pattern where the majority of students from UCP have 1st year grades between 11 and 14, and UP students between 11 and 16.

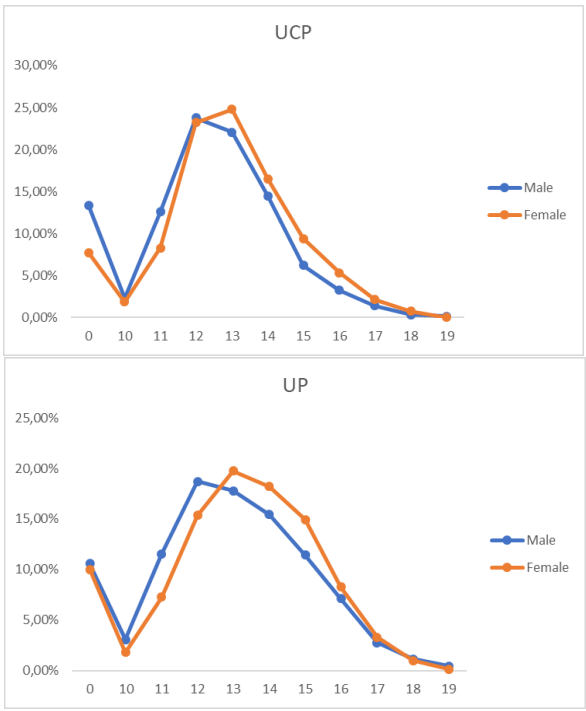
For both Universities there seems to be no major changes throughout the three years.

Those students who are inserted in the 0 category represent students who did not achieve a grade, this means as well they were not able to complete any ECTS and will be looked at in detail further in this analysis in the Zero ECTS section.

An interesting approach is to understand if there is a major difference in grade achieved between genders. As previously seen females tend to score higher in ECTS completion, so it would be expected the same regarding the ability to achieve better grades Table 10 will explain this difference.

Table 10: Nº of students scoring grade by gender

University 1st Year Grade	Male	Female
UCP	643	1085
0	86	84
10	15	20
11	81	90
12	153	252
13	142	269
14	93	179
15	40	102
16	21	58
17	9	23
18	2	8
19	1	
UP	3759	4787
0	397	479
10	115	86
11	434	348
12	703	735
13	669	946
14	580	871
15	429	715
16	268	396
17	104	157
18	43	48
19	17	6



The same situation that happened for ECTS completion happens when analyzing first year grades, females are more present in the higher grades, whereas males tend to score lower, both at UP and UCP.

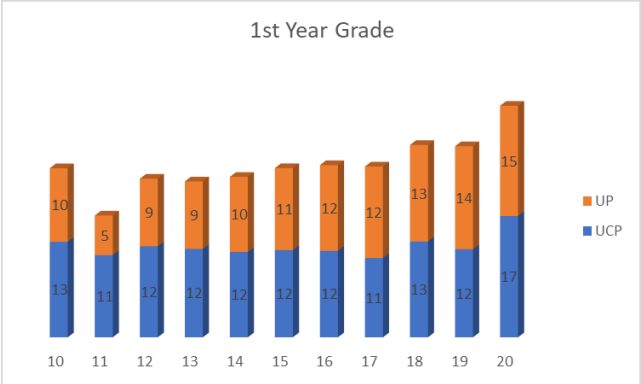


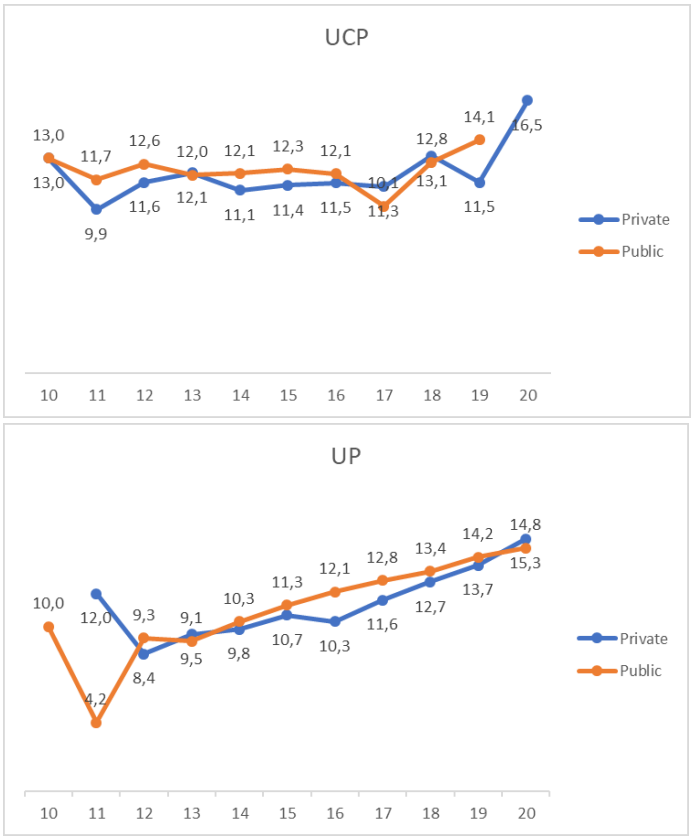
Figure 6: Average 1st Year grade by Entry grade by University

When comparing 1st Year grades by Entry grade, shown in Figure 6 we see that at UCP there is more homogeneity of results. For UP the students tend to achieve slightly higher grades as their Entry grade increases. Note that these results need to be interpreted carefully since the 1st year grades do not consider the number of courses completed.

Lastly in this section we will compare the performance of students from both types of school in regards to their grades at UP and UCP, shown in Table 11.

Table 11: Average 1st Year grade by type of school and Entry grade

Entry Grade	Private	Public
UCP	11,5	12,0
10	13,0	13,0
11	9,9	11,7
12	11,6	12,6
13	12,1	12,0
14	11,1	12,1
15	11,4	12,3
16	11,5	12,1
17	11,3	10,1
18	13,1	12,8
19	11,5	14,1
20	16,5	
UP	11,8	12,2
10		10,0
11	12,0	4,2
12	8,4	9,3
13	9,5	9,1
14	9,8	10,3
15	10,7	11,3
16	10,3	12,1
17	11,6	12,8
18	12,7	13,4
19	13,7	14,2
20	15,3	14,8



Public students score higher at both Universities for the majority of Entry grades. It is also noticeable the tendency of students scoring higher as the entry grade increases for UP.

In this section we have seen that, students from public schools tend to perform better than those from private schools, which is in agreement with the literature (Smith and Naylor (2005)). Public students complete on average more ECTS´s than students from private schools (45vs41). We have also seen that if we divide the ECTS in incrementing categories, where each corresponds to the addition of a new subject, the number of students who fit in these categories

tends to be similar until the category 55-60, where it shows that this is the category with more population (16% for UCP and 18% for UP).

In this case regarding the rate of ECTS completed, Cabral and Pechincha (2014) found out that for UP in the first year 64% of students completed at least 45 ECTS, our findings are in agreement with theirs, as we obtained for the students at UP exactly the same percentage of students in this category. The students at UCP faired slightly worse with 56% of students achieving at least 45 ECTS.

It was also shown that females perform better than males (Birch and Miller (2007)). For the same category 55-60, at UP 60% of the population was female and the same case for UCP showed 74% of females.

Regarding the students Entry grade and their ability to complete ECTS´s we have seen that for UP the tendency is the higher the Entry grade, the more ECTS´s the student completes (Smith and Naylor (2005)). For UCP this tendency is nonexistent, with all students being able to accomplish a similar number of ECTS´s.

For 1st Year grades we have seen that students at UP (13,5) score better than those at UCP (13,1).

For both UP and UCP the majority of students are found achieving grades 13 and 14.

Females tend to be more present than males when it comes to achieving higher grades.

At UCP students score very similarly when it comes to 1st Year grades, regardless of Entry grade, whereas for UP they tend to achieve higher grades the higher their entry grade.

We also seen that public school students tend to achieve higher grades both at UP and UCP.

4.1.1 Zero ECTS

This analysis will begin with a look at how many students in each faculty conclude their first year without completing any ECTS. A student may fit in this category because, either it reveals incapacity to complete ECTS, or lack of motivation due to inadaptability to the university schooling methods, both can be caused by, amongst others, lack of preparation during high school.

Table 12: Number and percentage of students with 0 ECTS completed by University and Faculty (percentages computed within university)

University/Faculty	Nº Students	0 ECTS	% 0 ECTS
UCP	1728	170	9,84%
Escola das Artes	144	10	6,94%
Escola do Porto da Faculdade de Direito	555	59	10,63%
Escola Superior de Biotecnologia	291	17	5,84%
Faculdade de Economia e Gestão	440	65	14,77%
Faculdade de Educação e Psicologia	167	6	3,59%
Faculdade de Teologia	37	3	8,11%
Instituto de Ciências da Saúde	94	10	10,64%
UP	8546	876	10,25%
FADEUP	294	25	8,50%
FAUP	267	25	9,36%
FBAUP	279	22	7,89%
FCNAUP	137	20	14,60%
FCUP	1311	225	17,16%
FDUP	384	33	8,59%
FEP	743	46	6,19%
FEUP	1878	146	7,77%
FFUP	407	64	15,72%
FLUP	1279	183	14,31%
FMDUP	133	13	9,77%
FMUP	533	16	3,00%
FPCEUP	336	25	7,44%
ICBAS	565	33	5,84%
Total	**10274**	**1046**	**10,18%**

Table 12 reveals that the average rate of students not completing ECTS is around 10% for both Universities. Also it does not seem that the number of students in a University has to do with their 0 ECTS rate, as we see some of the Faculties with most students achieving rates equal of those with fewer students. For example we see in the 14% 0 ECTS rate FLUP (1279 students) and FCNAUP

(137 students), and at 7% 0 ECTS rate FEUP (1878 students) and FPCEUP (336 students).

It is also of relevance to understand if we see differences in the rate of students not completing ECTS from both types of school, as such the next table gives that information.

Table 13: Comparison of 0 ECTS between Private and Public school students

	2013	2014	2015
Private	0,85%	1,24%	1,30%
Publlic	2,69%	2,00%	2,11%
Total	**3,53%**	**3,23%**	**3,42%**

Table 13 shows students who come from public schools have a higher tendency for not completing any ECTS than their peers from private schools, note that percentages are computed based on the total number of students in each year.

To conclude this section, we will look at the 0 ECTS category by entry grade to see if there is a larger tendency of students from certain grade spectrums to fall under this category.

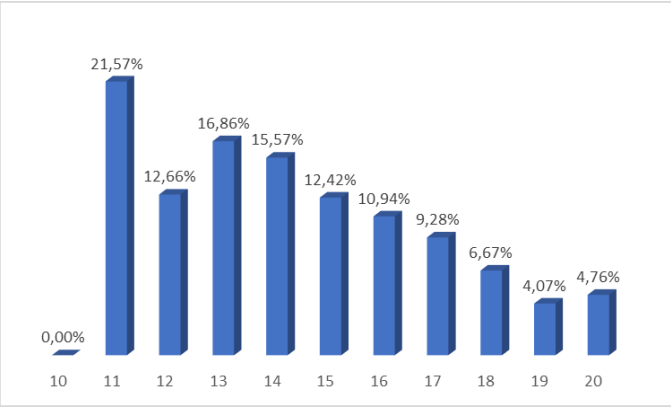


Figure 7: Percentage of students who completed 0 ECTS by entry grade and year

As is shown in Figure 7, the tendency for students not completing any ECTS´s diminishes as the Entry grade increases, Cabral and Pechincha (2014) observed the same phenomenon in their work. The grade with the highest number of students in this category is grade 11 (21,57%), with the majority of the following grades diminishing as the grade increases. The high rate for low entry grades may be related with the fact that students did not enter in the course of their first choice given their low entry grade.

Summarizing the analysis of 0 ECTS, we know that 10% of students who enroll in UP and UCP do not complete any ECTS, Cabral and Pechincha (2014) observed a rate of 17% of students in this category for UP which is higher than what we observe in this study.

Public school students tend to be more present in this category and there is a decreasing tendency to be in this category as the Entry grade increases.

4.2 The Students at University

This section will focus on the comparison of courses on a number of performance variables: average 1st year grade, average ECTS completed, % of students with 0ECTS. We will also analyze the standard deviations of entry and exit grades since these are measures of the homogeneity of the students in a given cohort.

Table 14: Comparing courses by University, Faculty and Degree.

University/Faculty/Degree	Nº Students	Entry Grade	ECTS	1st Year Grade	0 ECTS (%)	Entry Standard Deviation	1st Year Standard Deviation
UCP	1728	14,8	40	13,1	170 (9,83%)	1,42	1,41
Escola das Artes	144	14,2	49	13,7	10 (6,94%)	1,75	1,32
Arte, Conservação e Restauro	29	13,8	38	12,8	3 (10,3%)	1,69	1,34
Som e Imagem	115	14,3	52	14,0	7 (6,08%)	1,76	1,32
Escola do Porto da Faculdade de Direito	555	14,9	32	12,5	59 (10,6%)	1,50	1,53
Direito UCP	555	14,9	32	12,5	59 (10,6%)	1,50	1,53
Escola Superior de Biotecnologia	291	14,3	43	13,5	17 (5,84%)	1,65	1,39
Bioengenharia	99	15,6	42	13,8	9 (9,09%)	1,74	1,56
Ciências da Nutrição	123	13,9	47	13,2	7 (5,69%)	1,66	1,36
Microbiologia	69	13,2	38	13,4	1 (1,44%)	1,49	1,22
Faculdade de Economia e Gestão	440	16,1	40	13,0	65 (14,7%)	1,04	1,36
Economia UCP	149	16,2	38	13,3	35 (23,4%)	1,13	1,45
Gestão	291	16,1	41	12,9	30 (10,3%)	1,00	1,31
Faculdade de Educação e Psicologia	167	13,6	48	13,4	6 (3,59%)	1,44	1,42
Psicologia	167	13,6	48	13,4	6 (3,59%)	1,44	1,42
Faculdade de Teologia	37	13,1	37	13,6	3 (8,10%)	2,02	1,62
Teologia	37	13,1	37	13,6	3 (8,10%)	2,02	1,62
Instituto de Ciências da Saúde	94	13,1	52	13,5	10 (10,6%)	1,17	0,92
Enfermagem	94	13,1	52	13,5	10 (10,6%)	1,17	0,92
UP	8546	16,5	44	13,5	876 (10,2%)	0,82	1,44
FADEUP	294	15,1	43	13,7	25 (8,50%)	0,97	1,09
Ciências do Desporto	294	15,1	43	13,7	25 (8,50%)	0,97	1,09
FAUP	267	18,6	53	13,5	25 (9,36%)	0,51	1,21
Mestrado Integrado em Arquitetura	267	18,6	53	13,5	25 (9,36%)	0,51	1,21
FBAUP	279	16,7	46	13,9	22 (7,88%)	0,69	1,17
Artes Plásticas	180	16,4	45	13,8	17 (9,44%)	0,74	1,29
Design de Comunicação	99	17,4	48	14,1	5 (5,05%)	0,60	0,95
FCNAUP	137	16,4	44	13,8	20 (14,5%)	0,50	1,15
Licenciatura em Ciências da Nutrição	137	16,4	44	13,8	20 (14,5%)	0,50	1,15
FCUP	1311	15,1	36	12,9	225 (17,1%)	1,51	1,61
Licenciatura em Arquitectura Paisagista	54	15,5	35	12,9	9 (16,6%)	1,00	1,03
Licenciatura em Astronomia	2	13,9	19	13,2	0 (0%)	1,29	1,77
Licenciatura em Biologia	335	15,8	43	12,9	38 (11,3%)	2,39	1,56
Licenciatura em Bioquímica	178	17,1	43	14,3	19 (10,6%)	0,54	1,63
Licenciatura em Ciência de Computadores	87	13,4	27	11,9	17 (19,5%)	1,11	1,50
Licenciatura em Ciências de Engenharia	24	13,8	41	13,5	1 (4,16%)	1,33	1,32
Licenciatura em Ciências e Tecnologia do Ambiente	88	14,1	31	11,6	22 (25%)	0,67	0,89
Licenciatura em Física	80	16,6	41	13,7	9 (11,2%)	1,67	1,98
Licenciatura em Geologia	58	13,5	31	11,9	12 (20,6%)	0,90	0,94
Licenciatura em Matemática	111	14,8	27	12,6	35 (31,5%)	2,31	2,55
Licenciatura em Química	61	14,1	41	13,8	7 (11,4%)	1,34	1,52
Mestrado Integrado em Engenharia de Redes e Sistemas Informáticos	162	13,5	26	11,9	38 (23,4%)	1,15	1,74
Mestrado Integrado em Engenharia Física	71	15,1	29	12,9	18 (25,3%)	1,78	1,74
FDUP	384	17,0	46	12,4	33 (8,59%)	0,73	1,47
Criminologia	78	16,9	41	12,9	14 (17,9%)	0,62	1,69
Direito	306	17,1	47	12,3	19 (6,20%)	0,75	1,42
FEP	743	17,4	51	13,9	46 (6,19%)	0,71	1,62
Economia	497	17,6	52	14,1	24 (4,82%)	0,75	1,64
Licenciatura em Gestão	246	17,1	48	13,3	22 (8,94%)	0,64	1,58
FEUP	1878	16,6	45	13,4	146 (7,77%)	0,75	1,64
Licenciatura em Ciências de Engenharia - Engenharia de Minas e Geo-Ambiente	35	13,2	32	12,6	7 (20%)	1,27	1,54
Mestrado Integrado em Bioengenharia	129	18,4	48	14,3	5 (3,87%)	0,41	1,66
Mestrado Integrado em Engenharia Civil	229	14,3	40	12,6	30 (13,1%)	1,34	1,54
Mestrado Integrado em Engenharia do Ambiente	76	15,0	36	13,3	21 (27,6%)	0,84	1,25
Mestrado Integrado em Engenharia e Gestão Industrial	157	18,4	54	14,4	2 (1,27%)	0,50	1,52
Mestrado Integrado em Engenharia Electrotécnica e de Computadores	449	16,2	41	13,1	25 (5,56%)	0,79	1,78
Mestrado Integrado em Engenharia Informática e Computação	247	17,2	48	13,9	15 (6,07%)	0,70	2,03
Mestrado Integrado em Engenharia Mecânica	338	17,5	48	13,2	18 (5,32%)	0,57	1,53
Mestrado Integrado em Engenharia Metalúrgica e de Materiais	70	15,2	43	13,4	12 (17,1%)	0,60	1,37
Mestrado Integrado em Engenharia Química	148	16,7	45	13,1	11 (7,43%)	0,69	1,38
FFUP	407	16,5	39	12,8	64 (15,7%)	0,56	1,36
Mestrado Integrado em Ciências Farmacêuticas	407	16,5	39	12,8	64 (15,7%)	0,56	1,36
FLUP	1279	15,4	43	13,5	183 (14,3%)	0,95	1,31
Licenciatura em Arqueologia	63	13,9	42	13,0	10 (15,8%)	1,36	1,30
Licenciatura em Ciência da Informação	86	15,2	49	13,4	8 (9,30%)	0,74	1,21
Licenciatura em Ciências da Comunicação: Jornalismo, Assessoria, Multimédia	163	17,0	53	14,6	12 (7,36%)	0,73	0,90
Licenciatura em Ciências da Linguagem	50	13,6	31	13,3	15 (30%)	0,89	1,67
Licenciatura em Estudos Portugueses e Lusófonos	45	13,9	34	12,4	7 (15,5%)	1,22	1,59
Licenciatura em Filosofia	83	13,6	31	12,3	20 (24,0%)	1,46	1,98
Licenciatura em Geografia	142	13,6	32	11,5	30 (21,1%)	1,11	1,12
Licenciatura em História	142	15,0	44	12,8	16 (11,2%)	1,21	1,43
Licenciatura em História da Arte	60	14,9	34	14,3	20 (33,3%)	1,23	1,31
Licenciatura em Línguas Aplicadas	101	17,2	49	14,7	7 (6,93%)	0,66	1,20
Licenciatura em Línguas e Relações Internacionais	85	18,1	54	15,0	4 (4,70%)	0,45	1,29
Licenciatura em Línguas, Literaturas e Culturas	176	16,3	46	13,9	16 (9,09%)	0,85	1,52
Licenciatura em Sociologia	83	15,3	39	13,3	18 (21,6%)	0,84	1,08
FMDUP	133	17,6	30	13,7	13 (9,77%)	0,32	1,03
Mestrado Integrado em Medicina Dentária	133	17,6	30	13,7	13 (9,77%)	0,32	1,03
FMUP	533	18,8	51	13,2	16 (3,00%)	0,31	1,40
Mestrado Integrado em Medicina - FMUP	533	18,8	51	13,2	16 (3,00%)	0,31	1,40
FPCEUP	336	16,3	49	14,5	25 (7,44%)	0,76	1,31
Licenciatura em Ciências da Educação	100	14,6	51	14,6	11 (11%)	0,74	1,06
Mestrado Integrado em Psicologia	236	17,0	48	14,4	14 (5,93%)	0,77	1,42
ICBAS	565	17,8	47	14,6	33 (5,84%)	0,38	1,25
Licenciatura em Ciências do Meio Aquático	65	15,2	41	13,8	12 (18,4%)	0,96	1,48
Mestrado Integrado em Medicina - ICBAS	364	18,5	52	15,1	7 (1,92%)	0,25	1,16
Mestrado Integrado em Medicina Veterinária	136	17,4	35	13,4	14 (10,2%)	0,44	1,38
Total	**10274**	**16,2**	**43**	**13,4**	**1046 (10,1%)**	**0,92**	**1,44**

From Table 14 some interesting conclusions are drawn for each of the universities.

For UCP:

- The course with the most students is Direito
- The course with highest entry grades is Economia
- The course with highest 1st year grades is Som e Imagem
- The course with the highest percentage of students that did not complete any ECTS is Economia
- The course with the highest standard deviation on entry is Teologia
- The course with the highest 1st Year standard deviation is also Teologia

For UP:

- The course with the most students is Mestrado em Medicina from FMUP
- The course with highest entry grades is Mestrado em Medicina from FMUP
- The course with highest 1st year grades is Mestrado Integrado em Medicina from ICBAS
- The course with the highest percentage of students that did not complete any ECTS is Licenciatura em História da Arte
- The course with the highest standard deviation on entry is Licenciatura em Biologia
- The course with the highest 1st year standard deviation is Licenciatura em Matemática

In general it is interesting to see that degrees differ by a considerable amount in terms of the average grades on entry, but overall the cohort of students entering the course is homogeneous, especially for UP – as reflected in low standard deviations (happening especially for those courses where the entry grade is very high, like medicine courses or Engenharia Industrial e Gestão). However, at the end of the first year, there is a large heterogeneity of students in most courses.

To further delve into this analysis a new variable will be presented, that being the adjusted 1st year grade, this is a combination between the 1st year grade and the ECTS completed (see Description of variables at the beginning of the document).

Two new variables are shown, Top and Bottom students per degree. We considered that a top student is one who completes over 50 ECTS and has a 1st year score above 1,5. A bottom student is one who completes less than 30 ECTS.

Table 15: Number of Top and Bottom students and Adjusted 1st year grade

University/Faculty/Degree	Top (%)	Bottom (%)	Adjusted 1st Year Grade
UCP	99 (5,72%)	515 (29,8%)	9,8
Escola das Artes	6 (4,16%)	24 (16,6%)	12,1
Arte, Conservação e Restauro	1 (3,44%)	10 (34,4%)	9,4
Som e Imagem	5 (4,34%)	14 (12,1%)	12,8
Escola do Porto da Faculdade de Direito	32 (5,76%)	248 (44,6%)	7,5
Direito	32 (5,76%)	248 (44,6%)	7,5
Escola Superior de Biotecnologia	19 (6,52%)	65 (22,3%)	10,4
Bioengenharia	5 (5,05%)	24 (24,2%)	10,6
Ciências da Nutrição	9 (7,31%)	19 (15,4%)	11,3
Microbiologia	5 (7,24%)	22 (31,8%)	8,6
Faculdade de Economia e Gestão	24 (5,45%)	120 (27,2%)	10,2
Economia	10 (6,71%)	48 (32,2%)	11,0
Gestão	14 (4,81%)	72 (24,7%)	9,9
Faculdade de Educação e Psicologia	9 (5,38%)	29 (17,3%)	11,4
Psicologia	9 (5,38%)	29 (17,3%)	11,4
Faculdade de Teologia	1 (2,70%)	18 (48,6%)	8,7
Teologia	1 (2,70%)	18 (48,6%)	8,7
Instituto de Ciências da Saúde	8 (8,51%)	11 (11,7%)	13,1
Enfermagem	8 (8,51%)	11 (11,7%)	13,1
UP	485 (5,67%)	1901 (22,2%)	11,1
FADEUP	16 (5,44%)	63 (21,4%)	10,8
Ciências do Desporto	16 (5,44%)	63 (21,4%)	10,8
FAUP	20 (7,49%)	31 (11,6%)	13,0
Mestrado Integrado em Arquitetura	20 (7,49%)	31 (11,6%)	13,0
FBAUP	12 (4,30%)	50 (17,9%)	11,6
Artes Plásticas	8 (4,44%)	38 (21,1%)	11,5
Design de Comunicação	4 (4,04%)	12 (12,1%)	12,0
FCNAUP	8 (5,83%)	32 (23,3%)	11,8
Licenciatura em Ciências da Nutrição	8 (5,83%)	32 (23,3%)	11,8
FCUP	69 (5,26%)	450 (34,3%)	9,5
Licenciatura em Arquitectura Paisagista	2 (3,70%)	18 (33,3%)	9,1
Licenciatura em Astronomia	0 (0%)	1 (50%)	4,5
Licenciatura em Biologia	19 (5,67%)	73 (21,7%)	10,6
Licenciatura em Bioquímica	11 (6,17%)	35 (19,6%)	11,6
Licenciatura em Ciência de Computadores	3 (3,44%)	47 (54,0%)	6,9
Licenciatura em Ciências de Engenharia	1 (4,16%)	4 (16,6%)	9,8
Licenciatura em Ciências e Tecnologia do Ambiente	4 (4,54%)	40 (45,4%)	8,2
Licenciatura em Física	6 (7,5%)	21 (26,2%)	11,0
Licenciatura em Geologia	1 (1,72%)	25 (43,1%)	7,8
Licenciatura em Matemática	6 (5,40%)	57 (51,3%)	8,5
Licenciatura em Química	3 (4,91%)	13 (21,3%)	10,7
Mestrado Integrado em Engenharia de Redes e Sistemas Informáticos	8 (4,93%)	83 (51,2%)	6,9
Mestrado Integrado em Engenharia Física	5 (7,04%)	33 (46,4%)	8,7
FDUP	22 (5,72%)	77 (20,0%)	10,5
Criminologia	5 (6,41%)	22 (28,2%)	10,9
Direito	17 (5,55%)	55 (17,9%)	10,4
FEP	51 (6,86%)	84 (11,3%)	12,6
Economia	36 (7,24%)	47 (9,45%)	13,0
Licenciatura em Gestão	15 (6,09%)	37 (15,0%)	11,8
FEUP	108 (5,75%)	415 (22,0%)	10,9
Licenciatura em Ciências de Engenharia - Engenharia de Minas e Geo-Ambiente	1 (2,85%)	11 (31,4%)	8,6
Mestrado Integrado em Bioengenharia	6 (4,65%)	16 (12,4%)	12,2
Mestrado Integrado em Engenharia Civil	14 (6,11%)	70 (30,5%)	9,5
Mestrado Integrado em Engenharia do Ambiente	3 (3,94%)	29 (38,1%)	11,1
Mestrado Integrado em Engenharia e Gestão Industrial	8 (5,09%)	10 (6,36%)	13,2
Mestrado Integrado em Engenharia Electrotécnica e de Computadores	26 (5,79%)	132 (29,3%)	9,8
Mestrado Integrado em Engenharia Informática e Computação	14 (5,66%)	43 (17,4%)	12,0
Mestrado Integrado em Engenharia Mecânica	21 (6,21%)	59 (17,4%)	11,0
Mestrado Integrado em Engenharia Metalúrgica e de Materiais	5 (7,14%)	16 (22,8%)	11,6
Mestrado Integrado em Engenharia Química	10 (6,75%)	29 (19,5%)	10,7
FFUP	21 (5,15%)	122 (29,9%)	9,9
Mestrado Integrado em Ciências Farmacêuticas	21 (5,15%)	122 (29,9%)	9,9
FLUP	70 (5,47%)	306 (23,9%)	11,4
Licenciatura em Arqueologia	3 (4,76%)	15 (23,8%)	10,9
Licenciatura em Ciência da Informação	4 (4,65%)	9 (10,4%)	12,1
Licenciatura em Ciências da Comunicação: Jornalismo, Assessoria, Multimédia	11 (6,74%)	18 (11,0%)	13,8
Licenciatura em Ciências da Linguagem	3 (6%)	21 (42%)	10,2
Licenciatura em Estudos Portugueses e Lusófonos	2 (4,44%)	18 (40%)	8,6
Licenciatura em Filosofia	4 (4,81%)	36 (43,3%)	8,6
Licenciatura em Geografia	9 (6,33%)	61 (42,9%)	7,9
Licenciatura em História	7 (4,92%)	30 (21,1%)	10,6
Licenciatura em História da Arte	1 (1,66%)	25 (41,6%)	12,2
Licenciatura em Línguas Aplicadas	4 (3,96%)	17 (16,8%)	13,0
Licenciatura em Línguas e Relações Internacionais	5 (5,88%)	6 (7,05%)	14,1
Licenciatura em Línguas, Literaturas e Culturas	12 (6,81%)	28 (15,9%)	11,8
Licenciatura em Sociologia	5 (6,02%)	22 (26,5%)	11,3
FMDUP	4 (3,00%)	60 (45,1%)	7,7
Mestrado Integrado em Medicina Dentária	4 (3,00%)	60 (45,1%)	7,7
FMUP	40 (7,50%)	59 (11,0%)	11,7
Mestrado Integrado em Medicina - FMUP	40 (7,50%)	59 (11,0%)	11,7
FPCEUP	15 (4,46%)	46 (13,6%)	12,8
Licenciatura em Ciências da Educação	4 (4%)	13 (13%)	13,9
Mestrado Integrado em Psicologia	11 (4,66%)	33 (13,9%)	12,3
ICBAS	29 (5,13%)	106 (18,7%)	12,1
Licenciatura em Ciências do Meio Aquático	4 (6,15%)	19 (29,2%)	11,8
Mestrado Integrado em Medicina - ICBAS	21 (5,76%)	40 (10,9%)	13,2
Mestrado Integrado em Medicina Veterinária	4 (2,94%)	47 (34,5%)	9,0
Total	**584 (5,68%)**	**2416 (23,5%)**	**10,9**

Table 15 lists for all courses the number of Top and Bottom students in each degree. Also showing the adjusted 1st Year grade to better aid in understanding how the students of each degree perform academically.

By looking at the table we can see that there is a lot of variation between degrees.

For instance we see Mestrado Integrado em Engenharia Civil from FEUP with an adjusted first year grade of 9,5, Licenciatura em Ciências da Comunicação from FPCEUP with 13,9 and Licenciatura em Astronomia from FCUP with 4,5. This proves the students in each degree are very different from each other, as the degrees themselves vary on subjects and difficulty.

In this section we have seen different outputs from different schools and were able to observe that degrees are not comparable just by looking individually at the variables presented for them, given their variation amongst degrees. This means that these degrees are not comparable between them using these variables, this motivates the introduction in this study of the variables Entry score and 1st Year score.

In the next section the focus will be on schools, which is the main focus of this thesis.

4.3 Schools' Performance

We will now begin with analysis of schools, in this part we will look at how the students from each school behave at University. Given that students from schools go on to enroll in different degrees at University and that those degrees are different between themselves it is not correct to compare them directly by grades, that is why three new variables are shown in this part:

- Entry Score represents the number of standard deviations that the students differs from the mean of the course they attend. As such this score makes it possible to compare the school (with national exams) performance of the students in each degree.

- 1st year Score is computed to show the number of standard deviations that the student differs from the mean of the grades at the first year at the university in his course. Given that it compares the performance of students in a degree, it can be interpreted as the preparation for University that the school provided the students.

- Delta score represents the difference between 1st year scores and entry scores. As a result, this Delta score assumes an important role here. Allowing the comparison of schools in terms of how well their students perform at University with their performance at school and national exams. As this score computes the two prior ones it can be understood as the fairness of the grading system of the school.

Due to the large number of schools in the study (529), Table 16 which shows the outputs of schools, only shows those that placed 10 or more students at University. By doing this we exclude 354 (67%) schools, that contained only 9,3% of the student population. Studying schools with less than 10 students would be nearly the same as classifying individual students, not schools.

This table gives information regarding: the number of students from each school that entered UP or UCP, the average entry grade and average first year conclusion grade, the average ECTS completion per school, the number of students who completed 0 ECTS with percentage, values for top and bottom students with percentage, Entry score, 1st Year score and Delta score. The schools shown are ordered decreasingly by number of students placed.

Table 16: Schools' performance

Schools	Nº Students	Entry Grade	ECTS	1st Year Grade	0 ECTS (%)	Top (%)	Bottom (%)	Entry Score	1st Year Score	Δ Score
Externato Ribadouro	1020	17,0	38	13,0	109 (10,6%)	15 (1,47%)	326 (31,9%)	0,125	-0,503	-0,628
Escola Secundária Garcia de Orta	228	15,9	43	13,5	26 (11,4%)	10 (4,38%)	54 (23,6%)	0,067	0,058	-0,010
Colégio Nossa Senhora do Rosário	218	17,1	45	13,3	18 (8,25%)	17 (7,79%)	45 (20,6%)	0,424	-0,266	-0,690
Colégio Internato dos Carvalhos	194	16,1	46	13,7	18 (9,27%)	17 (8,76%)	38 (19,5%)	0,176	-0,001	-0,177
Escola Secundária da Maia	194	15,9	47	13,5	18 (9,27%)	13 (6,70%)	38 (19,5%)	0,047	0,022	-0,025
Escola Secundária Filipa de Vilhena	192	15,8	45	13,4	19 (9,89%)	10 (5,20%)	41 (21,3%)	-0,062	-0,098	-0,036
Escola Secundária Aurélia de Sousa	169	16,1	45	13,7	16 (9,46%)	13 (7,69%)	29 (17,1%)	0,036	0,075	0,039
Escola Secundária de Almeida Garrett	163	15,9	43	13,7	19 (11,6%)	15 (9,20%)	36 (22,0%)	-0,032	0,083	0,115
Escola Secundária de Rio Tinto	139	15,5	47	13,5	14 (10,0%)	11 (7,91%)	27 (19,4%)	-0,085	-0,002	0,083
Escola Secundária Eça de Queirós - Póvoa de Varzim	138	16,8	48	13,7	13 (9,42%)	11 (7,97%)	24 (17,3%)	0,264	0,007	-0,257
Escola Secundária de Penafiel	137	16,3	46	13,3	13 (9,48%)	9 (6,56%)	25 (18,2%)	-0,127	-0,147	-0,021
Escola Secundária Santa Maria Maior	127	16,5	45	13,4	10 (7,87%)	9 (7,08%)	29 (22,8%)	-0,074	-0,204	-0,130
Externato Paulo VI	126	17,0	42	13,6	12 (9,52%)	10 (7,93%)	33 (26,1%)	0,219	-0,146	-0,365
Escola Secundária de Santa Maria da Feira	121	16,0	44	13,7	13 (10,7%)	11 (9,09%)	28 (23,1%)	0,113	0,134	0,021
Escola Secundária Dr. Manuel Gomes de Almeida	120	16,4	46	13,9	8 (6,66%)	12 (10%)	23 (19,1%)	0,335	0,210	-0,124
Escola Secundária de Ermesinde	111	15,5	45	13,5	10 (9,00%)	9 (8,10%)	23 (20,7%)	-0,089	0,016	0,104
Escola Secundária João Gonçalves Zarco	110	15,8	43	13,4	13 (11,8%)	4 (3,63%)	23 (20,9%)	-0,112	-0,008	0,104
Colégio Luso-Francês	108	16,5	48	13,7	7 (6,48%)	10 (9,25%)	16 (14,8%)	0,371	0,063	-0,307
Escola Secundária Dr. Joaquim Gomes Ferreira Alves	108	16,2	43	13,3	13 (12,0%)	2 (1,85%)	32 (29,6%)	0,069	-0,241	-0,310
Colégio Liceal de Santa Maria de Lamas	105	16,4	47	13,6	7 (6,66%)	11 (10,4%)	19 (18,0%)	0,034	-0,047	-0,081
Escola Secundária de Paredes	105	15,7	42	13,4	15 (14,2%)	6 (5,71%)	28 (26,6%)	-0,085	-0,147	-0,062
Escola Secundária de Gondomar	105	14,8	44	13,4	16 (15,2%)	4 (3,80%)	22 (20,9%)	-0,290	-0,039	0,251
Escola Secundária Augusto Gomes	100	16,1	46	13,6	8 (8%)	7 (7%)	19 (19%)	0,060	0,047	-0,013
Colégio da Trofa	100	16,5	39	12,4	9 (9%)	1 (1%)	26 (26%)	-0,104	-0,758	-0,654
Escola Secundária José Régio	97	16,1	42	13,5	13 (13,4%)	4 (4,12%)	24 (24,7%)	-0,031	-0,076	-0,045
Escola Secundária Alves Martins	93	17,0	47	13,7	9 (9,67%)	3 (3,22%)	19 (20,4%)	0,073	-0,090	-0,163
Escola Secundária de Marco de Canaveses	92	16,6	47	13,4	8 (8,69%)	1 (1,08%)	15 (16,3%)	-0,145	-0,263	-0,119
Escola Secundária de Monserrate	92	16,8	49	13,6	6 (6,52%)	6 (6,52%)	15 (16,3%)	0,015	-0,154	-0,168
Escola Secundária de Inês de Castro	83	15,7	40	13,3	7 (8,43%)	3 (3,61%)	24 (28,9%)	-0,039	-0,231	-0,192
Escola Secundária Dr. Manuel Laranjeira	82	16,3	43	13,3	10 (12,1%)	6 (7,31%)	19 (23,1%)	0,159	-0,172	-0,331
Escola Básica e Secundária Clara de Resende	79	16,1	47	13,8	4 (5,06%)	5 (6,32%)	13 (16,4%)	0,132	0,030	-0,102
Colégio D. Duarte	79	15,3	33	12,6	9 (11,3%)	3 (3,79%)	34 (43,0%)	-0,160	-0,628	-0,467
Escola Secundária de Fafe	75	16,9	46	13,6	6 (8%)	9 (12%)	16 (21,3%)	-0,037	-0,047	-0,010
Escola Secundária António Sérgio	69	15,8	43	13,2	7 (10,1%)	2 (2,89%)	18 (26,0%)	-0,059	-0,238	-0,180
Escola Secundária Soares dos Reis	69	16,4	47	14,0	4 (5,79%)	7 (10,1%)	10 (14,4%)	-0,178	0,116	0,294
Escola Secundária de Lousada	68	16,4	49	13,9	5 (7,35%)	6 (8,82%)	8 (11,7%)	-0,186	0,187	0,373
Escola Secundária de Valongo	67	15,5	43	13,6	9 (13,4%)	4 (5,97%)	15 (22,3%)	-0,219	0,082	0,301
Escola Secundária de Paços de Ferreira	67	15,9	46	13,5	5 (7,46%)	2 (2,98%)	14 (20,8%)	-0,212	-0,101	0,111
Colégio São Gonçalo	65	16,9	42	13,2	5 (7,69%)	4 (6,15%)	17 (26,1%)	-0,050	-0,472	-0,422
Colégio D. Diogo de Sousa	62	16,7	36	13,0	9 (14,5%)	0 (0%)	23 (37,0%)	-0,031	-0,545	-0,514
Externato Camões	61	16,9	40	13,3	6 (9,83%)	2 (3,27%)	16 (26,2%)	0,134	-0,374	-0,507
Equivalências (nº 2 Artº 20-A)	59	17,6	32	13,0	14 (23,7%)	2 (3,38%)	28 (47,4%)	0,773	-0,641	-1,414
Escola Secundária de Amarante	59	16,4	43	13,5	7 (11,8%)	2 (3,38%)	15 (25,4%)	0,044	-0,125	-0,169
Escola Secundária Camilo Castelo Branco - Vila Real	58	17,0	39	13,5	11 (18,9%)	3 (5,17%)	16 (27,5%)	-0,016	-0,121	-0,104
Escola Secundária de Ponte de Lima	58	16,7	48	13,6	3 (5,17%)	5 (8,62%)	10 (17,2%)	0,023	-0,048	-0,071
Escola Básica e Secundária de Águas Santas	56	15,6	40	13,5	10 (17,8%)	2 (3,57%)	13 (23,2%)	-0,070	-0,033	0,037
Escola Secundária Rocha Peixoto	55	16,1	43	13,1	5 (9,09%)	5 (9,09%)	14 (25,4%)	-0,050	-0,245	-0,195
Escola Secundária de S. Pedro	55	17,1	50	14,1	4 (7,27%)	5 (9,09%)	7 (12,7%)	0,245	0,236	-0,010
Colégio Novo da Maia	54	17,1	41	13,3	7 (12,9%)	1 (1,85%)	16 (29,6%)	0,366	-0,255	-0,621
Externato Carvalho Araújo	54	15,8	30	12,7	10 (18,5%)	1 (1,85%)	24 (44,4%)	-0,364	-0,546	-0,183
Externato Académico	53	13,7	34	12,3	7 (13,2%)	1 (1,88%)	23 (43,3%)	-0,632	-0,731	-0,099
Escola Secundária Ferreira de Castro	53	16,7	49	14,2	6 (11,3%)	4 (7,54%)	9 (16,9%)	-0,158	0,170	0,328
Escola Secundária D. Afonso Henriques	53	16,0	45	13,9	4 (7,54%)	8 (15,0%)	11 (20,7%)	-0,054	0,128	0,182
Centro de Estudos Básico e Secundário - CEBES	53	15,6	25	12,6	15 (28,3%)	1 (1,88%)	27 (50,9%)	0,060	-0,592	-0,653
Escola Secundária Fernão de Magalhães	52	16,4	37	13,1	7 (13,4%)	2 (3,84%)	19 (36,5%)	0,027	-0,395	-0,423
Colégio de Gaia	51	15,9	45	13,4	4 (7,84%)	4 (7,84%)	10 (19,6%)	0,139	-0,134	-0,273
Escola Secundária Dr. Mário Sacramento	51	17,1	50	14,2	5 (9,80%)	8 (15,6%)	8 (15,6%)	0,032	0,376	0,344
Escola Secundária D. Sancho I	50	16,7	46	13,8	2 (4%)	3 (6%)	11 (22%)	-0,236	0,040	0,276
Escola Secundária Francisco de Holanda	49	16,4	45	13,5	4 (8,16%)	4 (8,16%)	12 (24,4%)	0,033	-0,001	-0,034
Escola Secundária Carolina Michaellis	49	15,5	50	13,7	2 (4,08%)	3 (6,12%)	5 (10,2%)	-0,240	0,188	0,428
Escola Básica e Secundária Oliveira Júnior	48	16,6	52	14,0	1 (2,08%)	7 (14,5%)	4 (8,33%)	0,033	0,234	0,201
Escola Secundária Camilo Castelo Branco-V.N.Famalicão	48	16,6	50	13,6	1 (2,08%)	1 (2,08%)	6 (12,5%)	0,074	-0,098	-0,172
Escola Básica e Secundária Rodrigues de Freitas	47	15,9	37	13,7	8 (17,0%)	3 (6,38%)	18 (38,2%)	0,073	0,031	-0,042
Escola Secundária Latino Coelho	47	17,4	50	13,6	2 (4,25%)	1 (2,12%)	7 (14,8%)	0,136	-0,216	-0,352
Escola Básica e Secundária de Búzio - Vale de Cambra	46	16,3	51	13,7	2 (4,34%)	2 (4,34%)	6 (13,0%)	0,009	0,074	0,064
Colégio D. Dinis	44	13,4	41	13,0	3 (6,81%)	0 (0%)	14 (31,8%)	-0,431	-0,276	0,154
Escola Secundária de Felgueiras	43	15,9	39	13,6	6 (13,9%)	5 (11,6%)	14 (32,5%)	0,041	0,057	0,017
Escola Secundária Abel Salazar	43	15,6	42	13,3	3 (6,97%)	3 (6,97%)	12 (27,9%)	0,134	-0,083	-0,217
Escola Secundária Dr. José Macedo Fragateiro	43	16,4	45	13,5	4 (9,30%)	0 (0%)	10 (23,2%)	-0,098	-0,203	-0,105
Escola Secundária Alberto Sampaio	43	16,7	48	13,3	3 (6,97%)	1 (2,32%)	7 (16,2%)	0,084	-0,235	-0,320
Escola Secundária Carlos Amarante	43	16,6	42	13,2	8 (18,6%)	2 (4,65%)	11 (25,5%)	-0,095	-0,327	-0,232
Externato Delfim Ferreira - Delfinopolis	42	17,4	53	13,5	2 (4,76%)	1 (2,38%)	4 (9,52%)	0,592	-0,123	-0,715
Escola Secundária Tomaz Pelayo	41	16,4	51	13,8	0 (0%)	6 (14,6%)	3 (7,31%)	0,328	0,153	-0,175
Escola Secundária Alcaides de Faria - Arcozelo	41	16,2	48	13,2	3 (7,31%)	0 (0%)	6 (14,6%)	-0,125	-0,273	-0,148
Escola Secundária de Barcelos	40	16,4	40	13,7	6 (15%)	2 (5%)	11 (27,5%)	0,018	-0,027	-0,045
Escola Secundária Alexandre Herculano	40	14,4	41	13,5	5 (12,5%)	2 (5%)	12 (30%)	-0,437	-0,081	0,357
Escola Secundária da Boa Nova - Leça da Palmeira	40	15,2	39	12,9	4 (10%)	2 (5%)	12 (30%)	-0,153	-0,278	-0,125
Escola Secundária D. Dinis (Santo Tirso)	40	16,8	45	13,9	3 (7,5%)	2 (5%)	9 (22,5%)	-0,031	0,120	0,152
Escola Secundária Clara de Resende	38	14,5	47	13,3	0 (0%)	3 (7,89%)	8 (21,0%)	0,003	-0,034	-0,037
Escola Secundária Henrique Medina	38	16,6	42	13,6	6 (15,7%)	4 (10,5%)	9 (23,6%)	-0,069	0,034	0,102
Escola Secundária Júlio Dinis	37	16,0	44	13,5	2 (5,40%)	3 (8,10%)	9 (24,3%)	-0,103	0,027	0,129
Escola Secundária João Silva Correia	37	15,8	48	13,7	4 (10,8%)	1 (2,70%)	5 (13,5%)	-0,068	0,049	0,117

Escola Secundária de Vila Cova da Lixa	35	16,4	42	13,4	5 (14,2%)	3 (8,57%)	8 (22,8%)	-0,017	-0,232	-0,215
Escola Secundária de Caldas de Vizela	35	16,7	45	13,6	3 (8,57%)	4 (11,4%)	8 (22,8%)	0,054	0,109	0,055
Colégio Casa Mãe	34	17,6	41	12,9	4 (11,7%)	2 (5,88%)	9 (26,4%)	0,270	-0,604	-0,873
Escola INED - Nevogilde	32	17,3	42	13,3	7 (21,8%)	1 (3,12%)	9 (28,1%)	-0,118	-0,360	-0,242
Externato de Vila Meã	32	16,8	46	13,3	5 (15,6%)	2 (6,25%)	6 (18,7%)	0,044	-0,129	-0,173
Escola Básica e Secundária Vale de Ovil - Baião	32	15,3	38	12,4	4 (12,5%)	0 (0%)	8 (25%)	-0,411	-0,717	-0,305
Escola Secundária de Mirandela	30	15,8	42	13,3	1 (3,33%)	1 (3,33%)	9 (30%)	-0,072	-0,196	-0,124
Escola Secundária de Alpendurada	30	15,9	48	13,1	3 (10%)	2 (6,66%)	4 (13,3%)	-0,179	-0,002	0,176
Escola Artística Soares dos Reis	29	13,9	46	14,0	4 (13,7%)	2 (6,89%)	6 (20,6%)	-0,121	0,162	0,283
Escola Secundária da Trofa	29	16,6	51	13,9	2 (6,89%)	3 (10,3%)	2 (6,89%)	0,114	0,212	0,097
Colégio de Lamego	29	17,0	36	13,8	7 (24,1%)	0 (0%)	10 (34,4%)	0,479	-0,054	-0,533
Escola Secundária de Monção	29	16,2	45	13,2	3 (10,3%)	0 (0%)	5 (17,2%)	-0,113	-0,216	-0,103
Escola Secundária de Padrão da Légua	29	16,6	48	14,5	2 (6,89%)	4 (13,7%)	5 (17,2%)	0,172	0,466	0,294
Escola Secundária de Barcelinhos	29	15,8	47	13,8	4 (13,7%)	5 (17,2%)	4 (13,7%)	-0,204	0,350	0,554
Escola Secundária Diogo de Macedo	28	14,6	41	13,2	5 (17,8%)	0 (0%)	7 (25%)	-0,393	-0,166	0,227
Escola Secundária Martins Sarmento	28	15,6	40	13,2	4 (14,2%)	2 (7,14%)	8 (28,5%)	-0,053	-0,183	-0,130
Escola Secundária Emídio Garcia	28	16,5	38	13,0	5 (17,8%)	0 (0%)	9 (32,1%)	-0,033	-0,591	-0,558
Escola Secundária de Arouca	27	15,7	47	13,5	0 (0%)	0 (0%)	5 (18,5%)	-0,051	-0,113	-0,062
Externato de São Miguel de Refojos	27	16,5	43	13,6	3 (11,1%)	1 (3,70%)	7 (25,9%)	0,263	-0,191	-0,454
Escola Secundária José Estevão	26	17,0	50	14,2	2 (7,69%)	1 (3,84%)	4 (15,3%)	0,101	0,241	0,140
Escola Secundária da Senhora da Hora	26	14,9	54	13,4	0 (0%)	1 (3,84%)	2 (7,69%)	-0,315	-0,043	0,272
Escola Básica e Secundária D. Moisés Alves de Pinho	26	16,6	48	13,6	3 (11,5%)	2 (7,69%)	4 (15,3%)	-0,029	-0,069	-0,039
Escola Secundária de Vilela	25	15,3	55	13,6	1 (4%)	5 (20%)	2 (8%)	0,033	0,362	0,329
Grande Colégio Universal	25	16,7	38	12,2	3 (12%)	0 (0%)	8 (32%)	0,299	-0,639	-0,938
Colégio Alemão do Porto	25	15,8	41	13,7	4 (16%)	3 (12%)	7 (28%)	0,112	0,381	0,270
Colégio Terras de Santa Maria	24	17,0	40	13,0	3 (12,5%)	0 (0%)	8 (33,3%)	0,241	-0,471	-0,712
Escola Secundária de Caldas das Taipas	24	17,1	52	13,9	1 (4,16%)	2 (8,33%)	2 (8,33%)	0,026	0,084	0,057
Escola Básica e Secundária Sidónio Pais - Caminha	24	15,9	37	12,3	3 (12,5%)	0 (0%)	7 (29,1%)	-0,180	-0,804	-0,624
Colégio D. Dinis (Antº. Carneiro)	23	15,6	42	12,7	4 (17,3%)	0 (0%)	6 (26,0%)	0,016	-0,536	-0,553
Escola Secundária Abade de Baçal	23	16,6	45	12,8	2 (8,69%)	2 (8,69%)	4 (17,3%)	0,287	-0,450	-0,737
Escola Secundária Prof. Dr. Flávio F. Pinto Resende	22	15,3	36	12,3	3 (13,6%)	1 (4,54%)	9 (40,9%)	-0,341	-0,603	-0,263
Colégio Paulo VI	22	15,6	49	12,9	0 (0%)	2 (9,09%)	1 (4,54%)	0,237	-0,212	-0,449
Escola Secundária de Esmoriz	22	15,6	47	13,7	2 (9,09%)	2 (9,09%)	4 (18,1%)	0,296	0,280	-0,016
Escola Secundária do Castêlo da Maia	22	15,0	42	12,7	3 (13,6%)	1 (4,54%)	5 (22,7%)	-0,010	-0,352	-0,342
Escola Secundária Padre Benjamim Salgado - Joane	22	16,7	42	13,6	3 (13,6%)	1 (4,54%)	6 (27,2%)	-0,136	-0,159	-0,023
Colégio Sezim - Egas Moniz	22	16,9	38	12,9	3 (13,6%)	1 (4,54%)	8 (36,3%)	-0,047	-0,369	-0,322
Colégio Luso Internacional do Porto - CLIP	22	17,2	30	13,3	4 (18,1%)	3 (13,6%)	12 (54,5%)	1,088	0,105	-0,983
Cooperativa de Ensino Ancorensis	21	16,5	38	13,7	4 (19,0%)	1 (4,76%)	7 (33,3%)	-0,052	-0,058	-0,006
Escola Secundária Almeida Garrett	21	14,6	50	13,1	0 (0%)	1 (4,76%)	2 (9,52%)	-0,073	-0,148	-0,075
Escola Secundária D. Afonso Sanches	21	15,7	45	13,0	1 (4,76%)	1 (4,76%)	5 (23,8%)	-0,060	-0,350	-0,290
Escola Secundária António Nobre	21	14,3	36	13,1	5 (23,8%)	3 (14,2%)	7 (33,3%)	-0,176	0,215	0,391
Instituto Nun Álvares - Santo Tirso	21	16,6	48	13,3	1 (4,76%)	2 (9,52%)	3 (14,2%)	-0,244	-0,197	0,048
Escola Secundária de Carvalhos	20	15,1	48	13,0	3 (15%)	0 (0%)	3 (15%)	-0,077	0,104	0,181
Escola Básica e Secundária Dr. Manuel Pinto de Vasconcelos	20	15,8	47	13,6	1 (5%)	0 (0%)	3 (15%)	0,265	0,117	-0,148
Escola Básica e Secundária de Valdevez	20	16,7	43	13,2	2 (10%)	0 (0%)	7 (35%)	-0,079	-0,411	-0,332
Escola Secundária Eça de Queirós	19	14,3	36	12,8	2 (10,5%)	1 (5,26%)	8 (42,1%)	-0,143	-0,224	-0,081
Escola Secundária Morgado de Mateus -Vila Real	19	16,5	40	13,3	3 (15,7%)	1 (5,26%)	5 (26,3%)	-0,297	-0,322	-0,025
Escola Secundária Camilo Castelo Branco	19	13,8	44	12,8	1 (5,26%)	0 (0%)	4 (21,0%)	-0,469	-0,363	0,106
Escola Básica e Secundária Arga e Lima - Lanheses	18	16,9	51	12,8	0 (0%)	1 (5,55%)	1 (5,55%)	0,055	-0,461	-0,516
Escola Secundária Dr. António Granjo	18	16,3	45	13,5	1 (5,55%)	2 (11,1%)	3 (16,6%)	-0,152	-0,243	-0,091
Externato Júlio Dinis	18	16,3	31	12,6	3 (16,6%)	0 (0%)	8 (44,4%)	0,197	-0,576	-0,773
Escola Secundária Dr. Júlio Martins	18	15,8	43	13,1	1 (5,55%)	0 (0%)	5 (27,7%)	-0,372	-0,168	0,203
Colégio Nossa Senhora da Bonança	18	17,4	48	13,7	0 (0%)	3 (16,6%)	4 (22,2%)	0,407	0,186	-0,221
Escola Secundária Afonso de Albuquerque	18	15,7	40	12,6	0 (0%)	1 (5,55%)	6 (33,3%)	0,375	-0,279	-0,655
Escola Secundária Dr. João Araújo Correia	17	16,2	43	13,7	3 (17,6%)	0 (0%)	5 (29,4%)	-0,129	0,077	0,206
Escola Secundária D. Maria II	17	15,5	31	13,4	5 (29,4%)	1 (5,88%)	7 (41,1%)	-0,205	0,023	0,228
Escola Básica e Secundária de Celorico de Basto	16	15,6	47	12,2	3 (18,7%)	0 (0%)	3 (18,7%)	0,026	-0,683	-0,709
Colégio D. Dinis (Stª Catarina)	16	15,0	43	13,5	2 (12,5%)	1 (6,25%)	3 (18,7%)	-0,334	-0,212	0,123
Cooperativa de Ensino Didáxis	16	15,6	48	13,1	1 (6,25%)	1 (6,25%)	2 (12,5%)	0,160	-0,276	-0,436
Colégio de Albergaria	16	17,4	44	12,8	1 (6,25%)	0 (0%)	4 (25%)	-0,276	-0,650	-0,375
Escola Secundária Soares Basto - Oliveira de Azeméis	16	16,2	45	12,8	1 (6,25%)	0 (0%)	3 (18,7%)	-0,244	-0,408	-0,165
Instituto de Educação e Desenvolvimento - INED	16	15,7	50	13,8	0 (0%)	3 (18,7%)	1 (6,25%)	0,258	0,239	-0,020
Escola Básica e Secundária de Melgaço	15	16,5	48	14,1	1 (6,66%)	4 (26,6%)	2 (13,3%)	0,122	0,384	0,261
Escola Secundária Dr. Jaime Magalhães Lima	15	16,3	46	13,1	3 (20%)	1 (6,66%)	3 (20%)	0,104	-0,217	-0,321
Escola Secundária Daniel Faria - Baltar	14	15,0	53	13,2	0 (0%)	1 (7,14%)	0 (0%)	-0,283	0,119	0,403
Escola Secundária Rodrigues de Freitas	14	14,1	46	13,4	0 (0%)	0 (0%)	2 (14,2%)	-0,453	0,058	0,511
Escola Secundária de Estarreja	14	16,1	37	13,2	2 (14,2%)	0 (0%)	6 (42,8%)	0,304	0,033	-0,271
Escola Secundária Arquitecto Oliveira Ferreira	14	16,1	48	13,9	1 (7,14%)	2 (14,2%)	2 (14,2%)	-0,231	-0,145	0,086
Escola Básica e Secundária à Beira Douro	14	15,1	38	13,7	3 (21,4%)	1 (7,14%)	4 (28,5%)	-0,401	0,014	0,415
Colégio Ellen Key	14	15,9	33	12,8	3 (21,4%)	0 (0%)	6 (42,8%)	-0,228	-0,440	-0,212
Escola Secundária Homem Cristo	14	15,5	37	13,7	2 (14,2%)	1 (7,14%)	4 (28,5%)	0,005	-0,076	-0,081
Escola Básica e Secundária de Castelo de Paiva	13	15,6	50	14,7	1 (7,69%)	4 (30,7%)	2 (15,3%)	0,117	0,824	0,707
Cooperativa de Ensino DIDALVI - Alvito	13	16,9	50	13,3	0 (0%)	1 (7,69%)	1 (7,69%)	0,041	-0,227	-0,267
Escola Cooperativa Vale S. Cosme (Didaxis)	13	15,8	51	13,3	1 (7,69%)	0 (0%)	1 (7,69%)	0,088	-0,081	-0,170
Externato Infante D. Henrique	12	16,1	47	13,2	0 (0%)	0 (0%)	1 (8,33%)	0,376	-0,171	-0,547
Escola Secundária de Alfena	12	15,9	52	14,2	0 (0%)	1 (8,33%)	1 (8,33%)	-0,040	0,353	0,392
Escola Secundária Oliveira Júnior	12	15,1	55	14,1	0 (0%)	2 (16,6%)	1 (8,33%)	0,225	0,514	0,288
Escola Secundária Dr. Serafim Leite	12	15,7	47	13,5	0 (0%)	1 (8,33%)	1 (8,33%)	-0,119	0,000	0,119
Escola Secundária de Oliveira do Douro	12	15,1	39	13,6	2 (16,6%)	1 (8,33%)	3 (25%)	-0,051	0,197	0,248
Escola Secundária de Tondela	11	17,1	48	13,6	1 (9,09%)	1 (9,09%)	1 (9,09%)	0,453	-0,027	-0,481
Colégio de Amorim	11	16,6	46	13,5	1 (9,09%)	1 (9,09%)	2 (18,1%)	0,690	-0,188	-0,878
Escola Básica e Secundária de Macedo de Cavaleiros	11	17,1	42	13,0	2 (18,1%)	0 (0%)	2 (18,1%)	-0,216	-0,635	-0,418
Escola Secundária de S. Pedro da Cova	11	16,4	47	13,1	0 (0%)	1 (9,09%)	2 (18,1%)	-0,256	-0,145	0,111
Escola Secundária Viriato	11	17,1	45	12,9	1 (9,09%)	0 (0%)	3 (27,2%)	0,456	-0,411	-0,867
Escola Básica e Secundária de Sever do Vouga	11	17,1	50	13,6	1 (9,09%)	1 (9,09%)	1 (9,09%)	-0,143	-0,113	0,030
Escola Secundária Sá de Miranda	11	16,7	52	13,1	0 (0%)	0 (0%)	1 (9,09%)	-0,194	-0,402	-0,208
Escola Básica e Secundária Prof.António da Natividade - Mesão Frio	11	16,5	46	12,9	1 (9,09%)	0 (0%)	2 (18,1%)	-0,351	-0,322	0,028
Escola Básica e Secundária de Canelas	11	16,6	35	13,2	3 (27,2%)	0 (0%)	3 (27,2%)	0,372	-0,088	-0,460
Escola Secundária de Pombal	10	15,5	55	14,1	0 (0%)	0 (0%)	1 (10%)	-0,324	0,186	0,510
Escola Secundária de São Pedro do Sul	10	17,8	51	14,0	1 (10%)	0 (0%)	1 (10%)	0,545	0,291	-0,254
Escola Secundária de Cantanhede	10	17,2	47	13,9	1 (10%)	0 (0%)	2 (20%)	-0,510	0,008	0,517
Escola Básica e Secundária de Muralhas do Minho - Valença	10	15,1	49	13,2	1 (10%)	0 (0%)	1 (10%)	-0,188	-0,115	0,073
Colégio de Ermesinde	10	14,7	17	11,6	2 (20%)	0 (0%)	8 (80%)	0,059	-1,296	-1,355
Total	**9322**	**16,3**	**43**	**13,4**	**942 (10,1%)**	**525 (5,63%)**	**2186 (23,4%)**	**0,029**	**-0,145**	**-0,174**

Given the amount of schools in the analysis, and to focus more on schools that make a significant impact and are less affected by individual student performance, we will focus this analysis section on the schools who placed 50 or more students in University.

We begin with one of the most important indicators, the delta score, which, as said before is the difference between the 1st Year score and the Entry score, it shows if on average the students who left a school improved or not on their performance. Delta scores may take on negative, neutral and positive values.

Neutral scores imply that the scores on the national exam (together with internal scores that are considered in the entry grade) are a fair assessment of students in the sense that at the university the students kept their entry ranking.

Take the example of Escola Secundária de S.Pedro, with an Entry score of 0,25 and 1st Year score of 0,25. Therefore, we can consider that Escola Secundária de S.Pedro graded their students in a correct way, given that their students maintain their relative performance when at university.

Positive values assume that there is an improvement in the students' placement in the first year when compared to the ranking on entry. This effect happens when the students are under evaluated, with schools grading their students below their actual performance.

Escola Secundária Dr. Mário Sacramento is a perfect example, achieving a positive Delta score (0,38), with an Entry Score of -0,01 and a 1st Year score of 0,37. These students were evaluated by the school with grades placing them on the average at the entry of their degree, and after their first year at University they stood out as being 0,37 standard deviations above the mean.

When Delta scores take on negative values, exactly the opposite of what happens for positive values happens. Students are over evaluated, having their school grades placing them higher than what they are actually able to perform, resulting in drop of performance at the end of the first year at University.

For example, Colégio Nossa Senhora do Rosário sees their students enter their respective degrees 0.4 standard deviations above the mean and finish those degrees 0.71 standard deviations below the mean, achieving a Delta score if -1,11.

In both these cases (positive and negative delta scores) entry scores do not reflect fair assessments of students since their performance at the university is not consistent with their entry grade. These are cases where eventually inflated internal grades contributed to improve entry grades, or where the school has prepared the student very well for exams, but not for other aspects of learning, which are equally important in university (e.g. autonomy).

A summary of the Delta scores is:

- 45 schools show Positive Delta scores, of which 43 are public and 2 are private;
- 24 schools show Neutral Delta scores, of which 20 are public and 4 are private;
- 106 schools, show Negative Delta scores, of which 67 are public and 39 are private;

Looking at the summary, it stands out that most private schools tend to achieve negative Delta scores and Public schools positive. Also the schools with neutral Delta scores (those that fairly grade their students) only represent 14% of the school population.

While Delta score is a good measure of overall school performance, we can look at other more specific indicators for schools.

Looking individually at the 1st Year score is a good way to understand how the schools are preparing the students for University. With Positive value representing a good preparation and negative values a poor one.

The two indicators of Top and Bottom student are good to evaluate if a school prepares students to achieve very high performance regarding the ability to complete the degree as well as their ability to score good grades.

Combining these three indicators we can achieve interesting outcomes regarding the schools.

Schools may score poorly on 1st Year score and place few students on Top.

We see Centro de Estudos Básico e Secundário – CEBES with a negative 1st year score (-1,77) placing one student at the Top and 27 at the Bottom. The most likely case for this student is that his placement at the Top is due to his innate superior ability and not influence of the school, meaning by this that that student would be a top student regardless of the school he attended.

There can also be cases where the schools achieve positive 1st year scores and a high percentage of Top students, indicating that school is exceptionally good at preparing their students for academic success. We see this with Escola Secundária Dr. Mário Sacramento where students achieve a positive 1st Year score (0,37) and place 16% of their students on Top and 16% as well on Bottom (note that on average Bottom percentages are 4 times higher than Top, so we can consider this a good result for the school).

In this section Table 16 was presented, which shows how the students of each school performed on entry and after their first year at university, allowing the comparison between the two, which resulted in the Delta score.

We have seen how the Delta score can take on Positive, Negative and Neutral values and the implications these values have for the schools.

We also saw that combining 1st Year scores with Top and Bottom indicators, can provide interesting results of the level of preparation the schools endow their students.

4.4 Degree Clustering

Table 17: Degrees and their respective category

Category/Degree
Art
Arte, Conservação e Restauro
Artes Plásticas
Licenciatura em Arquitectura Paisagista
Licenciatura em História da Arte
Mestrado Integrado em Arquitetura
Som e Imagem
Engineering
Bioengenharia
Licenciatura em Ciência da Informação
Licenciatura em Ciência de Computadores
Licenciatura em Ciências de Engenharia
Licenciatura em Ciências de Engenharia - Engenharia de Minas e Geo-Ambiente
Mestrado Integrado em Bioengenharia
Mestrado Integrado em Engenharia Civil
Mestrado Integrado em Engenharia de Redes e Sistemas Informáticos
Mestrado Integrado em Engenharia do Ambiente
Mestrado Integrado em Engenharia e Gestão Industrial
Mestrado Integrado em Engenharia Electrotécnica e de Computadores
Mestrado Integrado em Engenharia Física
Mestrado Integrado em Engenharia Informática e Computação
Mestrado Integrado em Engenharia Mecânica
Mestrado Integrado em Engenharia Metalúrgica e de Materiais
Mestrado Integrado em Engenharia Química
Health
Ciências da Nutrição
Enfermagem
Licenciatura em Ciências da Nutrição
Mestrado Integrado em Ciências Farmacêuticas
Mestrado Integrado em Medicina - FMUP
Mestrado Integrado em Medicina - ICBAS
Mestrado Integrado em Medicina Dentária
Mestrado Integrado em Medicina Veterinária
Humanities
Design de Comunicação
Licenciatura em Arqueologia
Licenciatura em Ciências da Comunicação: Jornalismo, Assessoria, Multimédia
Licenciatura em Ciências da Educação
Licenciatura em Ciências da Linguagem
Licenciatura em Estudos Portugueses e Lusófonos
Licenciatura em Filosofia
Licenciatura em História
Licenciatura em Línguas Aplicadas
Licenciatura em Línguas e Relações Internacionais
Licenciatura em Línguas, Literaturas e Culturas
Teologia
Law
Criminologia
Direito
Natural Science
Licenciatura em Astronomia
Licenciatura em Biologia
Licenciatura em Bioquímica
Licenciatura em Ciências do Meio Aquático
Licenciatura em Ciências e Tecnologia do Ambiente
Licenciatura em Física
Licenciatura em Geografia
Licenciatura em Geologia
Licenciatura em Matemática
Licenciatura em Química
Microbiologia
Social Science
Economia
Gestão
Licenciatura em Gestão
Licenciatura em Sociologia
Mestrado Integrado em Psicologia
Psicologia
Sports
Ciências do Desporto

So far, we have looked at University degrees as a whole, not differentiating between them. Assuming that some schools might be better at preparing students for a certain type of degree the analysis will now contemplate the degrees clustered into different categories.

These are coupled into clusters that define their main field of study in order to understand if some schools are better at preparing the students for a specific type of degree.

Table 17 shows these categories and the degrees we have inserted in them.

Table 18 illustrates the total number of students in each category. As well as the number of students that each of the 5 most contributing schools placed in that respective category.

Table 18: Number of students per cluster with top 5 contributing schools

Art	705
Escola Secundária Soares dos Reis	52
Escola Artística Soares dos Reis	23
Externato Ribadouro	23
Escola Secundária Garcia de Orta	17
Escola Secundária de Marco de Canaveses	15
Engineering	2407
Externato Ribadouro	240
Colégio Nossa Senhora do Rosário	57
Escola Secundária Filipa de Vilhena	52
Escola Secundária de Almeida Garrett	48
Escola Secundária da Maia	47
Health	1927
Externato Ribadouro	405
Colégio Nossa Senhora do Rosário	37
Escola Secundária de Fafe	32
Colégio da Trofa	31
Externato Paulo VI	30
Humanities	1144
Escola Secundária de Almeida Garrett	39
Externato Ribadouro	31
Escola Secundária Aurélia de Sousa	30
Escola Secundária de Gondomar	29
Escola Secundária de Rio Tinto	27
Law	939
Externato Ribadouro	80
Escola Secundária Garcia de Orta	47
Escola Secundária da Maia	22
Colégio Nossa Senhora do Rosário	20
Colégio Luso-Francês	19
Natural Science	1189
Externato Ribadouro	55
Escola Secundária da Maia	45
Colégio Internato dos Carvalhos	33
Escola Secundária Filipa de Vilhena	31
Escola Secundária de Almeida Garrett	25
Social Science	1669
Externato Ribadouro	170
Colégio Nossa Senhora do Rosário	77
Escola Secundária Garcia de Orta	64
Escola Secundária Filipa de Vilhena	38
Colégio Internato dos Carvalhos	36
Sports	294
Colégio Internato dos Carvalhos	19
Externato Ribadouro	16
Colégio de Gaia	9
Colégio São Gonçalo	9
Escola Secundária Santa Maria Maior	8

This table shows that some clusters are much more populated than others. For example Health degrees having 1927 students whereas Law has nearly half (939) and Sports contains very few students compared to the others (294).

We also see that Externato Ribadouro is the only school to place in the top 5 contributing schools for all clusters.

An overview on these categories is shown in Table 19, which will explain the differences found in clusters of degrees by the type of school attended.

Table 19: Students performance by Cluster and type of School.

Degree Category	Nº Students (%)	Entry grade	ECTS	1st Year Grade	0 ECTS (%)	Top (%)	Bottom (%)	Entry Score	1st Year Score	Δ Score
Private	3261 (31,7%)	16,5	41	13,1	348 (10,6%)	135 (4,13%)	915 (28,0%)	0,119	-0,344	-0,463
Art	145 (4,44%)	16,7	49	13,4	16 (11,0%)	7 (4,82%)	27 (18,6%)	0,188	-0,254	-0,442
Engineering	724 (22,2%)	16,5	39	12,9	72 (9,94%)	21 (2,90%)	220 (30,3%)	0,068	-0,446	-0,515
Health	820 (25,1%)	17,5	42	13,3	78 (9,51%)	27 (3,29%)	207 (25,2%)	0,051	-0,406	-0,457
Humanities	201 (6,16%)	16,1	44	13,8	24 (11,9%)	8 (3,98%)	49 (24,3%)	0,127	-0,284	-0,411
Law	342 (10,4%)	15,7	33	12,4	41 (11,9%)	25 (7,30%)	151 (44,1%)	0,132	-0,179	-0,311
Natural Science	261 (8,00%)	15,6	34	13,0	44 (16,8%)	14 (5,36%)	104 (39,8%)	0,416	-0,273	-0,689
Social Science	664 (20,3%)	16,5	44	13,2	62 (9,33%)	28 (4,21%)	138 (20,7%)	0,089	-0,327	-0,416
Sports	104 (3,18%)	15,4	42	13,7	11 (10,5%)	5 (4,80%)	19 (18,2%)	0,301	-0,171	-0,472
Public	7013 (68,2%)	16,1	45	13,5	698 (9,95%)	449 (6,40%)	1501 (21,4%)	-0,025	-0,041	-0,017
Art	560 (7,98%)	16,5	47	13,7	65 (11,6%)	30 (5,35%)	109 (19,4%)	-0,049	-0,048	0,001
Engineering	1683 (23,9%)	15,9	44	13,4	165 (9,80%)	113 (6,71%)	395 (23,4%)	-0,029	-0,018	0,011
Health	1107 (15,7%)	17,1	48	13,8	73 (6,59%)	88 (7,94%)	183 (16,5%)	-0,038	0,066	0,104
Humanities	943 (13,4%)	15,7	46	13,9	102 (10,8%)	52 (5,51%)	183 (19,4%)	-0,027	-0,084	-0,057
Law	597 (8,51%)	15,8	40	12,4	51 (8,54%)	29 (4,85%)	174 (29,1%)	-0,076	-0,147	-0,072
Natural Science	928 (13,2%)	15,1	39	13,0	141 (15,1%)	54 (5,81%)	263 (28,3%)	0,115	-0,126	-0,241
Social Science	1005 (14,3%)	16,6	48	13,9	87 (8,65%)	72 (7,16%)	150 (14,9%)	-0,059	-0,009	0,050
Sports	190 (2,70%)	14,9	43	13,7	14 (7,36%)	11 (5,78%)	44 (23,1%)	-0,165	-0,107	0,058
Total	**10274 (100%)**	**16,2**	**43**	**13,4**	**1046 (10,1%)**	**584 (5,68%)**	**2416 (23,5%)**	**0,021**	**-0,137**	**-0,158**

Analyzing Table 19 we draw the following conclusions for each type of school.

For students from private schools:

- Students enrolling in Natural Science degrees achieve the highest Entry scores and Health achieve the lowest
- Students enrolling in Sports degrees achieve the highest 1st Year scores and Engineering students achieve the lowest
- Students enrolling in Law achieve the highest Delta score and Natural Science students the lowest
- Students enrolling in Law degrees have the biggest percentage of students at the Top and Bottom
- Students enrolling in Natural science have the biggest percentage of 0 ECTS

For Public:

- Natural Science students achieve the highest Entry scores and Sports achieve the lowest

- Health students achieve the highest 1st Year scores and Law students achieve the lowest
- Health students achieve the highest Delta score and Natural Science students the lowest
- Health degrees have the biggest percentage of students at the Top and Law at the Bottom
- Natural science is the degree with the biggest percentage of 0 ECTS students

It is interesting to see how the majority of students who enroll in Law degrees demonstrate they are not well prepared for it, as these students are the ones with the biggest percentage of students at the Bottom category as well as achieving negative delta scores. This may be due to particular characteristics of these degrees which schools may be lacking in their preparation and thus students are not able to succeed in these degrees.

Also interesting is the number of students who fit in the 0 ECTS category for Natural Science degrees, being the highest for both types of school. The same situation that was stipulated for Law degrees, that some fundamental skills to complete these degrees are not being properly explored at school, should be applied here, as this cluster of degrees achieves negative 1st Year scores as well as having the second highest percentage of Bottoms.

This table allows for the direct comparison between the types of institutions for each of the categories. We see public schools with a much more fair grading system (-0.017 for Delta score vs -0,463 Delta score for private schools), with the majority of the categories assuming neutral or very close to neutral values.

For private schools the lack of preparation stands out as all their 1st Year scores are negative (-0,344) and considerably lower than their public peers (-0,041).

To further complete this analysis we will now identify which schools are the best per category of degrees. Being that enrolling at university is one way to measure the relevance of a school, Table 20 contemplates for each category the same variables studied before, only this time by cluster of Degrees and gives information regarding the top 24 schools in placing the most students at University.

The reason for this choice is that these 24 schools (4,5% of the total schools) represent 41% of the student population, meaning these are the most popular schools in the study.

Table 20: Performance by cluster for schools which place the most students

School/Cluster	Nº Students	Entry Grade	ECTS	1st Year Grade	0ECTS%	TOP%	Bottom%	Entry Score	1st Year Grade	Δ Score
Externato Ribadouro	1020	17,0	38	13,0	109 (10,6%)	15 (1,47%)	326 (31,9%)	0,125	-0,503	-0,628
Art	23 (2,25%)	17,7	40	13,6	6 (26,0%)	2 (8,69%)	8 (34,7%)	0,692	-0,034	-0,725
Engineering	240 (23,5%)	16,6	35	12,7	23 (9,58%)	3 (1,25%)	95 (39,5%)	-0,020	-0,576	-0,556
Health	405 (39,7%)	17,8	40	13,2	41 (10,1%)	4 (0,98%)	115 (28,3%)	0,086	-0,540	-0,626
Humanities	31 (3,03%)	17,2	48	14,2	2 (6,45%)	0 (0%)	4 (12,9%)	0,740	0,059	-0,681
Law	80 (7,84%)	16,0	32	12,1	12 (15%)	4 (5%)	33 (41,2%)	0,258	-0,355	-0,613
Natural Science	55 (5,39%)	16,1	29	12,6	9 (16,3%)	0 (0%)	27 (49,0%)	0,380	-0,613	-0,994
Social Science	170 (16,6%)	16,6	42	12,9	15 (8,82%)	2 (1,17%)	40 (23,5%)	0,084	-0,530	-0,614
Sports	16 (1,56%)	15,2	42	13,7	1 (6,25%)	0 (0%)	4 (25%)	0,161	-0,197	-0,358
Escola Secundária Garcia de Orta	228	15,9	43	13,5	26 (11,4%)	10 (4,38%)	54 (23,6%)	0,067	0,058	-0,010
Art	17 (7,45%)	16,4	47	14,2	2 (11,7%)	1 (5,88%)	4 (23,5%)	0,192	0,295	0,104
Engineering	42 (18,4%)	16,0	42	13,7	5 (11,9%)	1 (2,38%)	11 (26,1%)	0,333	0,147	-0,186
Health	20 (8,77%)	17,2	41	14,1	3 (15%)	1 (5%)	5 (25%)	-0,233	0,028	0,261
Humanities	16 (7,01%)	16,8	41	14,4	4 (25%)	1 (6,25%)	5 (31,2%)	0,108	0,133	0,025
Law	47 (20,6%)	15,4	43	12,9	4 (8,51%)	4 (8,51%)	12 (25,5%)	0,004	0,226	0,222
Natural Science	19 (8,33%)	14,6	32	12,3	3 (15,7%)	0 (0%)	8 (42,1%)	-0,006	-0,338	-0,332
Social Science	64 (28,0%)	16,0	48	13,6	5 (7,81%)	2 (3,12%)	9 (14,0%)	0,033	-0,062	-0,095
Sports	3 (1,31%)	14,5	47	13,3	0 (0%)	0 (0%)	0 (0%)	-0,372	-0,315	0,058
Colégio Nossa Senhora do Rosário	218	17,1	45	13,3	18 (8,25%)	17 (7,79%)	45 (20,6%)	0,424	-0,266	-0,690
Art	10 (4,58%)	17,6	39	13,7	2 (20%)	1 (10%)	4 (40%)	0,658	-0,062	-0,720
Engineering	57 (26,1%)	17,1	49	13,2	1 (1,75%)	3 (5,26%)	8 (14,0%)	0,214	-0,397	-0,612
Health	37 (16,9%)	18,2	49	13,7	3 (8,10%)	4 (10,8%)	5 (13,5%)	0,458	-0,138	-0,596
Humanities	8 (3,66%)	17,2	48	14,8	1 (12,5%)	0 (0%)	1 (12,5%)	0,710	0,486	-0,224
Law	20 (9,17%)	16,5	37	12,9	3 (15%)	2 (10%)	8 (40%)	1,062	0,144	-0,918
Natural Science	7 (3,21%)	17,0	31	12,8	2 (28,5%)	0 (0%)	3 (42,8%)	1,086	-0,524	-1,610
Social Science	77 (35,3%)	16,6	43	13,0	6 (7,79%)	7 (9,09%)	16 (20,7%)	0,270	-0,403	-0,673
Sports	2 (0,91%)	15,8	60	13,9	0 (0%)	0 (0%)	0 (0%)	0,657	-0,187	-0,844
Escola Secundária da Maia	194	15,9	47	13,5	18 (9,27%)	13 (6,70%)	38 (19,5%)	0,047	0,022	-0,025
Art	7 (3,60%)	18,2	50	14,0	0 (0%)	1 (14,2%)	0 (0%)	0,473	0,259	-0,214
Engineering	47 (24,2%)	15,6	46	13,3	5 (10,6%)	2 (4,25%)	10 (21,2%)	-0,014	-0,064	-0,050
Health	21 (10,8%)	17,2	52	14,7	1 (4,76%)	1 (4,76%)	3 (14,2%)	-0,323	0,599	0,923
Humanities	23 (11,8%)	15,7	48	14,1	2 (8,69%)	1 (4,34%)	3 (13,0%)	-0,015	0,038	0,054
Law	22 (11,3%)	15,9	45	12,5	2 (9,09%)	2 (9,09%)	6 (27,2%)	-0,128	-0,166	-0,039
Natural Science	45 (23,1%)	14,9	40	12,9	7 (15,5%)	2 (4,44%)	14 (31,1%)	0,245	-0,198	-0,443
Social Science	23 (11,8%)	17,0	56	14,1	1 (4,34%)	2 (8,69%)	1 (4,34%)	0,105	0,059	-0,046
Sports	6 (3,09%)	15,5	46	14,0	0 (0%)	2 (33,3%)	1 (16,6%)	0,485	0,250	-0,235
Colégio Internato dos Carvalhos	194	16,1	46	13,7	18 (9,27%)	17 (8,76%)	38 (19,5%)	0,176	-0,001	-0,177
Art	7 (3,60%)	15,4	50	13,3	1 (14,2%)	1 (14,2%)	2 (28,5%)	0,034	-0,480	-0,514
Engineering	35 (18,0%)	16,0	49	13,3	3 (8,57%)	1 (2,85%)	4 (11,4%)	-0,025	-0,029	-0,005
Health	19 (9,79%)	16,9	50	14,4	1 (5,26%)	2 (10,5%)	2 (10,5%)	0,330	0,450	0,120
Humanities	27 (13,9%)	16,8	46	14,3	3 (11,1%)	2 (7,40%)	7 (25,9%)	0,162	-0,204	-0,366
Law	18 (9,27%)	15,3	41	12,7	0 (0%)	3 (16,6%)	6 (33,3%)	-0,073	0,020	0,094
Natural Science	33 (17,0%)	16,0	43	13,7	5 (15,1%)	3 (9,09%)	7 (21,2%)	0,446	-0,049	-0,495
Social Science	36 (18,5%)	16,3	48	13,6	2 (5,55%)	2 (5,55%)	5 (13,8%)	-0,074	-0,245	-0,171
Sports	19 (9,79%)	15,8	40	14,5	3 (15,7%)	3 (15,7%)	5 (26,3%)	0,699	0,605	-0,094
Escola Secundária Filipa de Vilhena	192	15,8	45	13,4	19 (9,89%)	10 (5,20%)	41 (21,3%)	-0,062	-0,098	-0,036
Art	14 (7,29%)	16,5	49	13,6	1 (7,14%)	0 (0%)	2 (14,2%)	0,033	-0,254	-0,287
Engineering	52 (27,0%)	15,5	37	13,0	8 (15,3%)	0 (0%)	19 (36,5%)	-0,123	-0,211	-0,088
Health	20 (10,4%)	16,4	51	13,6	1 (5%)	2 (10%)	2 (10%)	-0,359	-0,044	0,315
Humanities	19 (9,89%)	15,2	49	14,0	1 (5,26%)	2 (10,5%)	3 (15,7%)	-0,015	0,109	0,125
Law	11 (5,72%)	16,6	46	12,5	1 (9,09%)	1 (9,09%)	2 (18,1%)	0,310	-0,090	-0,400
Natural Science	31 (16,1%)	14,9	39	12,9	4 (12,9%)	2 (6,45%)	8 (25,8%)	-0,066	-0,126	-0,060
Social Science	38 (19,7%)	16,8	51	14,0	2 (5,26%)	3 (7,89%)	4 (10,5%)	0,087	0,004	-0,083
Sports	7 (3,64%)	14,5	45	13,5	1 (14,2%)	0 (0%)	1 (14,2%)	-0,457	-0,217	0,239
Escola Secundária Aurélia de Sousa	169	16,1	45	13,7	16 (9,46%)	13 (7,69%)	29 (17,1%)	0,036	0,075	0,039
Art	8 (4,73%)	16,9	40	12,9	2 (25%)	0 (0%)	2 (25%)	0,602	-0,192	-0,794
Engineering	42 (24,8%)	15,7	43	14,0	5 (11,9%)	2 (4,76%)	10 (23,8%)	0,007	0,248	0,241
Health	21 (12,4%)	16,4	49	14,0	1 (4,76%)	2 (9,52%)	1 (4,76%)	-0,076	0,307	0,383
Humanities	30 (17,7%)	15,4	44	13,3	2 (6,66%)	1 (3,33%)	6 (20%)	-0,126	-0,245	-0,119
Law	14 (8,28%)	15,9	37	12,2	1 (7,14%)	1 (7,14%)	4 (28,5%)	-0,234	-0,251	-0,016
Natural Science	15 (8,87%)	16,2	47	14,1	2 (13,3%)	2 (13,3%)	2 (13,3%)	0,270	0,235	-0,035
Social Science	34 (20,1%)	16,8	51	14,3	3 (8,82%)	5 (14,7%)	3 (8,82%)	0,295	0,276	-0,019
Sports	5 (2,95%)	14,2	46	12,9	0 (0%)	0 (0%)	1 (20%)	-0,899	-0,844	0,055
Escola Secundária de Almeida Garrett	163	15,9	43	13,7	19 (11,6%)	15 (9,20%)	36 (22,0%)	-0,032	0,083	0,115
Art	9 (5,52%)	16,5	33	13,7	3 (33,3%)	0 (0%)	3 (33,3%)	0,355	-0,105	-0,460
Engineering	48 (29,4%)	16,0	45	13,6	2 (4,16%)	5 (10,4%)	10 (20,8%)	0,119	0,092	-0,026
Health	14 (8,58%)	17,0	45	13,7	1 (7,14%)	0 (0%)	3 (21,4%)	-0,009	0,051	0,059
Humanities	39 (23,9%)	15,5	40	14,0	7 (17,9%)	3 (7,69%)	9 (23,0%)	-0,272	0,072	0,344
Law	7 (4,29%)	17,4	44	12,9	1 (14,2%)	1 (14,2%)	1 (14,2%)	0,206	-0,041	-0,247
Natural Science	25 (15,3%)	14,9	45	13,2	2 (8%)	3 (12%)	5 (20%)	-0,006	0,093	0,099
Social Science	19 (11,6%)	16,7	44	14,1	3 (15,7%)	2 (10,5%)	4 (21,0%)	-0,205	0,230	0,435
Sports	2 (1,22%)	14,7	40	13,9	0 (0%)	1 (50%)	1 (50%)	-0,376	-0,066	0,310
Escola Secundária de Rio Tinto	139	15,5	47	13,5	14 (10,0%)	11 (7,91%)	27 (19,4%)	-0,085	-0,002	0,083
Art	7 (5,03%)	16,3	43	13,2	0 (0%)	0 (0%)	1 (14,2%)	0,151	-0,338	-0,489
Engineering	29 (20,8%)	15,5	44	13,1	3 (10,3%)	1 (3,44%)	7 (24,1%)	-0,137	-0,078	0,060
Health	16 (11,5%)	16,2	50	14,5	2 (12,5%)	3 (18,7%)	2 (12,5%)	0,411	0,589	0,178
Humanities	27 (19,4%)	14,9	49	14,0	3 (11,1%)	4 (14,8%)	5 (18,5%)	-0,155	0,095	0,250
Law	7 (5,03%)	15,5	45	13,2	0 (0%)	1 (14,2%)	2 (28,5%)	-0,074	0,277	0,351
Natural Science	24 (17,2%)	14,5	40	12,2	4 (16,6%)	0 (0%)	8 (33,3%)	-0,152	-0,486	-0,334
Social Science	26 (18,7%)	16,4	54	14,0	2 (7,69%)	2 (7,69%)	2 (7,69%)	-0,265	0,066	0,331
Sports	3 (2,15%)	15,1	47	13,7	0 (0%)	0 (0%)	0 (0%)	-0,074	-0,059	0,016
Escola Secundária Eça de Queirós - Póvoa de Varzim	138	16,8	48	13,7	13 (9,42%)	11 (7,97%)	24 (17,3%)	0,264	0,007	-0,257
Art	8 (5,79%)	17,1	55	13,3	0 (0%)	0 (0%)	0 (0%)	-0,003	-0,259	-0,256
Engineering	39 (28,2%)	16,5	47	14,0	5 (12,8%)	5 (12,8%)	7 (17,9%)	0,019	0,247	0,228
Health	28 (20,2%)	17,8	44	14,0	4 (14,2%)	2 (7,14%)	8 (28,5%)	0,372	0,128	-0,244
Humanities	25 (18,1%)	16,9	51	14,2	2 (8%)	3 (12%)	2 (8%)	0,872	0,105	-0,767
Law	2 (1,44%)	17,3	60	13,4	0 (0%)	0 (0%)	0 (0%)	0,375	0,638	0,263
Natural Science	16 (11,5%)	15,1	41	12,4	0 (0%)	0 (0%)	5 (31,2%)	0,335	-0,553	-0,887
Social Science	20 (14,4%)	17,2	53	13,8	2 (10%)	1 (5%)	2 (10%)	-0,134	-0,190	-0,056
Escola Secundária de Penafiel	137	16,3	46	13,3	13 (9,48%)	9 (6,56%)	25 (18,2%)	-0,127	-0,147	-0,021
Art	8 (5,83%)	17,0	56	13,0	1 (12,5%)	0 (0%)	1 (12,5%)	-0,448	-0,288	0,160
Engineering	34 (24,8%)	15,9	43	12,9	2 (5,88%)	3 (8,82%)	7 (20,5%)	-0,221	-0,301	-0,079
Health	28 (20,4%)	17,6	50	13,6	1 (3,57%)	2 (7,14%)	2 (7,14%)	-0,163	0,031	0,194
Humanities	15 (10,9%)	15,9	56	13,6	0 (0%)	0 (0%)	1 (6,66%)	-0,208	-0,369	-0,160
Law	9 (6,56%)	16,1	33	11,0	1 (11,1%)	0 (0%)	4 (44,4%)	-0,104	-1,161	-1,057
Natural Science	21 (15,3%)	15,1	45	13,8	3 (14,2%)	3 (14,2%)	4 (19,0%)	0,290	0,402	0,112
Social Science	17 (12,4%)	16,6	39	13,9	4 (23,5%)	1 (5,88%)	5 (29,4%)	-0,277	-0,134	0,143
Sports	5 (3,64%)	15,2	45	14,2	1 (20%)	0 (0%)	1 (20%)	0,205	0,471	0,266

Escola Secundária Santa Maria Maior	127	16,5	45	13,4	10 (7,87%)	9 (7,08%)	29 (22,8%)	-0,074	-0,204	-0,130
Art	13 (10,2%)	17,2	42	13,7	1 (7,69%)	2 (15,3%)	5 (38,4%)	-0,111	-0,080	0,031
Engineering	45 (35,4%)	16,1	41	13,1	4 (8,88%)	2 (4,44%)	13 (28,8%)	-0,100	-0,261	-0,161
Health	16 (12,5%)	18,0	51	13,2	0 (0%)	1 (6,25%)	1 (6,25%)	-0,156	-0,394	-0,239
Humanities	15 (11,8%)	16,9	50	14,4	2 (13,3%)	1 (6,66%)	3 (20%)	0,097	0,141	0,044
Law	5 (3,93%)	15,5	50	11,3	0 (0%)	0 (0%)	0 (0%)	-0,688	-0,647	0,041
Natural Science	10 (7,87%)	15,5	49	12,8	1 (10%)	0 (0%)	1 (10%)	0,630	-0,231	-0,861
Social Science	15 (11,8%)	17,2	45	13,8	1 (6,66%)	1 (6,66%)	3 (20%)	-0,328	-0,205	0,123
Sports	8 (6,29%)	15,0	42	13,9	1 (12,5%)	2 (25%)	3 (37,5%)	-0,050	0,068	0,118
Externato Paulo VI	126	17,0	42	13,6	12 (9,52%)	10 (7,93%)	33 (26,1%)	0,219	-0,146	-0,365
Art	3 (2,38%)	17,3	46	13,3	0 (0%)	0 (0%)	1 (33,3%)	1,081	-0,046	-1,126
Engineering	34 (26,9%)	16,6	33	12,5	5 (14,7%)	1 (2,94%)	14 (41,1%)	0,056	-0,601	-0,657
Health	30 (23,8%)	18,0	44	14,0	2 (6,66%)	2 (6,66%)	6 (20%)	0,113	-0,010	-0,124
Humanities	9 (7,14%)	17,0	47	14,4	1 (11,1%)	2 (22,2%)	1 (11,1%)	0,494	0,277	-0,217
Law	3 (2,38%)	16,7	57	12,8	0 (0%)	0 (0%)	0 (0%)	0,314	0,052	-0,262
Natural Science	17 (13,4%)	16,2	33	13,4	2 (11,7%)	1 (5,88%)	8 (47,0%)	0,395	-0,228	-0,623
Social Science	25 (19,8%)	17,4	50	14,3	2 (8%)	3 (12%)	3 (12%)	0,320	0,025	-0,295
Sports	5 (3,96%)	14,9	51	14,1	0 (0%)	1 (20%)	0 (0%)	-0,225	0,327	0,552
Escola Secundária de Santa Maria da Feira	121	16,0	44	13,7	13 (10,7%)	11 (9,09%)	28 (23,1%)	0,113	0,134	0,021
Art	10 (8,26%)	15,8	44	13,8	0 (0%)	0 (0%)	2 (20%)	-0,627	-0,132	0,496
Engineering	34 (28,0%)	16,3	48	13,8	5 (14,7%)	4 (11,7%)	5 (14,7%)	0,191	0,191	0,000
Health	15 (12,3%)	16,7	52	14,1	0 (0%)	2 (13,3%)	2 (13,3%)	-0,133	0,177	0,310
Humanities	9 (7,43%)	15,8	47	13,5	0 (0%)	0 (0%)	2 (22,2%)	0,043	-0,327	-0,370
Law	16 (13,2%)	15,9	41	12,9	1 (6,25%)	1 (6,25%)	5 (31,2%)	0,094	0,135	0,041
Natural Science	14 (11,5%)	14,4	35	12,5	3 (21,4%)	1 (7,14%)	6 (42,8%)	0,444	-0,129	-0,573
Social Science	16 (13,2%)	17,0	37	14,7	4 (25%)	2 (12,5%)	5 (31,2%)	0,463	0,422	-0,041
Sports	7 (5,78%)	14,9	43	14,6	0 (0%)	1 (14,2%)	1 (14,2%)	0,001	0,700	0,699
Escola Secundária Dr. Manuel Gomes de Almeida	120	16,4	46	13,9	8 (6,66%)	12 (10%)	23 (19,1%)	0,335	0,210	-0,124
Art	4 (3,33%)	17,6	50	13,6	0 (0%)	0 (0%)	0 (0%)	0,643	-0,192	-0,835
Engineering	38 (31,6%)	16,5	47	13,5	1 (2,63%)	3 (7,89%)	5 (13,1%)	0,197	-0,010	-0,207
Health	23 (19,1%)	17,5	46	14,5	2 (8,69%)	4 (17,3%)	6 (26,0%)	0,572	0,769	0,197
Humanities	14 (11,6%)	15,9	48	15,0	2 (14,2%)	2 (14,2%)	3 (21,4%)	0,429	0,544	0,115
Law	8 (6,66%)	15,9	35	11,4	1 (12,5%)	0 (0%)	3 (37,5%)	0,385	-0,863	-1,248
Natural Science	18 (15%)	15,3	44	13,4	2 (11,1%)	1 (5,55%)	4 (22,2%)	0,116	-0,002	-0,118
Social Science	13 (10,8%)	16,8	52	15,2	0 (0%)	2 (15,3%)	1 (7,69%)	0,528	0,819	0,291
Sports	2 (1,66%)	14,5	36	12,3	0 (0%)	0 (0%)	1 (50%)	-0,546	-1,276	-0,730
Escola Secundária de Ermesinde	111	15,5	45	13,5	10 (9,00%)	9 (8,10%)	23 (20,7%)	-0,089	0,016	0,104
Art	8 (7,20%)	15,6	44	13,3	1 (12,5%)	0 (0%)	1 (12,5%)	-0,439	-0,479	-0,040
Engineering	25 (22,5%)	15,7	47	13,6	2 (8%)	2 (8%)	6 (24%)	-0,110	0,185	0,295
Health	12 (10,8%)	16,3	47	13,3	0 (0%)	1 (8,33%)	2 (16,6%)	-0,051	-0,136	-0,085
Humanities	22 (19,8%)	14,4	36	13,9	4 (18,1%)	2 (9,09%)	9 (40,9%)	-0,265	0,150	0,415
Law	6 (5,40%)	14,5	53	11,7	0 (0%)	0 (0%)	0 (0%)	-0,579	-0,504	0,075
Natural Science	24 (21,6%)	15,1	43	13,0	3 (12,5%)	1 (4,16%)	5 (20,8%)	0,255	-0,200	-0,455
Social Science	13 (11,7%)	16,9	59	14,7	0 (0%)	3 (23,0%)	0 (0%)	-0,004	0,510	0,514
Sports	1 (0,90%)	15,5	60	14,4	0 (0%)	0 (0%)	0 (0%)	0,268	0,209	-0,059
Escola Secundária João Gonçalves Zarco	110	15,8	43	13,4	13 (11,8%)	4 (3,63%)	23 (20,9%)	-0,112	-0,008	0,104
Art	3 (2,72%)	14,3	31	12,3	1 (33,3%)	0 (0%)	1 (33,3%)	-0,759	-0,603	0,156
Engineering	26 (23,6%)	16,0	47	13,6	2 (7,69%)	1 (3,84%)	4 (15,3%)	-0,219	0,040	0,259
Health	14 (12,7%)	16,2	51	13,9	0 (0%)	1 (7,14%)	1 (7,14%)	0,221	0,437	0,216
Humanities	15 (13,6%)	16,0	49	14,0	2 (13,3%)	0 (0%)	2 (13,3%)	-0,295	-0,086	0,209
Law	14 (12,7%)	15,7	40	12,2	1 (7,14%)	0 (0%)	4 (28,5%)	-0,354	-0,288	0,067
Natural Science	20 (18,1%)	15,2	33	12,4	4 (20%)	0 (0%)	6 (30%)	0,322	-0,429	-0,752
Social Science	14 (12,7%)	16,3	48	14,2	2 (14,2%)	2 (14,2%)	3 (21,4%)	-0,402	0,284	0,686
Sports	4 (3,63%)	15,4	24	14,7	1 (25%)	0 (0%)	2 (50%)	0,289	0,564	0,275
Escola Secundária Dr. Joaquim Gomes Ferreira Alves	108	16,2	43	13,3	13 (12,0%)	2 (1,85%)	32 (29,6%)	0,069	-0,241	-0,310
Art	5 (4,62%)	15,5	25	13,3	2 (40%)	0 (0%)	3 (60%)	-0,633	-0,371	0,262
Engineering	30 (27,7%)	16,0	37	13,0	5 (16,6%)	0 (0%)	12 (40%)	-0,067	-0,388	-0,321
Health	13 (12,0%)	18,0	58	14,0	0 (0%)	0 (0%)	1 (7,69%)	0,300	-0,046	-0,346
Humanities	14 (12,9%)	16,2	42	14,0	2 (14,2%)	1 (7,14%)	4 (28,5%)	0,287	-0,077	-0,364
Law	10 (9,25%)	16,1	42	12,3	1 (10%)	0 (0%)	4 (40%)	0,095	-0,295	-0,390
Natural Science	20 (18,5%)	15,6	40	13,2	2 (10%)	0 (0%)	6 (30%)	0,310	-0,267	-0,578
Social Science	16 (14,8%)	16,4	49	13,5	1 (6,25%)	1 (6,25%)	2 (12,5%)	-0,150	-0,205	-0,055
Colégio Luso-Francês	108	16,5	48	13,7	7 (6,48%)	10 (9,25%)	16 (14,8%)	0,371	0,063	-0,307
Art	4 (3,70%)	16,4	56	13,9	0 (0%)	0 (0%)	0 (0%)	0,306	0,134	-0,172
Engineering	29 (26,8%)	16,4	46	13,6	3 (10,3%)	2 (6,89%)	5 (17,2%)	0,071	-0,111	-0,182
Health	10 (9,25%)	17,1	43	14,1	1 (10%)	1 (10%)	2 (20%)	-0,073	0,079	0,152
Humanities	5 (4,62%)	16,6	60	14,5	0 (0%)	1 (20%)	0 (0%)	0,887	0,436	-0,451
Law	19 (17,5%)	16,3	36	13,2	3 (15,7%)	3 (15,7%)	7 (36,8%)	0,797	0,383	-0,413
Natural Science	6 (5,55%)	18,3	57	15,6	0 (0%)	2 (33,3%)	0 (0%)	1,774	0,995	-0,779
Social Science	31 (28,7%)	16,1	54	13,2	0 (0%)	1 (3,22%)	2 (6,45%)	0,152	-0,247	-0,399
Sports	4 (3,70%)	15,7	48	14,4	0 (0%)	0 (0%)	0 (0%)	0,635	0,350	-0,285
Escola Secundária de Paredes	105	15,7	42	13,4	15 (14,2%)	6 (5,71%)	28 (26,6%)	-0,085	-0,147	-0,062
Art	8 (7,61%)	15,7	44	14,0	2 (25%)	0 (0%)	2 (25%)	-0,680	-0,077	0,604
Engineering	32 (30,4%)	15,3	37	13,2	6 (18,7%)	3 (9,37%)	12 (37,5%)	-0,146	-0,082	0,064
Health	15 (14,2%)	17,3	57	14,5	0 (0%)	1 (6,66%)	0 (0%)	0,062	0,224	0,163
Humanities	15 (14,2%)	15,4	42	14,2	4 (26,6%)	1 (6,66%)	4 (26,6%)	-0,061	0,290	0,351
Law	5 (4,76%)	15,1	42	12,2	0 (0%)	0 (0%)	1 (20%)	0,093	-0,371	-0,463
Natural Science	16 (15,2%)	15,4	43	13,0	2 (12,5%)	1 (6,25%)	3 (18,7%)	0,115	-0,315	-0,431
Social Science	9 (8,57%)	16,2	41	12,4	1 (11,1%)	0 (0%)	3 (33,3%)	-0,308	-0,792	-0,484
Sports	5 (4,76%)	15,4	34	12,9	0 (0%)	0 (0%)	3 (60%)	0,329	-0,909	-1,238
Escola Secundária de Gondomar	105	14,8	44	13,4	16 (15,2%)	4 (3,80%)	22 (20,9%)	-0,290	-0,039	0,251
Art	3 (2,85%)	15,6	38	14,9	1 (33,3%)	0 (0%)	1 (33,3%)	-0,502	0,509	1,011
Engineering	25 (23,8%)	14,4	40	13,1	6 (24%)	1 (4%)	6 (24%)	-0,494	-0,017	0,477
Health	6 (5,71%)	15,3	41	13,6	1 (16,6%)	0 (0%)	1 (16,6%)	-0,919	-0,349	0,570
Humanities	29 (27,6%)	14,7	48	13,7	2 (6,89%)	0 (0%)	6 (20,6%)	-0,375	-0,125	0,250
Law	6 (5,71%)	15,0	42	12,3	0 (0%)	0 (0%)	2 (33,3%)	-0,197	-0,313	-0,116
Natural Science	23 (21,9%)	14,7	40	13,0	5 (21,7%)	2 (8,69%)	5 (21,7%)	0,090	0,114	0,023
Social Science	12 (11,4%)	15,8	53	13,9	1 (8,33%)	1 (8,33%)	1 (8,33%)	-0,010	0,063	0,073
Sports	1 (0,95%)	14,2	60	13,8	0 (0%)	0 (0%)	0 (0%)	-1,000	0,075	1,076
Colégio Liceal de Santa Maria de Lamas	105	16,4	47	13,6	7 (6,66%)	11 (10,4%)	19 (18,0%)	0,034	-0,047	-0,081
Art	12 (11,4%)	17,2	57	13,1	0 (0%)	1 (8,33%)	0 (0%)	-0,298	-0,507	-0,209
Engineering	30 (28,5%)	16,8	50	13,9	1 (3,33%)	5 (16,6%)	3 (10%)	0,357	0,127	-0,230
Health	14 (13,3%)	17,4	47	14,0	2 (14,2%)	1 (7,14%)	2 (14,2%)	-0,266	0,142	0,408
Humanities	8 (7,61%)	15,6	44	14,3	2 (25%)	1 (12,5%)	2 (25%)	-0,386	-0,522	-0,136
Law	9 (8,57%)	15,5	35	12,1	0 (0%)	0 (0%)	4 (44,4%)	-0,154	-0,318	-0,164
Natural Science	13 (12,3%)	15,1	32	12,4	1 (7,69%)	2 (15,3%)	7 (53,8%)	0,253	-0,217	-0,470
Social Science	17 (16,1%)	16,2	56	14,4	1 (5,88%)	1 (5,88%)	1 (5,88%)	-0,044	0,407	0,452
Sports	2 (1,90%)	16,1	52	12,9	0 (0%)	0 (0%)	0 (0%)	1,064	-0,914	-1,978
Escola Secundária Augusto Gomes	100	16,1	46	13,6	8 (8%)	7 (7%)	19 (19%)	0,060	0,047	-0,013
Art	11 (11%)	15,7	47	13,5	0 (0%)	0 (0%)	2 (18,1%)	-0,028	-0,249	-0,221
Engineering	16 (16%)	16,4	50	13,7	1 (6,25%)	1 (6,25%)	3 (18,7%)	-0,287	0,116	0,402
Health	4 (4%)	16,7	38	14,1	1 (25%)	0 (0%)	1 (25%)	0,641	0,669	0,028
Humanities	18 (18%)	16,2	52	14,1	0 (0%)	1 (5,55%)	1 (5,55%)	0,077	-0,062	-0,139
Law	18 (18%)	16,1	44	13,0	1 (5,55%)	2 (11,1%)	4 (22,2%)	0,254	0,151	-0,103
Natural Science	10 (10%)	15,7	41	13,4	1 (10%)	1 (10%)	3 (30%)	0,254	-0,018	-0,273
Social Science	19 (19%)	16,3	45	14,0	4 (21,0%)	2 (10,5%)	4 (21,0%)	0,005	0,203	0,199
Sports	4 (4%)	15,1	37	13,6	0 (0%)	0 (0%)	1 (25%)	-0,056	-0,245	-0,189
Colégio da Trofa	100	16,5	39	12,4	9 (9%)	1 (1%)	26 (26%)	-0,104	-0,758	-0,654
Art	1 (1%)	17,3	40	11,8	0 (0%)	0 (0%)	0 (0%)	1,567	-1,549	-3,116
Engineering	26 (26%)	16,8	33	12,2	1 (3,84%)	0 (0%)	8 (30,7%)	0,050	-0,860	-0,910
Health	31 (31%)	16,6	37	12,9	5 (16,1%)	1 (3,22%)	9 (29,0%)	-0,313	-0,681	-0,368
Humanities	2 (2%)	15,6	60	13,7	0 (0%)	0 (0%)	0 (0%)	-0,203	0,075	0,278
Law	9 (9%)	16,2	39	11,6	0 (0%)	0 (0%)	2 (22,2%)	-0,203	-0,783	-0,580
Natural Science	4 (4%)	15,4	45	14,3	1 (25%)	0 (0%)	1 (25%)	0,262	0,544	0,282
Social Science	25 (25%)	16,5	43	12,2	2 (8%)	0 (0%)	6 (24%)	-0,098	-0,882	-0,784
Sports	2 (2%)	15,2	54	12,5	0 (0%)	0 (0%)	0 (0%)	0,057	-1,325	-1,383
Total	**4238**	**16,4**	**43**	**13,4**	**424 (10,0%)**	**237 (5,59%)**	**1004 (23,6%)**	**0,078**	**-0,160**	**-0,238**

Table 20 allows us to understand for each of these schools, in which fields of study they are stronger and weaker. This is an important analysis as the majority of schools place their students in a select few categories.

Listing some interesting cases we observe Externato do Ribadouro, which is by far the school with more students at UP and UCP, placing 80% of its students in 3 of the 8 categories available. Looking individually at those categories we have, Health (40%), Engineering (24%) and Social Science (17%).

The students who enroll in Health degrees enter 0,09 standard deviations above the mean and finish 0,54 standard deviations below, with 1% of students achieving Top and 28% Bottom. For those in Engineering they enter just on the average (Entry score of -0,026) and finish 0,6 standard deviations below, with 1% of students at Top and 40% Bottom, whereas for those in Social Science they enter above (Entry score of 0,084) and finish below (1st Year score of -0,530), with 1% at Top and 24% Bottom.

What this tells us is that this school prepares their students well for exams and grades them higher than what they are able to perform, which improves their Entry score, but fails to provide them with the necessary tools to succeed once they enroll in University.

Another interesting note that is in resonance with the previous comment is for the entire school the few amount of students ranking Top (1,47%) and the high amount ranking Bottom (31,9%), with a 1st Year Score of -0,503.

Looking at Escola Secundária Aurélia de Sousa, we can see that they place 75% of their students in Engineering (25%), Social Science (20%), Humanities (18%) and Health (12%) degrees, with the rest being more evenly dispersed through the other categories.

Looking at these individually we see, the students who enroll in Engineering degrees enter on the average (Entry score of 0,007), and improve on their score at the end of the first year (1st year score of 0,248), placing 5% of those students at the Top and 24% at the Bottom.

For Social Science they enter and finish above average, without demonstrating a major change in performance (delta score of -0,019) with 15% of those students at the Top and 9% at Bottom. This demonstrates that for this category, not only the students are well prepared for university, but also fairly graded by the school.

The students who enroll in Humanities degrees enter below and finish even further below average, which leads them to a negative Delta score (-0,116), placing only 3% of Top students and 20% Bottom ones. This case represents exactly the opposite of the previous category and it is interesting to see how within the same school students can have different performances depending on the course and the preparation of the school.

Health students achieve the highest Delta score (0,383) for the categories in this school as they enter just below the mean (-0,08) and finish noticeably above (0,307) with 10% of students on Top and 5% at Bottom.

We can conclude that this school is good at preparing and grading their students for some degrees and not so good for other fields of those that most students enroll in. Students that end up in Engineering and Health degrees improve the most, Humanities students perform worse and Social Science students maintain their performance.

Colégio Nossa Senhora do Rósario is the one with the overall lowest Delta Score (-0,69). Most of their students enroll in Social Science (35%), Engineering (26%) and Health (17%) categories.

The students at Social Science degrees enter with a positive Entry score (0,27) and achieve a negative 1st Year score (-0,403), they place 9% of their students at Top and 21% at Bottom.

Those in Engineering have a positive Entry score (0,214) and negative 1st Year score (-0,397), with three times more students placing Bottom (14%) than Top (5%).

The situation is the same for Health degrees, positive Entry score (0,458) and negative 1st Year score (-0,138) with 11% of students at the Top and 14% at Bottom.

We can conclude that this school reveals problems in the preparation of their students to most university courses, evidenced by their negative 1st year scores. It also stands out the inflation they give their students grades, as it achieves very high positive Entry scores for all categories, justified by their negative delta scores.

Escola Secundária da Maia is the school in those represented in Table 20 with the highest Delta score for a single category. The students from this school that enroll in Health degrees (11%) have a low Entry score (-0,396) and high 1st Year score (0,6). This means that for this particularly degree students are unfairly graded with their potential not being recognized by the school (evidenced by the very high delta score of 0,923) and their good preparation is evident by their positive 1st Year score.

This school does not achieve the same type of result for the other categories, the one where they place most of their students, Engineering (24%) achieves a delta score (-0,049) close to 0, meaning they are fairly graded. Whereas for Natural Science (23%) they over grade the students (Delta score of -0,151).

This means that this school is exceptionally good at preparing their students for Health degrees but overall is less impressive, only showing that above average performance for Health degrees.

This section illustrated the performance of schools in different clusters of degrees. We have seen that clusters vary between themselves. Schools place the majority of their students in few categories, and generally achieve different outcomes for each category. We have also seen that within a school (by 1st Year scores) the preparation for students in these categories is very different as well as the fairness of the accuracy of the grading system of the school (by Delta score).

5. Predictors of Success

As we proposed to understand which are the main variables that affect the students' performance, we will now proceed with a linear regression analysis.

These models were computed using the software Rstudio.

We began by computing a linear regression using Entry grades for students who completed 45 ECTS or more to understand how these affect 1st Year score.

The result was as follows:

1st Year Score = -1,68 + 0,108*Entry grade; With a P-value of 0 and R^2 of 0,04.

The P-value being 0 means that this model is statistically significant, although as the R^2 is of 0,0509 it means that the Entry grade variable only explains 5,09% of the 1st Year scores. That being said we see that higher Entry grades mean higher 1st Year scores.

To obtain a more complete model we then computed one including Entry grades, the gender and type of school, to understand if and which of these variables most impact the students' academic success at the first year at University.

We obtained the following result:

1st Year score = -1,77 + 0,118*Entry grade + 0,003*Gender – 0,311*Type; With a P-value of 0 and R^2 of 0,06.

As previously stated the P-value of 0 means the model is statistically significant and the R^2 means these variables explain 6% of the results.

As would be expected, due to this model containing more variables it explains more of the results, although it is still not enough to accurately predict the students' performance.

Also in this case the variable gender is not statistically significant and the variable most affecting the 1st Year Score is Entry grades.

In our model we categorized Females as 1 and Males as 0 and for Type of school Private is 1 and Public is 0. With this in mind we can conclude that being a female affects the 1st Year score positively and attending a private school negatively.

While this model does not achieve a high rate of explaining the scores it is useful in understanding which variables most affect the students' performance.

Attending a private school produces a negative effect on the students 1st Year score.

As the Entry grade increases it achieves a positive effect on the students 1st Year score.

In this case gender is not statistically significant and it is the least affecting variable, therefore it should not be considered, although as we will present in the continuation of this section, usually being a female influences the academic performance positively.

Our findings here are similar to those Cabral and Pechincha (2014) found in their study, they computed two models. The first, like ours, attempted to predict academic success by Entry grades, they found this model explained only 4,5% of scores (our model explains 5,09%). Their second model computed Entry grades, type of school, gender and Entry option, finding that the variable most affecting the performance (negatively) to be attending a private school

and the one least affecting to be the Entry grade, this second model explained 5,92% of the results.

To further develop this analysis we computed a different regression, this time using Entry Scores, gender and type of school attended to understand if using Entry scores it would be possible to better predict academic performance.

We begin by using ECTS as the measure of academic success and when using Entry Score, gender and type of school achieve the following result:

ECTS = 42,58 + 3,1*Entry Score + 3,69*Gender – 4,48*Type; P-Value = 0 and R^2=0,036

In this case we find that none of these variables help in explaining the amount of ECTS completed by the students, as only 3,6% of the variation in ECTS' are explained and all variables are statistically significant.

Measuring success by 1st Year Score, we used Entry Scores, Gender and Type of school only for those students who had completed at least 45 ECTS (75% of the total). Achieving the following equation:

1st Year Score = 0.1516 + 0.42*Entry Score – 0.0054*Gen – 0.339*Type; P-Value = 0 and R^2 = 0,208

Our findings justify nearly 21% of the 1st Year Scores, although in this case Gender is not statistically significant as its P-Value is 0,8.

To understand if the scenarios seen until now are equal for all the different degrees, we are going to perform the same analysis but this time dividing the students by the different clusters of degrees presented earlier.

To simplify the reading of these results they will be shown in the format of a Table, showing for each cluster the estimated values for the variables, P-Value, R^2, the variables T-Value (to aid in understanding which ones are influencing the most) and if each variable is statistically significant ("SS"), assuming Yes when each variables P-value is less than 0,05 and No when it is higher.

The first table shows the regression for all students as to predict by Entry Score, gender and type of school the ECTS completed. The second table will predict by the same variables the 1st Year Score for the students who completed 45 ECTS or more. Remember when looking at the results that for Gender 1 is being female and 0 male and for Type 1 means attending a private school and 0 a public one.

Table 21: Multiple linear regressions for ECTS

		Intercept	Entry Score	Gender	Type	P-Value	R^2
Art	ECTS	45,5	1,37	1,84	1,95	0,17	0,0029
	T-Value	30,54	1,65	1,06	0,94		
	SS	Yes	No	No	No		
Engineering	ECTS	43,07	4,49	2,52	-5,33	0	0,054
	T-Value	70,89	10,15	2,66	-5,52		
	SS	Yes	Yes	Yes	Yes		
Health	ECTS	48,02	1,65	-0,25	-5,82	0	0,026
	T-Value	49,04	3,61	-0,24	-6,28		
	SS	Yes	Yes	No	Yes		
Humanities	ECTS	41,81	2,81	5,66	-1,84	0	0,031
	T-Value	34,49	4,45	4,08	-1,11		
	SS	Yes	Yes	Yes	No		
Law	ECTS	35,61	5,84	6,95	-8,14	0	0,12
	T-Value	25,25	8,2	4,53	-5,52		
	SS	Yes	Yes	Yes	Yes		
Natural Sciences	ECTS	35,73	4,27	5,68	-6,94	0	0,059
	T-Value	34,95	6,56	4,44	-4,49		
	SS	Yes	Yes	Yes	Yes		
Social Sciences	ECTS	46,3	2,19	3,49	-4,61	0	0,03
	T-Value	52,68	4,54	3,53	-4,69		
	SS	Yes	Yes	Yes	Yes		
Sports	ECTS	41,85	2,09	5,82	-2,1	0,023	0,032
	T-Value	25,94	1,79	2,37	-0,86		
	SS	Yes	No	Yes	No		

Table 21 allows for some very interesting conclusions regarding ECTS completion.

We see that these variables (Entry score, gender and type of school) are statistically significant for some clusters of degrees and not for others. Only for Engineering, Law, Natural Sciences and Social Sciences are all three statistically significant. We also see that the R^2 tends to achieve very low rates of explanation, the highest value is for Health degrees and even in that the variables explain only 12% of the ECTS completed.

As seen for Art degrees regressions are not statistically significant (P-value of 0,17).

Aside from Art only in Sports is Entry Score not statistically significant. Also whenever gender is significant it assumes a positive value, meaning females are better at completing ECTS. Regarding attending a private school, whenever it is statistically significant, it assumes negative values.

One other aspect to notice is the fact that T-values are always much higher for the Intercept, which means that these variables are not affecting much the ECTS output.

In general, it is not possible to predict ECTS completion from these equations.

In the next table we study the same variables but this time to predict 1st Year Score for the students who completed 45 ECTS or more.

Table 22: Multiple linear regressions for 1st Year Score

		Intercept	Entry Score	Gender	Type	P-Value	R^2
Art	1st Year Score	0,21	0,41	-0,16	-0,28	0	0,18
	T-Value	2,94	10,31	-1,99	-2,86		
	SS	Yes	Yes	Yes	Yes		
Engineering	1st Year Score	0,19	0,47	-0,02	-0,51	0	0,295
	T-Value	6,42	23	-0,49	-10,34		
	SS	Yes	Yes	No	Yes		
Health	1st Year Score	0,18	0,34	0,053	-0,47	0	0,169
	T-Value	3,41	13,73	0,95	-9,07		
	SS	Yes	Yes	No	Yes		
Humanities	1st Year Score	0,221	0,43	-0,16	-0,25	0	0,212
	T-Value	3,5	14,1	-2,31	-3,02		
	SS	Yes	Yes	Yes	Yes		
Law	1st Year Score	0,003	0,46	0,07	-0,03	0	0,254
	T-Value	0,033	12,51	0,77	-0,3		
	SS	No	Yes	No	No		
Natural Sciences	1st Year Score	0,044	0,38	0,04	-0,2	0	0,144
	T-Value	0,71	10,26	0,48	-2,09		
	SS	No	Yes	No	Yes		
Social Sciences	1st Year Score	0,18	0,44	-0,01	-0,31	0	0,221
	T-Value	4,05	17,88	-0,21	-6,08		
	SS	Yes	Yes	No	Yes		
Sports	1st Year Score	0,05	0,37	0,45	-0,24	0	0,221
	T-Value	0,5	5,66	3,38	-1,74		
	SS	No	Yes	Yes	No		

Looking at Table 22 we see that when predicting 1st Year Scores, all clusters of degrees are statistically significant and when comparing to explaining ECTS we have much higher R^2. The cluster of degrees where 1st Year Scores are least explained is Natural Sciences (14,4%) and the highest is Engineering (29,5%).

Another big change for when comparing with ECTS completion is that the variable Entry Score is for all clusters the biggest influencer of 1st Year Scores.

We also see for the first time in this study being a female not influencing positively the academic performance, this is seen for Art and Humanities degrees.

Attending private schools remains a negative factor in the performance of students.

Looking at these two tables it is clear from the variables used, that they are more efficient at predicting 1st Year Scores (when using students who complete at least 75% of the subjects) then predicting ECTS completion (for all students).

We also conclude that, when the variables are statistically significant, most of the times being a female leads to a positive outcome and attending private schools always leads to a negative one.

It was also interesting to see that for 1st Year Scores some clusters of degrees are affected by gender or type of school attended and others are not, while Entry Score is always significant and the most affecting variable.

Our findings here are similar to those of Smith and Naylor (2005) regarding the attendance of a private school affecting students negatively and prior grades affecting academic performance, they are also similar to those of Birch and Miller (2007) who found the same phenomenon for private schools and scores influencing positively as the score increased, as well as that females performed better than males.

Regarding the findings of Danilowicz-Gösele, Kamila, et al (2017), who found Entry grades as a good predictor of academic success but even better at predicting if students would complete their course, we achieve somewhat different results, we find Entry Scores to be the strongest predictor of the variables used, although what we found regarding ECTS completion (course completion) is that neither of the variables we used are good at predicting it.

6. DEA

In this section we will perform a DEA analysis to aggregate the various KPIs of schools.

DEA is a comparative technique used to identify performance. It characterizes DMU´s (Decision Making units) which in our case are the schools by comparing them with the benchmarks (the best DMU´s).

This analysis assumes that those schools that are not benchmarks are inefficient.

The model used for the DEA analysis assumes a convex structure, variable returns to scale due to our outputs being scale free, meaning that they are not directly comparable amongst them, for example a student achieving a Top rank and completing all ECTS are both important although it is not possible to directly compare them and understand which one is more important. Additive distance to allow the use of negative values and assumes an output orientation given that our goal is to find which are the schools that produce the best outputs, which is the same as to say the schools that maximize the students' performance.

We used for each school as input the Entry score of the students and as outputs the 1st Year score, the amount of ECTS completed, the percentage of Top students and the percentage of non bottom and non 0 ECTS students. The reason for Bottom and 0 ECTS being applied to the model as those students that do not fit the categories is due to the orientation of our model (output). As we valorize more the schools which produce more outputs we needed to transform these variables in such a way that the model could understand the positive part

of the variables. We began by using the model for those schools that placed 10 or more students at university.

The table with the direct results from the DEA, from which the table with the rankings was created, can be found in the Attachments (Table 29 and Table 30)

By interpreting those results we constructed the ranks. The schools in the frontier (being the best) are differentiated by those which are considered the benchmark more times. For example we see Escola Secundária Oliveira Júnior which is in the frontier (Score of 0) and is the benchmark more times than any other school in the frontier (139), being awarded the first place.

The following schools in the rank are placed as those closer to the frontier (represented by the lowest scores).

Our initial results show us the schools rank. Looking at the best school, Escola Secundária Oliveira Júnior, this school places 12 students in University who complete nearly all of the available ECTS (55), has no students in the 0 ECTS category and manages to place 17% of those on Top and 8% on Bottom with an Entry score of 0,225 and a 1st Year score 0,514.

Looking at the middle of the table we see Escola Secundária de Monção, with 29 students at University, an average of 45 ECTS, 10% of students not completing any ECTS, 0% of Top and 17% of Bottom students, with an Entry score of -0,113 and 1st Year Score of -0,216.

At last place, Colégio de Ermesinde with 10 students at University completing an average of 17 ECTS, of those 20% do not complete any ECTS, none ranks as Top and 80% rank Bottom, with an Entry score of 0,059 and 1st Year Score of -1,296.

Table 23: Schools' Rank for schools which place 10 or more students at University

Rank	Schools	Nº Students	Entry Grade	ECTS	1st Year Grade	0 ECTS (%)	Top (%)	Bottom (%)	Entry Score	1st Year Score	Δ Score
1	Escola Secundária Oliveira Júnior	12	15,1	55	14,1	0 (0%)	2 (16,6%)	1 (8,33%)	0,225	0,514	0,288
2	Escola Secundária de Pombal	10	15,5	55	14,1	0 (0%)	0 (0%)	1 (10%)	-0,324	0,186	0,510
3	Escola Secundária de Vilela	25	15,3	55	13,6	1 (4%)	5 (20%)	2 (8%)	0,033	0,362	0,329
4	Escola Secundária Daniel Faria - Baltar	14	15,0	53	13,2	0 (0%)	1 (7,14%)	0 (0%)	-0,283	0,119	0,403
5	Escola Secundária de Cantanhede	10	17,2	47	13,9	1 (10%)	0 (0%)	2 (20%)	-0,510	0,008	0,517
6	Escola Secundária de Barcelinhos	29	15,8	47	13,8	4 (13,7%)	5 (17,2%)	4 (13,7%)	-0,204	0,350	0,554
7	Escola Secundária da Senhora da Hora	26	14,9	54	13,4	0 (0%)	1 (3,84%)	2 (7,69%)	-0,315	-0,043	0,272
8	Escola Básica e Secundária de Castelo de Paiva	13	15,6	50	14,7	1 (7,69%)	4 (30,7%)	2 (15,3%)	0,117	0,824	0,707
9	Externato Académico	53	13,7	34	12,3	7 (13,2%)	1 (1,88%)	23 (43,3%)	-0,632	-0,731	-0,099
10	Escola Secundária Rodrigues de Freitas	14	14,1	46	13,4	0 (0%)	0 (0%)	2 (14,2%)	-0,453	0,058	0,511
11	Escola Secundária Arquitecto Oliveira Ferreira	14	16,1	48	13,9	1 (7,14%)	2 (14,2%)	2 (14,2%)	-0,231	-0,145	0,086
11	Escola Secundária de Alfena	12	15,9	52	14,2	0 (0%)	1 (8,33%)	1 (8,33%)	-0,040	0,353	0,392
11	Escola Secundária de S. Pedro da Cova	11	16,4	47	13,1	0 (0%)	1 (9,09%)	2 (18,1%)	-0,256	-0,145	0,111
11	Instituto de Educação e Desenvolvimento - INED	16	15,7	50	13,8	0 (0%)	3 (18,7%)	1 (6,25%)	0,258	0,239	-0,020
12	Escola Básica e Secundária Oliveira Júnior	48	16,6	52	14,0	1 (2,08%)	7 (14,5%)	4 (8,33%)	0,033	0,234	0,201
13	Escola Secundária de Caldas das Taipas	24	17,1	52	13,9	1 (4,16%)	2 (8,33%)	2 (8,33%)	0,026	0,084	0,057
14	Externato Delfim Ferreira - Delfinopolis	42	17,4	53	13,5	2 (4,76%)	1 (2,38%)	4 (9,52%)	0,592	-0,123	-0,715
15	Escola Secundária Camilo Castelo Branco	19	13,8	44	12,8	1 (5,26%)	0 (0%)	4 (21,0%)	-0,469	-0,363	0,106
16	Escola Secundária da Trofa	29	16,6	51	13,9	2 (6,89%)	3 (10,3%)	2 (6,89%)	0,114	0,212	0,097
17	Escola Secundária Sá de Miranda	11	16,7	52	13,1	0 (0%)	0 (0%)	1 (9,09%)	-0,194	-0,402	-0,208
18	Escola Secundária Tomaz Pelayo	41	16,4	51	13,8	0 (0%)	6 (14,6%)	3 (7,31%)	0,328	0,153	-0,175
19	Escola Básica e Secundária de Melgaço	15	16,5	48	14,1	1 (6,66%)	4 (26,6%)	2 (13,3%)	0,122	0,384	0,261
20	Escola Secundária Dr. Mário Sacramento	51	17,1	50	14,2	5 (9,80%)	8 (15,6%)	8 (15,6%)	0,032	0,376	0,344
20	Escola Cooperativa Vale S. Cosme (Didaxis)	13	15,8	51	13,3	1 (7,69%)	0 (0%)	1 (7,69%)	0,088	-0,081	-0,170
21	Escola Secundária Alexandre Herculano	40	14,4	41	13,5	5 (12,5%)	2 (5%)	12 (30%)	-0,437	-0,081	0,357
22	Escola Básica e Secundária de Búzio - Vale de Cambra	46	16,3	51	13,7	2 (4,34%)	2 (4,34%)	6 (13,0%)	0,009	0,074	0,064
23	Escola Secundária de São Pedro do Sul	10	17,8	51	14,0	1 (10%)	0 (0%)	1 (10%)	0,545	0,291	-0,254
23	Escola Básica e Secundária Arga e Lima - Lanheses	18	16,9	51	12,8	0 (0%)	1 (5,55%)	1 (5,55%)	0,055	-0,461	-0,516
24	Escola Básica e Secundária de Sever do Vouga	11	17,1	50	13,6	1 (9,09%)	1 (9,09%)	1 (9,09%)	-0,143	-0,113	0,030
25	Escola Secundária Carolina Michaellis	49	15,5	50	13,7	2 (4,08%)	3 (6,12%)	5 (10,2%)	-0,240	0,188	0,428
26	Cooperativa de Ensino DIDALVI - Alvito	13	16,9	50	13,3	0 (0%)	1 (7,69%)	1 (7,69%)	0,041	-0,227	-0,267
27	Escola Secundária José Estevão	26	17,0	50	14,2	2 (7,69%)	1 (3,84%)	4 (15,3%)	0,101	0,241	0,140
28	Escola Secundária de S. Pedro	55	17,1	50	14,1	4 (7,27%)	5 (9,09%)	7 (12,7%)	0,245	0,236	-0,010
29	Escola Secundária de Lousada	68	16,4	49	13,9	5 (7,35%)	6 (8,82%)	8 (11,7%)	-0,186	0,187	0,373
30	Escola Secundária Camilo Castelo Branco-V.N.Famalicão	48	16,6	50	13,6	1 (2,08%)	1 (2,08%)	6 (12,5%)	0,074	-0,098	-0,172
31	Escola Secundária Almeida Garrett	21	14,6	50	13,1	0 (0%)	1 (4,76%)	2 (9,52%)	-0,073	-0,148	-0,075
32	Escola Secundária Latino Coelho	47	17,4	50	13,6	2 (4,25%)	1 (2,12%)	7 (14,8%)	0,136	-0,216	-0,352
33	Instituto Nun Álvares - Santo Tirso	21	16,6	48	13,3	1 (4,76%)	2 (9,52%)	3 (14,2%)	-0,244	-0,197	0,048
34	Colégio Paulo VI	22	15,6	49	12,9	0 (0%)	2 (9,09%)	1 (4,54%)	0,237	-0,212	-0,449
35	Escola Secundária Ferreira de Castro	53	16,7	49	14,2	6 (11,3%)	4 (7,54%)	9 (16,9%)	-0,158	0,170	0,328
36	Escola Básica e Secundária de Muralhas do Minho - Valença	10	15,1	49	13,2	1 (10%)	0 (0%)	1 (10%)	-0,188	-0,115	0,073
37	Escola Secundária João Silva Correia	37	15,8	48	13,7	4 (10,8%)	1 (2,70%)	5 (13,5%)	-0,068	0,049	0,117
38	Escola Secundária de Monserrate	92	16,8	49	13,6	6 (6,52%)	6 (6,52%)	15 (16,3%)	0,015	-0,154	-0,168
39	Escola Secundária de Carvalhos	20	15,1	48	13,0	3 (15%)	0 (0%)	3 (15%)	-0,077	0,104	0,181
40	Escola Básica e Secundária D. Moisés Alves de Pinho	26	16,6	48	13,6	3 (11,5%)	2 (7,69%)	4 (15,3%)	-0,029	-0,069	-0,039
41	Escola Secundária de Tondela	11	17,1	48	13,6	1 (9,09%)	1 (9,09%)	1 (9,09%)	0,453	-0,027	-0,481
42	Escola Secundária Alcaides de Faria - Arcozelo	41	16,2	48	13,2	3 (7,31%)	0 (0%)	6 (14,6%)	-0,125	-0,273	-0,148
43	Escola Secundária Soares dos Reis	69	16,4	47	14,0	4 (5,79%)	7 (10,1%)	10 (14,4%)	-0,178	0,116	0,294
44	Escola Secundária de Ponte de Lima	58	16,7	48	13,6	3 (5,17%)	5 (8,62%)	10 (17,2%)	0,023	-0,048	-0,071
45	Escola Secundária de Padrão da Légua	29	16,6	48	14,5	2 (6,89%)	4 (13,7%)	5 (17,2%)	0,172	0,466	0,294
46	Escola Secundária de Alpendurada	30	15,9	48	13,1	3 (10%)	2 (6,66%)	4 (13,3%)	-0,179	-0,002	0,176
47	Colégio Nossa Senhora da Bonança	18	17,4	48	13,7	0 (0%)	3 (16,6%)	4 (22,2%)	0,407	0,186	-0,221
48	Colégio Luso-Francês	108	16,5	48	13,7	7 (6,48%)	10 (9,25%)	16 (14,8%)	0,371	0,063	-0,307
49	Escola Secundária Alberto Sampaio	43	16,7	48	13,3	3 (6,97%)	1 (2,32%)	7 (16,2%)	0,084	-0,235	-0,320
50	Escola Secundária Eça de Queirós - Póvoa de Varzim	138	16,8	48	13,7	13 (9,42%)	11 (7,97%)	24 (17,3%)	0,264	0,007	-0,257
51	Escola Básica e Secundária à Beira Douro	14	15,1	38	13,7	3 (21,4%)	1 (7,14%)	4 (28,5%)	-0,401	0,014	0,415
52	Escola Básica e Secundária Prof.António da Natividade - Mesão Frio	11	16,5	46	12,9	1 (9,09%)	0 (0%)	2 (18,1%)	-0,351	-0,322	0,028
53	Cooperativa de Ensino Didáxis	16	15,6	48	13,1	1 (6,25%)	1 (6,25%)	2 (12,5%)	0,160	-0,276	-0,436
53	Escola Secundária Dr. Serafim Leite	12	15,7	47	13,5	0 (0%)	1 (8,33%)	1 (8,33%)	-0,119	0,000	0,119
54	Colégio Liceal de Santa Maria de Lamas	105	16,4	47	13,6	7 (6,66%)	11 (10,4%)	19 (18,0%)	0,034	-0,047	-0,081
55	Escola Básica e Secundária Clara de Resende	79	16,1	47	13,8	4 (5,06%)	5 (6,32%)	13 (16,4%)	0,132	0,030	-0,102
56	Escola Básica e Secundária Dr. Manuel Pinto de Vasconcelos	20	15,8	47	13,6	1 (5%)	0 (0%)	3 (15%)	0,265	0,117	-0,148
57	Escola Secundária de Marco de Canaveses	92	16,6	47	13,4	8 (8,69%)	1 (1,08%)	15 (16,3%)	-0,145	-0,263	-0,119
58	Escola Secundária D. Sancho I	50	16,7	46	13,8	2 (4%)	3 (6%)	11 (22%)	-0,236	0,040	0,276
59	Escola Secundária de Rio Tinto	139	15,5	47	13,5	14 (10,0%)	11 (7,91%)	27 (19,4%)	-0,085	-0,002	0,083
60	Externato Infante D. Henrique	12	16,1	47	13,2	0 (0%)	0 (0%)	1 (8,33%)	0,376	-0,171	-0,547
61	Escola Secundária de Arouca	27	15,7	47	13,5	0 (0%)	0 (0%)	5 (18,5%)	-0,051	-0,113	-0,062
62	Escola Secundária de Esmoriz	22	15,6	47	13,7	2 (9,09%)	2 (9,09%)	4 (18,1%)	0,296	0,280	-0,016
63	Escola Secundária Clara de Resende	38	14,5	47	13,3	0 (0%)	3 (7,89%)	8 (21,0%)	0,003	-0,034	-0,037
64	Escola Secundária da Maia	194	15,9	47	13,5	18 (9,27%)	13 (6,70%)	38 (19,5%)	0,047	0,022	-0,025
65	Colégio D. Dinis (Stª Catarina)	16	15,0	43	13,5	2 (12,5%)	1 (6,25%)	3 (18,7%)	-0,334	-0,212	0,123
66	Escola Básica e Secundária de Celorico de Basto	16	15,6	47	12,2	3 (18,7%)	0 (0%)	3 (18,7%)	0,026	-0,683	-0,709
67	Escola Secundária Alves Martins	93	17,0	47	13,7	9 (9,67%)	3 (3,22%)	19 (20,4%)	0,073	-0,090	-0,163
68	Escola Secundária de Penafiel	137	16,3	46	13,3	13 (9,48%)	9 (6,56%)	25 (18,2%)	-0,127	-0,147	-0,021
69	Escola Artística Soares dos Reis	29	13,9	46	14,0	4 (13,7%)	2 (6,89%)	6 (20,6%)	-0,121	0,162	0,283
69	Colégio D. Dinis	44	13,4	41	13,0	3 (6,81%)	0 (0%)	14 (31,8%)	-0,431	-0,276	0,154
70	Externato de Vila Meã	32	16,8	46	13,3	5 (15,6%)	2 (6,25%)	6 (18,7%)	0,044	-0,129	-0,173
71	Escola Secundária Augusto Gomes	100	16,1	46	13,6	8 (8%)	7 (7%)	19 (19%)	0,060	0,047	-0,013
72	Escola Secundária Dr. Manuel Gomes de Almeida	120	16,4	46	13,9	8 (6,66%)	12 (10%)	23 (19,1%)	0,335	0,210	-0,124
73	Escola Secundária de Fafe	75	16,9	46	13,6	6 (8%)	9 (12%)	16 (21,3%)	-0,037	-0,047	-0,010
74	Escola Secundária Dr. António Granjo	18	16,3	45	13,5	1 (5,55%)	2 (11,1%)	3 (16,6%)	-0,152	-0,243	-0,091
75	Colégio Internato dos Carvalhos	194	16,1	46	13,7	18 (9,27%)	17 (8,76%)	38 (19,5%)	0,176	-0,001	-0,177
76	Escola Secundária de Paços de Ferreira	67	15,9	46	13,5	5 (7,46%)	2 (2,98%)	14 (20,8%)	-0,212	-0,101	0,111
77	Colégio de Amorim	11	16,6	46	13,5	1 (9,09%)	1 (9,09%)	2 (18,1%)	0,690	-0,188	-0,878
78	Escola Secundária de Ermesinde	111	15,5	45	13,5	10 (9,00%)	9 (8,10%)	23 (20,7%)	-0,089	0,016	0,104
79	Escola Secundária D. Dinis (Santo Tirso)	40	16,8	45	13,9	3 (7,5%)	2 (5%)	9 (22,5%)	-0,031	0,120	0,152
80	Escola Secundária Dr. Jaime Magalhães Lima	15	16,3	46	13,1	3 (20%)	1 (6,66%)	3 (20%)	0,104	-0,217	-0,321
81	Escola Secundária Aurélia de Sousa	169	16,1	45	13,7	16 (9,46%)	13 (7,69%)	29 (17,1%)	0,036	0,075	0,039
82	Escola Secundária de Monção	29	16,2	45	13,2	3 (10,3%)	0 (0%)	5 (17,2%)	-0,113	-0,216	-0,103
83	Escola Secundária Dr. Júlio Martins	18	15,8	43	13,1	1 (5,55%)	0 (0%)	5 (27,7%)	-0,372	-0,168	0,203
84	Escola Secundária D. Afonso Henriques	53	16,0	45	13,9	4 (7,54%)	8 (15,0%)	11 (20,7%)	-0,054	0,128	0,182
85	Escola Secundária Dr. José Macedo Fragateiro	43	16,4	45	13,5	4 (9,30%)	0 (0%)	10 (23,2%)	-0,098	-0,203	-0,105
86	Escola Secundária Francisco de Holanda	49	16,4	45	13,5	4 (8,16%)	4 (8,16%)	12 (24,4%)	0,033	-0,001	-0,034
87	Escola Secundária Santa Maria Maior	127	16,5	45	13,4	10 (7,87%)	9 (7,08%)	29 (22,8%)	-0,074	-0,204	-0,130
88	Escola Secundária D. Afonso Sanches	21	15,7	45	13,0	1 (4,76%)	1 (4,76%)	5 (23,8%)	-0,060	-0,350	-0,290
89	Escola Secundária de Caldas de Vizela	35	16,7	45	13,6	3 (8,57%)	4 (11,4%)	8 (22,8%)	0,054	0,109	0,055
90	Escola Secundária de Gondomar	105	14,8	44	13,4	16 (15,2%)	4 (3,80%)	22 (20,9%)	-0,290	-0,039	0,251

91	Escola Secundária Soares Basto - Oliveira de Azeméis	16	16,2	45	12,8	1 (6,25%)	0 (0%)	3 (18,7%)	-0,244	-0,408	-0,165
92	Escola Secundária Júlio Dinis	37	16,0	44	13,5	2 (5,40%)	3 (8,10%)	9 (24,3%)	-0,103	0,027	0,129
93	Escola Secundária Filipa de Vilhena	192	15,8	45	13,4	19 (9,89%)	10 (5,20%)	41 (21,3%)	-0,062	-0,098	-0,036
94	Colégio de Gaia	51	15,9	45	13,4	4 (7,84%)	4 (7,84%)	10 (19,6%)	0,139	-0,134	-0,273
95	Escola Secundária Diogo de Macedo	28	14,6	41	13,2	5 (17,8%)	0 (0%)	7 (25%)	-0,393	-0,166	0,227
96	Colégio Nossa Senhora do Rosário	218	17,1	45	13,3	18 (8,25%)	17 (7,79%)	45 (20,6%)	0,424	-0,266	-0,690
96	Escola Secundária Abade de Baçal	23	16,6	45	12,8	2 (8,69%)	2 (8,69%)	4 (17,3%)	0,287	-0,450	-0,737
97	Colégio de Albergaria	16	17,4	44	12,8	1 (6,25%)	0 (0%)	4 (25%)	-0,276	-0,650	-0,375
98	Escola Secundária de Santa Maria da Feira	121	16,0	44	13,7	13 (10,7%)	11 (9,09%)	28 (23,1%)	0,113	0,134	0,021
99	Escola Secundária Viriato	11	17,1	45	12,9	1 (9,09%)	0 (0%)	3 (27,2%)	0,456	-0,411	-0,867
100	Escola Secundária de Valongo	67	15,5	43	13,6	9 (13,4%)	4 (5,97%)	15 (22,3%)	-0,219	0,082	0,301
101	Escola Secundária João Gonçalves Zarco	110	15,8	43	13,4	13 (11,8%)	4 (3,63%)	23 (20,9%)	-0,112	-0,008	0,104
102	Escola Secundária Garcia de Orta	228	15,9	43	13,5	26 (11,4%)	10 (4,38%)	54 (23,6%)	0,067	0,058	-0,010
103	Escola Secundária de Almeida Garrett	163	15,9	43	13,7	19 (11,6%)	15 (9,20%)	36 (22,0%)	-0,032	0,083	0,115
103	Escola Básica e Secundária de Valdevez	20	16,7	43	13,2	2 (10%)	0 (0%)	7 (35%)	-0,079	-0,411	-0,332
104	Escola Secundária Rocha Peixoto	55	16,1	43	13,1	5 (9,09%)	5 (9,09%)	14 (25,4%)	-0,050	-0,245	-0,195
105	Escola Secundária Dr. João Araújo Correia	17	16,2	43	13,7	3 (17,6%)	0 (0%)	5 (29,4%)	-0,129	0,077	0,206
106	Escola Secundária António Sérgio	69	15,8	43	13,2	7 (10,1%)	2 (2,89%)	18 (26,0%)	-0,059	-0,238	-0,180
107	Escola Secundária Henrique Medina	38	16,6	42	13,6	6 (15,7%)	4 (10,5%)	9 (23,6%)	-0,069	0,034	0,102
108	Escola Secundária Dr. Manuel Laranjeira	82	16,3	43	13,3	10 (12,1%)	6 (7,31%)	19 (23,1%)	0,159	-0,172	-0,331
109	Escola Secundária de Paredes	105	15,7	42	13,4	15 (14,2%)	6 (5,71%)	28 (26,6%)	-0,085	-0,147	-0,062
110	Escola Secundária de Amarante	59	16,4	43	13,5	7 (11,8%)	2 (3,38%)	15 (25,4%)	0,044	-0,125	-0,169
111	Escola Secundária José Régio	97	16,1	42	13,5	13 (13,4%)	4 (4,12%)	24 (24,7%)	-0,031	-0,076	-0,045
111	Escola Secundária de Mirandela	30	15,8	42	13,3	1 (3,33%)	1 (3,33%)	9 (30%)	-0,072	-0,196	-0,124
112	Escola Secundária Abel Salazar	43	15,6	42	13,3	3 (6,97%)	3 (6,97%)	12 (27,9%)	0,134	-0,083	-0,217
112	Escola Secundária de Vila Cova da Lixa	35	16,4	42	13,4	5 (14,2%)	3 (8,57%)	8 (22,8%)	-0,017	-0,232	-0,215
113	Escola Secundária Dr. Joaquim Gomes Ferreira Alves	108	16,2	43	13,3	13 (12,0%)	2 (1,85%)	32 (29,6%)	0,069	-0,241	-0,310
114	Escola Secundária Carlos Amarante	43	16,6	42	13,2	8 (18,6%)	2 (4,65%)	11 (25,5%)	-0,095	-0,327	-0,232
115	Externato de São Miguel de Refojos	27	16,5	43	13,6	3 (11,1%)	1 (3,70%)	7 (25,9%)	0,263	-0,191	-0,454
116	Escola Secundária Padre Benjamim Salgado - Joane	22	16,7	42	13,6	3 (13,6%)	1 (4,54%)	6 (27,2%)	-0,136	-0,159	-0,023
117	Escola Básica e Secundária de Macedo de Cavaleiros	11	17,1	42	13,0	2 (18,1%)	0 (0%)	2 (18,1%)	-0,216	-0,635	-0,418
118	Escola Básica e Secundária Vale de Ovil - Baião	32	15,3	38	12,4	4 (12,5%)	0 (0%)	8 (25%)	-0,411	-0,717	-0,305
119	Colégio São Gonçalo	65	16,9	42	13,2	5 (7,69%)	4 (6,15%)	17 (26,1%)	-0,050	-0,472	-0,422
120	Externato Paulo VI	126	17,0	42	13,6	12 (9,52%)	10 (7,93%)	33 (26,1%)	0,219	-0,146	-0,365
121	Escola INED - Nevogilde	32	17,3	42	13,3	7 (21,8%)	1 (3,12%)	9 (28,1%)	-0,118	-0,360	-0,242
122	Escola Secundária do Castêlo da Maia	22	15,0	42	12,7	3 (13,6%)	1 (4,54%)	5 (22,7%)	-0,010	-0,352	-0,342
123	Colégio Alemão do Porto	25	15,8	41	13,7	4 (16%)	3 (12%)	7 (28%)	0,112	0,381	0,270
124	Colégio D. Dinis (Antº. Carneiro)	23	15,6	42	12,7	4 (17,3%)	0 (0%)	6 (26,0%)	0,016	-0,536	-0,553
125	Escola Secundária Morgado de Mateus -Vila Real	19	16,5	40	13,3	3 (15,7%)	1 (5,26%)	5 (26,3%)	-0,297	-0,322	-0,025
126	Colégio Novo da Maia	54	17,1	41	13,3	7 (12,9%)	1 (1,85%)	16 (29,6%)	0,366	-0,255	-0,621
127	Escola Básica e Secundária de Águas Santas	56	15,6	40	13,5	10 (17,8%)	2 (3,57%)	13 (23,2%)	-0,070	-0,033	0,037
128	Escola Secundária de Inês de Castro	83	15,7	40	13,3	7 (8,43%)	3 (3,61%)	24 (28,9%)	-0,039	-0,231	-0,192
129	Colégio Casa Mãe	34	17,6	41	12,9	4 (11,7%)	2 (5,88%)	9 (26,4%)	0,270	-0,604	-0,873
130	Escola Secundária Martins Sarmento	28	15,6	40	13,2	4 (14,2%)	2 (7,14%)	8 (28,5%)	-0,053	-0,183	-0,130
131	Escola Secundária Afonso de Albuquerque	18	15,7	40	12,6	0 (0%)	1 (5,55%)	6 (33,3%)	0,375	-0,279	-0,655
132	Escola Secundária de Oliveira do Douro	12	15,1	39	13,6	2 (16,6%)	1 (8,33%)	3 (25%)	-0,051	0,197	0,248
133	Escola Secundária de Barcelos	40	16,4	40	13,7	6 (15%)	2 (5%)	11 (27,5%)	0,018	-0,027	-0,045
134	Colégio Terras de Santa Maria	24	17,0	40	13,0	3 (12,5%)	0 (0%)	8 (33,3%)	0,241	-0,471	-0,712
135	Externato Camões	61	16,9	40	13,3	6 (9,83%)	2 (3,27%)	16 (26,2%)	0,134	-0,374	-0,507
136	Escola Secundária António Nobre	21	14,3	36	13,1	5 (23,8%)	3 (14,2%)	7 (33,3%)	-0,176	0,215	0,391
137	Escola Secundária de Felgueiras	43	15,9	39	13,6	6 (13,9%)	5 (11,6%)	14 (32,5%)	0,041	0,057	0,017
138	Escola Secundária da Boa Nova - Leça da Palmeira	40	15,2	39	12,9	4 (10%)	2 (5%)	12 (30%)	-0,153	-0,278	-0,125
139	Escola Secundária Camilo Castelo Branco - Vila Real	58	17,0	39	13,5	11 (18,9%)	3 (5,17%)	16 (27,5%)	-0,016	-0,121	-0,104
140	Colégio da Trofa	100	16,5	39	12,4	9 (9%)	1 (1%)	26 (26%)	-0,104	-0,758	-0,654
141	Colégio Sezim - Egas Moniz	22	16,9	38	12,9	3 (13,6%)	1 (4,54%)	8 (36,3%)	-0,047	-0,369	-0,322
142	Escola Secundária Prof. Dr. Flávio F. Pinto Resende	22	15,3	36	12,3	3 (13,6%)	1 (4,54%)	9 (40,9%)	-0,341	-0,603	-0,263
143	Cooperativa de Ensino Ancorensis	21	16,5	38	13,7	4 (19,0%)	1 (4,76%)	7 (33,3%)	-0,052	-0,058	-0,006
144	Externato Ribadouro	1020	17,0	38	13,0	109 (10,6%)	15 (1,47%)	326 (31,9%)	0,125	-0,503	-0,628
145	Escola Secundária Homem Cristo	14	15,5	37	13,7	2 (14,2%)	1 (7,14%)	4 (28,5%)	0,005	-0,076	-0,081
146	Escola Secundária Emídio Garcia	28	16,5	38	13,0	5 (17,8%)	0 (0%)	9 (32,1%)	-0,033	-0,591	-0,558
147	Grande Colégio Universal	25	16,7	38	12,2	3 (12%)	0 (0%)	8 (32%)	0,299	-0,639	-0,938
148	Escola Secundária Fernão de Magalhães	52	16,4	37	13,1	7 (13,4%)	2 (3,84%)	19 (36,5%)	0,027	-0,395	-0,423
149	Escola Básica e Secundária Rodrigues de Freitas	47	15,9	37	13,7	8 (17,0%)	3 (6,38%)	18 (38,2%)	0,073	0,031	-0,042
150	Escola Básica e Secundária Sidónio Pais - Caminha	24	15,9	37	12,3	3 (12,5%)	0 (0%)	7 (29,1%)	-0,180	-0,804	-0,624
151	Escola Secundária de Estarreja	14	16,1	37	13,2	2 (14,2%)	0 (0%)	6 (42,8%)	0,304	0,033	-0,271
152	Escola Secundária Eça de Queirós	19	14,3	36	12,8	2 (10,5%)	1 (5,26%)	8 (42,1%)	-0,143	-0,224	-0,081
153	Colégio de Lamego	29	17,0	36	13,8	7 (24,1%)	0 (0%)	10 (34,4%)	0,479	-0,054	-0,533
154	Colégio D. Diogo de Sousa	62	16,7	36	13,0	9 (14,5%)	0 (0%)	23 (37,0%)	-0,031	-0,545	-0,514
155	Escola Básica e Secundária de Canelas	11	16,6	35	13,2	3 (27,2%)	0 (0%)	3 (27,2%)	0,372	-0,088	-0,460
156	Externato Carvalho Araújo	54	15,8	30	12,7	10 (18,5%)	1 (1,85%)	24 (44,4%)	-0,364	-0,546	-0,183
157	Colégio D. Duarte	79	15,3	33	12,6	9 (11,3%)	3 (3,79%)	34 (43,0%)	-0,160	-0,628	-0,467
158	Colégio Ellen Key	14	15,9	33	12,8	3 (21,4%)	0 (0%)	6 (42,8%)	-0,228	-0,440	-0,212
159	Escola Secundária D. Maria II	17	15,5	31	13,4	5 (29,4%)	1 (5,88%)	7 (41,1%)	-0,205	0,023	0,228
161	Externato Júlio Dinis	18	16,3	31	12,6	3 (16,6%)	0 (0%)	8 (44,4%)	0,197	-0,576	-0,773
162	Colégio Luso Internacional do Porto - CLIP	22	17,2	30	13,3	4 (18,1%)	3 (13,6%)	12 (54,5%)	1,088	0,105	-0,983
163	Centro de Estudos Básico e Secundário - CEBES	53	15,6	25	12,6	15 (28,3%)	1 (1,88%)	27 (50,9%)	0,060	-0,592	-0,653
164	Colégio de Ermesinde	10	14,7	17	11,6	2 (20%)	0 (0%)	8 (80%)	0,059	-1,296	-1,355

Looking at our ranking we see that in the top 10 of schools, only one has more than 50 students (Externato Académico), with most schools placing from 10 to 30 students. This result even though it is a valid one fails to highlight those schools which are more relevant to the Universities, those being the schools that place there a high percentage of students.

To find out a ranking of the schools which are more relevant to the UP and UCP reality, we repeated the DEA analysis, but this time, considering only those schools which place 50 or more students at university.

The results achieved are shown in Table 24

Table 24: Schools' Rank for schools which place 50 or more students at University

Rank	Schools	Nº Students	Entry Grade	ECTS	1st Year Grade	0 ECTS (%)	Top (%)	Bottom (%)	Entry Score	1st Year Score	Δ Score
1	Escola Secundária Dr. Mário Sacramento	51	17,1	50	14,2	5 (9,80%)	8 (15,6%)	8 (15,6%)	0,032	0,376	0,344
2	Escola Secundária de Lousada	68	16,4	49	13,9	5 (7,35%)	6 (8,82%)	8 (11,7%)	-0,186	0,187	0,373
3	Escola Secundária de S. Pedro	55	17,1	50	14,1	4 (7,27%)	5 (9,09%)	7 (12,7%)	0,245	0,236	-0,010
4	Escola Secundária de Ponte de Lima	58	16,7	48	13,6	3 (5,17%)	5 (8,62%)	10 (17,2%)	0,023	-0,048	-0,071
4	Externato Académico	53	13,7	34	12,3	7 (13,2%)	1 (1,88%)	23 (43,3%)	-0,632	-0,731	-0,099
5	Escola Secundária Soares dos Reis	69	16,4	47	14,0	4 (5,79%)	7 (10,1%)	10 (14,4%)	-0,178	0,116	0,294
6	Escola Secundária D. Sancho I	50	16,7	46	13,8	2 (4%)	3 (6%)	11 (22%)	-0,236	0,040	0,276
7	Escola Secundária Dr. Manuel Gomes de Almeida	120	16,4	46	13,9	8 (6,66%)	12 (10%)	23 (19,1%)	0,335	0,210	-0,124
7	Escola Básica e Secundária Clara de Resende	79	16,1	47	13,8	4 (5,06%)	5 (6,32%)	13 (16,4%)	0,132	0,030	-0,102
7	Escola Secundária D. Afonso Henriques	53	16,0	45	13,9	4 (7,54%)	8 (15,0%)	11 (20,7%)	-0,054	0,128	0,182
8	Escola Secundária de Monserrate	92	16,8	49	13,6	6 (6,52%)	6 (6,52%)	15 (16,3%)	0,015	-0,154	-0,168
9	Escola Secundária Ferreira de Castro	53	16,7	49	14,2	6 (11,3%)	4 (7,54%)	9 (16,9%)	-0,158	0,170	0,328
10	Colégio Luso-Francês	108	16,5	48	13,7	7 (6,48%)	10 (9,25%)	16 (14,8%)	0,371	0,063	-0,307
11	Escola Secundária de Gondomar	105	14,8	44	13,4	16 (15,2%)	4 (3,80%)	22 (20,9%)	-0,290	-0,039	0,251
12	Colégio Liceal de Santa Maria de Lamas	105	16,4	47	13,6	7 (6,66%)	11 (10,4%)	19 (18,0%)	0,034	-0,047	-0,081
13	Escola Secundária de Marco de Canaveses	92	16,6	47	13,4	8 (8,69%)	1 (1,08%)	15 (16,3%)	-0,145	-0,263	-0,119
14	Escola Secundária Eça de Queirós - Póvoa de Varzim	138	16,8	48	13,7	13 (9,42%)	11 (7,97%)	24 (17,3%)	0,264	0,007	-0,257
15	Escola Secundária de Paços de Ferreira	67	15,9	46	13,5	5 (7,46%)	2 (2,98%)	14 (20,8%)	-0,212	-0,101	0,111
16	Escola Secundária de Rio Tinto	139	15,5	47	13,5	14 (10,0%)	11 (7,91%)	27 (19,4%)	-0,085	-0,002	0,083
17	Escola Secundária de Penafiel	137	16,3	46	13,3	13 (9,48%)	9 (6,56%)	25 (18,2%)	-0,127	-0,147	-0,021
18	Escola Secundária da Maia	194	15,9	47	13,5	18 (9,27%)	13 (6,70%)	38 (19,5%)	0,047	0,022	-0,025
19	Escola Secundária de Fafe	75	16,9	46	13,6	6 (8%)	9 (12%)	16 (21,3%)	-0,037	-0,047	-0,010
20	Escola Secundária Augusto Gomes	100	16,1	46	13,6	8 (8%)	7 (7%)	19 (19%)	0,060	0,047	-0,013
21	Escola Secundária Alves Martins	93	17,0	47	13,7	9 (9,67%)	3 (3,22%)	19 (20,4%)	0,073	-0,090	-0,163
22	Escola Secundária de Ermesinde	111	15,5	45	13,5	10 (9,00%)	9 (8,10%)	23 (20,7%)	-0,089	0,016	0,104
23	Colégio Internato dos Carvalhos	194	16,1	46	13,7	18 (9,27%)	17 (8,76%)	38 (19,5%)	0,176	-0,001	-0,177
24	Escola Secundária de Valongo	67	15,5	43	13,6	9 (13,4%)	4 (5,97%)	15 (22,3%)	-0,219	0,082	0,301
25	Escola Secundária Santa Maria Maior	127	16,5	45	13,4	10 (7,87%)	9 (7,08%)	29 (22,8%)	-0,074	-0,204	-0,130
26	Escola Secundária Aurélia de Sousa	169	16,1	45	13,7	16 (9,46%)	13 (7,69%)	29 (17,1%)	0,036	0,075	0,039
27	Escola Secundária Filipa de Vilhena	192	15,8	45	13,4	19 (9,89%)	10 (5,20%)	41 (21,3%)	-0,062	-0,098	-0,036
28	Colégio de Gaia	51	15,9	45	13,4	4 (7,84%)	4 (7,84%)	10 (19,6%)	0,139	-0,134	-0,273
29	Colégio Nossa Senhora do Rosário	218	17,1	45	13,3	18 (8,25%)	17 (7,79%)	45 (20,6%)	0,424	-0,266	-0,690
30	Escola Secundária João Gonçalves Zarco	110	15,8	43	13,4	13 (11,8%)	4 (3,63%)	23 (20,9%)	-0,112	-0,008	0,104
31	Escola Secundária de Santa Maria da Feira	121	16,0	44	13,7	13 (10,7%)	11 (9,09%)	28 (23,1%)	0,113	0,134	0,021
32	Escola Secundária Rocha Peixoto	55	16,1	43	13,1	5 (9,09%)	5 (9,09%)	14 (25,4%)	-0,050	-0,245	-0,195
33	Escola Secundária Garcia de Orta	228	15,9	43	13,5	26 (11,4%)	10 (4,38%)	54 (23,6%)	0,067	0,058	-0,010
34	Escola Secundária de Almeida Garrett	163	15,9	43	13,7	19 (11,6%)	15 (9,20%)	36 (22,0%)	-0,032	0,083	0,115
35	Escola Secundária António Sérgio	69	15,8	43	13,2	7 (10,1%)	2 (2,89%)	18 (26,0%)	-0,059	-0,238	-0,180
36	Escola Secundária de Paredes	105	15,7	42	13,4	15 (14,2%)	6 (5,71%)	28 (26,6%)	-0,085	-0,147	-0,062
37	Escola Secundária Dr. Manuel Laranjeira	82	16,3	43	13,3	10 (12,1%)	6 (7,31%)	19 (23,1%)	0,159	-0,172	-0,331
38	Escola Secundária José Régio	97	16,1	42	13,5	13 (13,4%)	4 (4,12%)	24 (24,7%)	-0,031	-0,076	-0,045
39	Escola Secundária de Amarante	59	16,4	43	13,5	7 (11,8%)	2 (3,38%)	15 (25,4%)	0,044	-0,125	-0,169
40	Colégio São Gonçalo	65	16,9	42	13,2	5 (7,69%)	4 (6,15%)	17 (26,1%)	-0,050	-0,472	-0,422
41	Escola Secundária Dr. Joaquim Gomes Ferreira Alves	108	16,2	43	13,3	13 (12,0%)	2 (1,85%)	32 (29,6%)	0,069	-0,241	-0,310
42	Externato Paulo VI	126	17,0	42	13,6	12 (9,52%)	10 (7,93%)	33 (26,1%)	0,219	-0,146	-0,365
43	Escola Básica e Secundária de Águas Santas	56	15,6	40	13,5	10 (17,8%)	2 (3,57%)	13 (23,2%)	-0,070	-0,033	0,037
44	Colégio Novo da Maia	54	17,1	41	13,3	7 (12,9%)	1 (1,85%)	16 (29,6%)	0,366	-0,255	-0,621
45	Escola Secundária de Inês de Castro	83	15,7	40	13,3	7 (8,43%)	3 (3,61%)	24 (28,9%)	-0,039	-0,231	-0,192
46	Externato Camões	61	16,9	40	13,3	6 (9,83%)	2 (3,27%)	16 (26,2%)	0,134	-0,374	-0,507
47	Colégio da Trofa	100	16,5	39	12,4	9 (9%)	1 (1%)	26 (26%)	-0,104	-0,758	-0,654
48	Escola Secundária Camilo Castelo Branco - Vila Real	58	17,0	39	13,5	11 (18,9%)	3 (5,17%)	16 (27,5%)	-0,016	-0,121	-0,104
49	Externato Carvalho Araújo	54	15,8	30	12,7	10 (18,5%)	1 (1,85%)	24 (44,4%)	-0,364	-0,546	-0,183
50	Externato Ribadouro	1020	17,0	38	13,0	109 (10,6%)	15 (1,47%)	326 (31,9%)	0,125	-0,503	-0,628
51	Escola Secundária Fernão de Magalhães	52	16,4	37	13,1	7 (13,4%)	2 (3,84%)	19 (36,5%)	0,027	-0,395	-0,423
52	Colégio D. Diogo de Sousa	62	16,7	36	13,0	9 (14,5%)	0 (0%)	23 (37,0%)	-0,031	-0,545	-0,514
53	Colégio D. Duarte	79	15,3	33	12,6	9 (11,3%)	3 (3,79%)	34 (43,0%)	-0,160	-0,628	-0,467
54	Centro de Estudos Básico e Secundário - CEBES	53	15,6	25	12,6	15 (28,3%)	1 (1,88%)	27 (50,9%)	0,060	-0,592	-0,653

Table 24 shows the schools ranking for those that place 50 or more students.

It can be used to compare the major schools at placing students at UP and UCP.

As the model considers as inputs the Entry score and evaluates which schools can produce the best outputs given their input, the best schools considered in the ranks will tend to be those that under-evaluate their students, only then followed by those that fairly grade them.

An overlook at Table 24 shows that most of the schools at the top of the rank achieve positive 1st Year scores.

The schools at the bottom of the table are characterized by having negative 1st Year scores with high percentages of Bottom.

To better visualize this Table 25 shows the average variables for the Top and Bottom 10 schools.

Table 25: Averages for DEA variables for Top 10 schools

Rank	Schools	ECTS	0 ECTS (%)	Top (%)	Bottom (%)	Entry Score	1st Year Score	Δ Score
1	Escola Secundária Dr. Mário Sacramento	50	5 (9,80%)	8 (15,6%)	8 (15,6%)	0,032	0,376	0,344
2	Escola Secundária de Lousada	49	5 (7,35%)	6 (8,82%)	8 (11,7%)	-0,186	0,187	0,373
3	Escola Secundária de S. Pedro	50	4 (7,27%)	5 (9,09%)	7 (12,7%)	0,245	0,236	-0,010
4	Escola Secundária de Ponte de Lima	48	3 (5,17%)	5 (8,62%)	10 (17,2%)	0,023	-0,048	-0,071
4	Externato Académico	34	7 (13,2%)	1 (1,88%)	23 (43,3%)	-0,632	-0,731	-0,099
5	Escola Secundária Soares dos Reis	47	4 (5,79%)	7 (10,1%)	10 (14,4%)	-0,178	0,116	0,294
6	Escola Secundária D. Sancho I	46	2 (4%)	3 (6%)	11 (22%)	-0,236	0,040	0,276
7	Escola Secundária Dr. Manuel Gomes de Almeida	46	8 (6,66%)	12 (10%)	23 (19,1%)	0,335	0,210	-0,124
7	Escola Básica e Secundária Clara de Resende	47	4 (5,06%)	5 (6,32%)	13 (16,4%)	0,132	0,030	-0,102
7	Escola Secundária D. Afonso Henriques	45	4 (7,54%)	8 (15,0%)	11 (20,7%)	-0,054	0,128	0,182
Average		46	7,18%	9,14%	19,31%	-0,052	0,054	0,106

Table 26: Averages for DEA variables for Bottom 10 schools

Rank	Schools	ECTS	0 ECTS (%)	Top (%)	Bottom (%)	Entry Score	1st Year Score	Δ Score
45	Escola Secundária de Inês de Castro	40	7 (8,43%)	3 (3,61%)	24 (28,9%)	-0,039	-0,231	-0,192
46	Externato Camões	40	6 (9,83%)	2 (3,27%)	16 (26,2%)	0,134	-0,374	-0,507
47	Colégio da Trofa	39	9 (9%)	1 (1%)	26 (26%)	-0,104	-0,758	-0,654
48	Escola Secundária Camilo Castelo Branco - Vila Real	39	11 (18,9%)	3 (5,17%)	16 (27,5%)	-0,016	-0,121	-0,104
49	Externato Carvalho Araújo	30	10 (18,5%)	1 (1,85%)	24 (44,4%)	-0,364	-0,546	-0,183
50	Externato Ribadouro	38	109 (10,6%)	15 (1,47%)	326 (31,9%)	0,125	-0,503	-0,628
51	Escola Secundária Fernão de Magalhães	37	7 (13,4%)	2 (3,84%)	19 (36,5%)	0,027	-0,395	-0,423
52	Colégio D. Diogo de Sousa	36	9 (14,5%)	0 (0%)	23 (37,0%)	-0,031	-0,545	-0,514
53	Colégio D. Duarte	33	9 (11,3%)	3 (3,79%)	34 (43,0%)	-0,160	-0,628	-0,467
54	Centro de Estudos Básico e Secundário - CEBES	25	15 (28,3%)	1 (1,88%)	27 (50,9%)	0,060	-0,592	-0,653
Average		36	14,28%	2,59%	35,23%	-0,037	-0,469	-0,432

In these two tables we show the Top and Bottom 10 schools, the reason for this choice of number is that the top schools represented are those that from the

DEA analysis we identified as being in the frontier. To represent the Bottom schools we chose 10 as well as to maintain the same amount of schools shown.

It is interesting to look at these results, for example it is clear as to why Escola Secundária Dr. Mário Sacramento takes first place, it achieves the highest percentage of Top students and the highest 1st Year Score of the top schools and it fares well on all other categories, on the other hand we see also as a top school Externato Académico, looking at their results we find none that stands out, their ECTS completion is quite low (34) and their percentage of Bottom students (43,3%) is high for a top school, that being said their Entry Score is the lowest of all the schools that place 50 or more students. And as our DEA model used Entry Score as input this justifies their placement as a frontier school, by that we mean that their Entry Score is so low compared to the other schools that any outputs they produce immediately makes them stand out. That is reason this school is only Benchmark to two other schools (Escola Secundária Paços de Ferreira (6%) and Escola Secundária Valongo (7%)).

Regarding the schools at the Bottom, they achieve overall negative 1st Year Scores, considerable higher percentages of Bottom students and very rarely place students at the Top, whereas when looking at Entry Scores the results do not differ by much.

To give a more detailed vision of these schools we show in Table 27 and Table 28 some other variables for these schools.

Table 27: Other variables for Top 10 schools

Rank	Schools	District	Type	Total Students	Nº Students	% Placed Students	Entry Grade	1st Year Grade	Entry Score	1st Year Score	Δ Score
1	Escola Secundária Dr. Mário Sacramento	Aveiro	Public	595	51	9%	17,1	14,2	0,032	0,376	0,344
2	Escola Secundária de Lousada	Porto	Public	787	68	9%	16,4	13,9	-0,186	0,187	0,373
3	Escola Secundária de S. Pedro	Vila Real	Public	441	55	12%	17,1	14,1	0,245	0,236	-0,010
4	Escola Secundária de Ponte de Lima	Viana do Castelo	Public	634	58	9%	16,7	13,6	0,023	-0,048	-0,071
4	Externato Académico	Porto	Private	78	53	68%	13,7	12,3	-0,632	-0,731	-0,099
5	Escola Secundária Soares dos Reis	Porto	Public	N/A	69	N/A	16,4	14,0	-0,178	0,116	0,294
6	Escola Secundária D. Sancho I	Braga	Public	499	50	10%	16,7	13,8	-0,236	0,040	0,276
7	Escola Secundária Dr. Manuel Gomes de Almeida	Aveiro	Public	535	120	22%	16,4	13,9	0,335	0,210	-0,124
7	Escola Básica e Secundária Clara de Resende	Porto	Public	376	79	21%	16,1	13,8	0,132	0,030	-0,102
7	Escola Secundária D. Afonso Henriques	Porto	Public	418	53	13%	16,0	13,9	-0,054	0,128	0,182

Table 28: Other variables for Bottom 10 schools

Rank	Schools	District	Type	Total Students	Nº Students	% Placed Students	Entry Grade	1st Year Grade	Entry Score	1st Year Score	Δ Score
45	Escola Secundária de Inês de Castro	Porto	Public	337	83	25%	15,7	13,3	-0,039	-0,231	-0,192
46	Externato Camões	Porto	Private	293	61	21%	16,9	13,3	0,134	-0,374	-0,507
47	Colégio da Trofa	Porto	Private	341	100	29%	16,5	12,4	-0,104	-0,758	-0,654
48	Escola Secundária Camilo Castelo Branco - Vila Real	Vila Real	Public	508	58	11%	17,0	13,5	-0,016	-0,121	-0,104
49	Externato Carvalho Araújo	Braga	Private	508	54	11%	15,8	12,7	-0,364	-0,546	-0,183
50	Externato Ribadouro	Porto	Private	1802	1020	57%	17,0	13,0	0,125	-0,503	-0,628
51	Escola Secundária Fernão de Magalhães	Vila Real	Public	326	52	16%	16,4	13,1	0,027	-0,395	-0,423
52	Colégio D. Diogo de Sousa	Braga	Private	411	62	15%	16,7	13,0	-0,031	-0,545	-0,514
53	Colégio D. Duarte	Porto	Private	411	79	19%	15,3	12,6	-0,160	-0,628	-0,467
54	Centro de Estudos Básico e Secundário - CEBES	Porto	Private	204	53	26%	15,6	12,6	0,060	-0,592	-0,653

Some final conclusions to draw from this analysis, we see for the Bottom 10 schools, 70% are private, while at the Top only 10% are.

There may be two reasons to explain this, the first is that private students grades are inflated and do not correspond to their actual performance and as such it is only natural to see it drop at University.

The second is associated with a strong preparation by private schools for national exams, which would help boost the students Entry Score, although such a specific preparation would leave other fields of development to explore and students entering University would feel more "lost" than their peers who had more embracing preparations at high school, resulting in a more difficult adaptation to University and consequent drop of performance when compared to that of High School. Both these reasons fit with the general results of private schools which are (when compared to public schools) higher Entry Scores and much lower 1st Year Scores.

These two conditions either aggregated or individually, if applicable to private schools, may help explain the reason as to why they occupy the majority of the lower ranks.

Another thing to notice in these two tables is the percentage of students placed at University from the total students at the school for 2013, 2014 and 2015 at the 12th year (note that for Externato Académico it was not possible to find the number of students for 2013). The total amount of students for each school was taken from the website "infoescolas.mec.pt/Secundario/".

We see that the schools at the bottom place a bigger percentage of students at University, achieving an average of 23% while the ones at the top (not counting Externato Académico achieve an average of 13%. Had our initial dataset contained these values and had this been incorporated in the DEA analysis as a variable the results would very likely be different with private schools climbing some positions in the rank.

7. Conclusion

In this thesis we conducted an in-depth analysis of the students who entered the Universities of Universidade do Porto and Universidade Católica do Porto for the years of 2013, 2014 and 2015. In which we have found students from public schools perform better than those from private schools at completing ECTS and achieving higher grades at University. We also found that females tend to perform better than males at University.

Degrees for both Universities were also compared, and we saw that students at UCP tend to be more homogenous in their outputs than those from UP.

The same data were analyzed from the perspective of schools, which allows the comparison between them.

The degrees were clustered by their main field of study, which allowed the understanding that some schools are stronger in more specific fields and weaker in others. The clusters themselves were also compared from a University perspective, which further reinforced the point that degrees vary greatly amongst themselves, which serves as further justification for the Entry and 1st Year Scores we introduced in this study.

We performed a Multiple linear regression for students who completed 45 ECTS or more and found that in regard to Entry Score, Gender and Type of school attended, the first (Entry Score) is the best predictor of academic success (1st Year Score).

We also analyzed these predictors of success independently by cluster of degrees and found out that the variables assume different importance at

predicting success for each one, although Entry Score is always the best predictor.

Finally we applied DEA to build a rank of the schools which place students at Universidade do Porto and Universiadade Católica do Porto. This ranking is ordered by the schools which with the smallest Entry scores are able to produce the best Outputs. These rankings can be used by students (or their tutors) who are concerned about their future academic success, in order to choose a school that is best suited to their needs.

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Attachments

Table 29: DEA results for schools that place 10 students or more

DMU	Score	Entry$ {I}{	Year$ {O}{	creds {O}{	Top {O}{V	NBottom {	n0ects {O}	Benchmar{S}	Entry${S}	Year${S}	creds {{S}	Top {O{S}	NBotto{S}	n0ects
Externato Ribadouro	18,22	0,19	-0,5	38,01	0,01	0,68	0,89	160 (0,82	0	0,96	16,81	0,12	0,23	0,11
Escola Secundária Garcia de Orta	12,15	0,1	0,06	43,33	0,04	0,76	0,89	160 (0,71	0	0,36	11,45	0,07	0,15	0,11
Colégio Nossa Senhora do Rosário	11,38	0	-0,27	44,57	0,08	0,79	0,92	160 (1,00	0,2	0,78	10,3	0,09	0,12	0,08
Escola Secundária da Maia	8,75	0,07	0,02	46,65	0,07	0,8	0,91	160 (0,67	0	0,39	8,12	0,05	0,11	0,09
Colégio Internato dos Carvalhos	9,65	0,27	0	45,95	0,09	0,8	0,91	160 (0,91	0	0,49	8,89	0,06	0,11	0,09
Escola Secundária Filipa de Vilhena	10,8	-0,09	-0,1	44,59	0,05	0,79	0,9	160 (0,48	0	0,44	10,12	0,03	0,12	0,1
Escola Secundária Aurélia de Sousa	10,02	0,05	0,07	45,28	0,08	0,83	0,91	160 (0,66	0	0,33	9,49	0,03	0,08	0,09
Escola Secundária de Almeida Garrett	12,47	-0,05	0,08	42,77	0,13	0,78	0,88	105 (0,04	0	0,28	11,95	0	0,13	0,12
Escola Secundária de Rio Tinto	8,43	-0,14	0	46,79	0,11	0,81	0,9	105 (0,07	0	0,33	7,9	0	0,1	0,1
Escola Secundária Eça de Queirós - Póvoa de Varzim	7,8	0	0,01	47,86	0,08	0,83	0,91	160 (1,00	0,04	0,51	7,02	0,09	0,09	0,09
Escola Secundária de Penafiel	9,28	-0,21	-0,15	46,02	0,09	0,82	0,91	105 (0,06	0	0,45	8,64	0	0,09	0,09
Escola Secundária Santa Maria Maior	10,46	-0,11	-0,2	45	0,07	0,77	0,92	160 (0,46	0	0,54	9,7	0,01	0,14	0,08
Externato Paulo VI	14,11	0,33	-0,15	41,77	0,08	0,74	0,9	160 (0,99	0	0,66	13,1	0,09	0,18	0,1
Escola Secundária de Santa Maria da Feira	11,64	0,17	0,13	43,78	0,09	0,77	0,89	160 (0,80	0	0,31	11,03	0,04	0,14	0,11
Escola Secundária Dr. Manuel Gomes de Almeida	9,42	0	0,21	46	0,1	0,81	0,93	160 (1,00	0,11	0,3	8,88	0,07	0,11	0,07
Escola Secundária de Ermesinde	9,78	-0,15	0,02	45,41	0,11	0,79	0,91	105 (0,10	0	0,31	9,27	0	0,12	0,09
Escola Secundária João Gonçalves Zarco	12,09	-0,17	-0,01	43,17	0,04	0,79	0,88	160 (0,39	0	0,32	11,51	0,03	0,12	0,12
Escola Secundária Dr. Joaquim Gomes Ferreira Alves	13,33	0,11	-0,24	42,54	0,02	0,7	0,88	160 (0,72	0	0,66	12,24	0,1	0,21	0,12
Colégio Luso-Francês	7,54	0	0,06	47,99	0,09	0,85	0,94	160 (1,00	0,15	0,45	6,88	0,07	0,06	0,06
Escola Secundária de Paredes	13,06	-0,13	-0,15	42,44	0,06	0,73	0,86	160 (0,44	0	0,48	12,25	0,02	0,17	0,14
Escola Secundária de Gondomar	10,65	-4,25	-0,04	43,95	0,94	0,79	0,85	105 (0,05	0	0,21	10,14	0	0,15	0,15
Colégio Liceal de Santa Maria de Lamas	8,04	0,05	-0,05	47,33	0,1	0,82	0,93	160 (0,65	0	0,45	7,43	0	0,09	0,07
Escola Secundária Augusto Gomes	9,41	0,09	0,05	45,97	0,07	0,81	0,92	160 (0,70	0	0,37	8,81	0,05	0,1	0,08
Colégio da Trofa	17,08	-0,16	-0,76	38,99	0,01	0,74	0,91	160 (0,40	0	1,08	15,69	0,06	0,17	0,09
Escola Secundária José Régio	13,17	-0,05	-0,08	42,33	0,04	0,75	0,87	160 (0,53	0	0,44	12,39	0,05	0,16	0,13
Escola Secundária Alves Martins	9,09	0,11	-0,09	46,51	0,03	0,8	0,9	160 (0,72	0	0,51	8,28	0,09	0,12	0,1
Escola Secundária de Monserrate	6,88	0,02	-0,15	48,59	0,07	0,84	0,93	160 (0,62	0	0,54	6,16	0,04	0,07	0,07
Escola Secundária de Marco de Canaveses	8,34	-0,22	-0,26	47,08	0,01	0,84	0,91	160 (0,33	0	0,56	7,58	0,04	0,07	0,09
Escola Secundária de Inês de Castro	15,19	-0,06	-0,23	40,45	0,04	0,71	0,92	160 (0,52	0	0,59	14,27	0,05	0,2	0,08
Escola Secundária Dr. Manuel Laranjeira	12,85	0,24	-0,17	42,97	0,07	0,77	0,88	160 (0,88	0	0,65	11,87	0,07	0,15	0,12
Colégio D. Duarte	23,11	-0,24	-0,63	32,91	0,04	0,57	0,89	160 (0,30	0	0,91	21,74	0,01	0,34	0,11
Escola Básica e Secundária Clara de Resende	8,11	0,2	0,03	47,34	0,06	0,84	0,95	160 (0,83	0	0,43	7,48	0,08	0,08	0,05
Escola Secundária de Fafe	9,56	-0,06	-0,05	45,72	0,17	0,79	0,92	105 (0,36	0	0,39	8,98	0	0,13	0,07
Escola Secundária Soares dos Reis	7,29	-2,6	0,12	47,07	2,5	0,86	0,94	105 (0,36	0	0,11	7,05	0	0,09	0,04
Escola Secundária António Sérgio	12,75	-0,09	-0,24	42,86	0,03	0,74	0,9	160 (0,48	0	0,58	11,84	0,05	0,17	0,1
Escola Secundária de Lousada	5,41	-2,72	0,19	49,08	2,17	0,88	0,93	105 (0,36	0	0,05	5,26	0	0,05	0,06
Escola Secundária de Paços de Ferreira	9,66	-0,32	-0,1	45,5	0,03	0,79	0,93	160 (0,20	0	0,35	9,12	0	0,11	0,07
Escola Secundária de Valongo	11,78	-3,21	0,08	43,2	1,47	0,78	0,87	105 (0,29	0	0,15	11,37	0	0,13	0,12
Colégio São Gonçalo	14,1	-0,08	-0,47	41,7	0,06	0,74	0,92	160 (0,50	0	0,82	13,01	0,02	0,17	0,08
Colégio D. Diogo de Sousa	19,8	-0,05	-0,54	36,34	0	0,63	0,85	160 (0,53	0	0,91	18,38	0,09	0,28	0,15
Externato Camões	16,32	0,2	-0,37	39,71	0,03	0,74	0,9	160 (0,83	0	0,83	15,11	0,11	0,18	0,1
Escola Secundária de Amarante	13,14	0,07	-0,12	42,52	0,03	0,75	0,88	160 (0,67	0	0,53	12,25	0,08	0,17	0,12
Equivalências (nº 2 Artº 20-A)	24,85	0	-0,64	31,94	0,03	0,53	0,76	160 (1,00	0,55	1,15	22,93	0,13	0,39	0,24
Escola Secundária de Ponte de Lima	7,32	0,03	-0,05	48,03	0,09	0,83	0,95	160 (0,63	0	0,44	6,72	0,02	0,08	0,05
Escola Secundária Camilo Castelo Branco - Vila Real	16,95	-0,02	-0,12	38,69	0,05	0,72	0,81	160 (0,56	0	0,49	16,04	0,04	0,19	0,19
Escola Básica e Secundária de Águas Santas	15	-0,11	-0,03	40,43	0,04	0,77	0,82	160 (0,46	0	0,37	14,27	0,04	0,14	0,18
Escola Secundária Rocha Peixoto	12,49	-0,08	-0,25	43,05	0,13	0,75	0,91	105 (0,09	0	0,59	11,65	0	0,16	0,09
Escola Secundária de S. Pedro	5,23	0	0,24	50,12	0,09	0,87	0,93	160 (1,00	0,02	0,28	4,76	0,08	0,04	0,07
Externato Carvalho Araújo	23,05	-16,43	-0,55	30,31	0,69	0,56	0,81	104 (0,48	0	0,58	21,98	0	0,33	0,16
Colégio Novo da Maia	14,84	0	-0,25	41,3	0,02	0,7	0,87	160 (1,00	0,14	0,77	13,58	0,15	0,21	0,13
Externato Académico	0	-84,09	-1,16	37,85	2	3,71	9,62	2						
Escola Secundária Ferreira de Castro	6,29	-0,26	0,17	48,62	0,11	0,83	0,89	105 (0,27	0	0,11	6,01	0	0,08	0,1
Centro de Estudos Básico e Secundário - CEBES	31,17	0,09	-0,59	25,42	0,02	0,49	0,72	160 (0,70	0	1,01	29,36	0,1	0,42	0,28
Escola Secundária D. Afonso Henriques	10,24	-0,09	0,13	44,78	0,21	0,79	0,92	105 (0,75	0	0,19	9,88	0	0,12	0,05
Escola Secundária Fernão de Magalhães	19,03	0,04	-0,4	37	0,04	0,63	0,87	160 (0,64	0	0,79	17,76	0,07	0,28	0,13
Escola Secundária Dr. Mário Sacramento	4,49	0,05	0,38	50,39	0,22	0,84	0,9	105 (0,53	0	0	4,34	0	0,07	0,08
Colégio de Gaia	11,01	0,21	-0,13	44,66	0,08	0,8	0,92	160 (0,84	0	0,6	10,17	0,06	0,11	0,08
Escola Secundária D. Sancho I	8,4	-3,45	0,04	46,27	1,48	0,78	0,96	105 (0,22	0	0,17	8,06	0	0,15	0,03
Escola Secundária Francisco de Holanda	10,43	0,05	0	45	0,08	0,76	0,92	160 (0,65	0	0,4	9,76	0,03	0,16	0,08
Escola Secundária Carolina Michaellis	4,71	-3,52	0,19	49,6	1,51	0,9	0,96	105 (0,20	0	0,01	4,63	0	0,04	0,03
Escola Secundária Camilo Castelo Branco-V.N.Famalicão	5,57	0,11	-0,1	49,9	0,02	0,88	0,98	160 (0,73	0	0,52	4,89	0,1	0,04	0,02
Escola Básica e Secundária Oliveira Júnior	2,6	0,06	0,23	52,27	0,15	11,59	2,67	105 (0,52	0	0,14	2,45	0,01	0	0
Escola Secundária Latino Coelho	5,75	0,21	-0,22	49,97	0,02	0,85	0,96	160 (0,84	0	0,68	4,85	0,12	0,06	0,04
Escola Básica e Secundária Rodrigues de Freitas	19,17	0,11	0,03	36,53	0,06	0,62	0,83	160 (0,72	0	0,39	18,25	0,06	0,3	0,17
Escola Básica e Secundária de Búzio - Vale de Cambra	4,65	0,01	0,07	50,55	0,04	0,87	0,96	160 (0,61	0	0,31	4,19	0,06	0,04	0,04
Colégio D. Dinis	9,35	-19,47	-0,28	41,15	0	0,68	0,93	171 (0,43	0	0,36	8,82	0	0,16	0,01
Escola Secundária Dr. José Macedo Fragateiro	10,35	-0,15	-0,2	45,16	0	0,77	0,91	160 (0,41	0	0,52	9,52	0,07	0,14	0,09
Escola Secundária de Felgueiras	16,63	0,07	0,06	38,85	0,16	0,67	0,86	105 (0,06	0	0,34	15,91	0	0,24	0,14
Escola Secundária Carlos Amarante	13,35	-0,15	-0,33	42,36	0,05	0,74	0,81	160 (0,42	0	0,65	12,32	0,02	0,16	0,19
Escola Secundária Abel Salazar	13,21	0,2	-0,08	42,49	0,07	0,72	0,93	160 (0,83	0	0,54	12,33	0,07	0,19	0,07
Escola Secundária Alberto Sampaio	7,71	0,13	-0,24	47,99	0,02	0,84	0,93	160 (0,74	0	0,67	6,8	0,1	0,08	0,07
Externato Delfim Ferreira - Delfinopolis	2,98	0	-0,12	52,74	0,02	0,9	0,95	160 (1,00	0,37	0,64	2,14	0,14	0,01	0,05
Escola Secundária Tomaz Pelayo	3,95	0	0,15	51,06	0,15	22,33	2251,06	153 (0,12	0,17	0,31	3,63	0,01	0	0
Escola Secundária Alcaides de Faria - Arcozelo	7,28	-0,19	-0,27	48,15	0	0,85	0,93	160 (0,36	0	0,58	6,52	0,06	0,05	0,07
Escola Secundária da Boa Nova - Leça da Palmeira	16,7	-0,23	-0,28	38,83	0,05	0,7	0,9	160 (0,31	0	0,57	15,83	0	0,21	0,1
Escola Secundária D. Dinis (Santo Tirso)	9,91	-0,05	0,12	45,3	0,05	0,78	0,93	160 (0,53	0	0,24	9,42	0,04	0,13	0,07
Escola Secundária de Barcelos	16,03	0,03	-0,03	39,53	0,05	0,73	0,85	160 (0,62	0	0,42	15,23	0,05	0,19	0,15
Escola Secundária Alexandre Herculano	4,51	-38,8	-0,08	41,05	7,62	0,7	0,88	51 (0,11)	0	0,11	4,3	0	0,09	0,01
Escola Secundária Henrique Medina	12,81	-0,11	0,03	42,46	0,15	0,76	0,84	105 (0,30	0	0,29	12,22	0	0,15	0,15
Escola Secundária Clara de Resende	8,62	0	-0,03	46,68	0,08	0,79	412,66	160 (0,60	0	0,42	8,06	0,02	0,12	0
Escola Secundária João Silva Correia	6,79	-0,1	0,05	48,41	0,03	0,86	0,89	160 (0,47	0	0,29	6,3	0,05	0,04	0,11
Escola Secundária Júlio Dinis	10,78	-0,17	0,03	44,38	0,11	0,76	0,95	105 (0,15	0	0,29	10,29	0	0,15	0,05
Escola Secundária de Vila Cova da Lixa	13,21	-0,03	-0,23	42,41	0,09	0,77	0,86	160 (0,56	0	0,6	12,32	0,01	0,14	0,14
Escola Secundária de Caldas de Vizela	10,6	0,08	0,11	44,7	0,11	0,77	0,91	160 (0,69	0	0,3	10,07	0	0,14	0,09
Colégio Casa Mãe	15,31	0	-0,6	41,09	0,06	0,74	0,88	160 (1,00	0,04	1,12	13,79	0,11	0,18	0,12
Externato de Vila Meã	9,39	0,07	-0,13	46,22	0,06	0,81	0,84	160 (0,67	0	0,53	8,55	0,05	0,1	0,16
Escola Básica e Secundária Vale de Ovil - Baião	13,77	-18,59	-0,72	38,03	0	0,75	0,88	171 (0,53	0	0,82	12,77	0	0,1	0,08
Escola INED - Nevogilde	14,14	-0,18	-0,36	41,64	0,03	0,72	0,78	160 (0,38	0	0,67	13,03	0,03	0,19	0,22
Escola Secundária de Mirandela	13,17	-0,11	-0,2	42,35	0,03	0,7	0,97	160 (0,46	0	0,53	12,35	0,04	0,21	0,03
Escola Secundária de Alpendurada	7,47	-0,29	0	47,55	0,09	0,87	0,9	105 (0,25	0	0,27	7,07	0	0,04	0,09
Escola Secundária de Monção	10,1	-0,17	-0,22	45,34	0	0,83	0,9	160 (0,39	0	0,53	9,33	0,06	0,08	0,1
Escola Secundária de Padrão da Légua	7,36	0,26	0,47	47,67	0,14	0,83	0,93	160 (0,90	0	0,02	7,17	0,01	0,09	0,07

Escola Secundária da Trofa	3,52	0,17	0,21	51,41	0,1	14,06	0,93	105 (0,14	0	0,22	3,18	0,05	0	0,06
Escola Artística Soares dos Reis	9,35	-0,2	0,16	45,71	0,1	0,79	0,86	105 (0,08	0	0,14	8,96	0	0,11	0,13
Colégio de Lamego	19,73	0	-0,05	36,38	0	0,66	0,76	160 (1,00	0,25	0,57	18,5	0,17	0,26	0,24
Escola Secundária de Barcelinhos	0	-59,42	6,07	67,67	99,74	98,18	12,39	5						
Escola Secundária Martins Sarmento	15,64	-0,08	-0,18	39,95	0,07	0,71	0,86	160 (0,49	0	0,53	14,76	0,01	0,19	0,14
Escola Secundária Diogo de Macedo	11,22	-17,76	-0,17	40,91	0	0,75	0,82	171 (0,63	0	0,29	10,68	0	0,11	0,14
Escola Secundária Emídio Garcia	18,65	-0,05	-0,59	37,52	0	0,68	0,82	160 (0,53	0	0,95	17,2	0,09	0,23	0,18
Externato de São Miguel de Refojos	13,4	0	-0,19	42,59	0,04	0,74	0,89	160 (1,00	0,04	0,71	12,28	0,13	0,18	0,11
Escola Secundária de Arouca	8,59	-0,08	-0,11	46,76	0	0,81	406,76	160 (0,50	0	0,46	7,95	0,08	0,09	0
Escola Secundária José Estevão	5,12	0,15	0,24	50,12	0,04	0,85	0,92	160 (0,77	0	0,2	4,69	0,09	0,07	0,08
Escola Básica e Secundária D. Moisés Alves de Pinho	7,21	-0,04	-0,07	48,13	0,08	0,85	0,88	160 (0,54	0	0,43	6,59	0,01	0,06	0,12
Escola Secundária da Senhora da Hora	0	-59,66	-0,16	300,49	7,02	18,36	152,96	3						
Escola Secundária de Vilela	0	1,04	1,69	235,27	15,2	24,04	17,54	29						
Grande Colégio Universal	18,99	0	-0,64	37,56	0	0,68	0,88	160 (1,00	0,07	1,15	17,31	0,17	0,24	0,12
Colégio Alemão do Porto	14,44	0,17	0,38	40,8	0,12	0,72	0,84	160 (0,79	0	0,06	14,01	0,01	0,19	0,16
Escola Secundária de Caldas das Taipas	2,71	0,04	0,08	52,4	0,08	4,69	0,96	105 (0,66	0	0,29	2,32	0,08	0	0,02
Escola Básica e Secundária Sidónio Pais - Caminha	19,26	-0,27	-0,8	36,81	0	0,71	0,88	160 (0,26	0	1,08	17,82	0,04	0,2	0,12
Colégio Terras de Santa Maria	16,15	0	-0,47	40,25	0	0,67	0,88	160 (1,00	0,02	0,99	14,62	0,17	0,25	0,12
Colégio D. Dinis (Antº. Carneiro)	14,54	0,03	-0,54	41,59	0	0,74	0,83	160 (0,62	0	0,93	13,16	0,1	0,17	0,17
Escola Secundária Abade de Baçal	11,38	0	-0,45	44,72	0,09	0,83	0,91	160 (1,00	0,06	0,96	10,16	0,08	0,09	0,09
Escola Secundária Padre Benjamim Salgado - Joane	13,63	-0,21	-0,16	41,82	0,05	0,73	0,86	160 (0,34	0	0,46	12,84	0,01	0,18	0,14
Escola Secundária do Castêlo da Maia	14,28	-0,02	-0,35	41,5	0,05	0,77	0,86	160 (0,57	0	0,73	13,24	0,05	0,14	0,14
Escola Secundária de Esmoriz	8,6	0	0,28	46,77	0,09	0,82	0,91	160 (1,00	0,07	0,23	8,1	0,08	0,1	0,09
Escola Secundária Prof. Dr. Flávio F. Pinto Resende	17,67	-16,27	-0,6	35,52	2,28	0,59	0,86	104 (0,34	0	0,64	16,57	0	0,34	0,12
Colégio Luso Internacional do Porto - CLIP	26,03	0	0,1	29,93	0,14	0,45	0,82	160 (1,00	0,86	0,41	24,94	0,03	0,46	0,18
Colégio Sezim - Egas Moniz	17,59	-0,07	-0,37	38,3	0,05	0,64	0,86	160 (0,50	0	0,72	16,42	0,04	0,27	0,14
Colégio Paulo VI	6,01	0	-0,21	48,75	0,09	23	385,7	153 (0,45	0,24	0,55	5,44	0,03	0	0
Instituto Nun Álvares - Santo Tirso	5,83	-14,15	-0,2	47,71	10,34	0,86	0,95	96 (0,01)	0	0,39	5,27	0	0,13	0,04
Escola Secundária António Nobre	16,34	-10,21	0,21	35,93	15,51	0,67	0,76	96 (0,15)	0	0,11	15,76	0	0,28	0,2
Cooperativa de Ensino Ancorensis	18,08	-0,08	-0,06	37,5	0,05	0,67	0,81	160 (0,50	0	0,41	17,21	0,04	0,24	0,19
Escola Secundária D. Afonso Sanches	10,51	-0,09	-0,35	45,12	0,05	0,76	0,95	160 (0,48	0	0,69	9,59	0,03	0,15	0,05
Escola Secundária Almeida Garrett	5,64	-0,11	-0,15	49,57	0,05	0,9	643,19	160 (0,46	0	0,48	5,13	0,03	0	0
Escola Básica e Secundária Dr. Manuel Pinto de Vasconcelos	8,15	0	0,12	47,4	0	0,85	0,95	160 (1,00	0,04	0,4	7,47	0,17	0,07	0,05
Escola Secundária de Carvalhos	6,93	-0,12	0,1	48,28	0	0,85	0,85	160 (0,45	0	0,23	6,42	0,08	0,06	0,15
Escola Básica e Secundária de Valdevez	12,47	-0,12	-0,41	43,4	0	0,65	0,9	160 (0,45	0	0,74	11,29	0,07	0,26	0,1
Escola Secundária Eça de Queirós	19,61	-0,22	-0,22	36	0,05	0,58	0,89	160 (0,33	0	0,52	18,66	0	0,33	0,11
Escola Secundária Morgado de Mateus -Vila Real	14,71	-9,02	-0,32	39,74	1,77	0,74	0,84	104 (0,20	0	0,42	13,9	0	0,23	0,16
Escola Secundária Camilo Castelo Branco	3,27	-32,24	-0,36	44,34	0	0,79	42,25	147 (0,37	0	0,41	2,82	0	0,04	0
Escola Secundária Dr. António Granjo	9,61	-2,23	-0,24	45,28	2,74	0,83	0,94	105 (0,45	0	0,49	8,98	0	0,11	0,04
Escola Secundária Dr. Júlio Martins	10,22	-16,8	-0,17	42,78	0	0,72	0,94	171 (0,74	0	0,31	9,73	0	0,15	0,03
Externato Júlio Dinis	25,2	0,3	-0,58	31,42	0	0,56	0,83	160 (0,95	0	1,07	23,44	0,16	0,36	0,17
Escola Básica e Secundária Arga e Lima - Lanheses	4,68	0,1	-0,46	50,61	0,06	11,95	477,44	153 (0,33	0	0,84	3,76	0,08	0	0
Escola Secundária Afonso de Albuquerque	15,81	0	-0,28	40,22	0,06	0,67	346,75	160 (1,00	0,15	0,79	14,65	0,11	0,25	0
Colégio Nossa Senhora da Bonança	7,48	0	0,19	47,86	33,15	0,78	1443,57	160 (1,00	0,18	0,33	7,01	0	0,14	0
Escola Secundária Dr. João Araújo Correia	12,65	-0,2	0,08	42,68	0	0,71	0,82	160 (0,36	0	0,23	11,99	0,06	0,2	0,18
Escola Secundária D. Maria II	24,46	-0,34	0,02	30,97	0,08	0,59	0,71	105 (0,25	0	0,23	23,63	0	0,32	0,28
Instituto de Educação e Desenvolvimento - INED	0	1,24	1	50,99	38,33	97,67	305,04	0						
Escola Secundária Soares Basto - Oliveira de Azeméis	10,67	-0,37	-0,41	44,75	0	0,81	0,94	160 (0,15	0	0,64	9,85	0,02	0,09	0,06
Colégio de Albergaria	11,61	-0,42	-0,65	44,06	0	0,75	0,94	160 (0,09	0	0,87	10,52	0,01	0,15	0,06
Colégio D. Dinis (Stª Catarina)	8,85	-23,03	-0,21	42,69	7,33	0,81	0,88	96 (0,09)	0	0,32	8,32	0	0,12	0,09
Escola Básica e Secundária de Celorico de Basto	8,98	0,04	-0,68	47,25	0	0,81	0,81	160 (0,64	0	1,08	7,51	0,11	0,1	0,19
Cooperativa de Ensino Didáxis	7,87	0,24	-0,28	47,91	0,06	0,88	0,94	160 (0,88	0	0,75	6,93	0,08	0,04	0,06
Escola Secundária Dr. Jaime Magalhães Lima	9,97	0,16	-0,22	45,87	0,07	0,8	0,8	160 (0,78	0	0,66	8,94	0,06	0,11	0,2
Escola Básica e Secundária de Melgaço	4,29	0	0,38	48,03	9,72	0,87	0,93	105 (0,38	0,04	0,26	4,02	0	0,01	0
Escola Secundária Rodrigues de Freitas	0	-101,28	0,61	47,38	0	13,52	225,21	1						
Escola Secundária de Estarreja	19,44	0	0,03	36,57	0	0,57	0,86	160 (1,00	0,08	0,48	18,3	0,17	0,35	0,14
Escola Secundária Homem Cristo	18,43	0,01	-0,08	37,14	0,07	0,71	0,86	160 (0,60	0	0,46	17,6	0,03	0,2	0,14
Escola Secundária Arquitecto Oliveira Ferreira	0	-32,76	-0,17	66,8	38,75	6,41	47,09	0						
Escola Básica e Secundária à Beira Douro	7,84	-35,59	0,01	37,64	10,89	0,71	0,79	51 (0,12)	0	0,04	7,62	0	0,08	0,1
Colégio Ellen Key	23,37	-0,35	-0,44	32,5	0	0,57	0,79	160 (0,18	0	0,68	22,11	0,03	0,33	0,21
Escola Secundária Daniel Faria - Baltar	0	-18,94	0,87	66,76	1,55	156,28	27,83	21						
Escola Básica e Secundária de Castelo de Paiva	0	2,64	18,49	62,02	23,32	10,29	15,72	3						
Escola Cooperativa Vale S. Cosme (Didaxis)	4,49	0,13	-0,08	50,92	0	13,94	0,92	105 (0,57	0	0,49	3,77	0,18	0	0,05
Cooperativa de Ensino DIDALVI - Alvito	5,05	0,08	-0,23	50,23	0,08	11,68	693,16	153 (0,12	0	0,62	4,39	0,04	0	0
Externato Infante D. Henrique	8,52	0	-0,17	47,21	0	20,79	658,32	160 (1,00	0,15	0,69	7,67	0,17	0	0
Escola Secundária Dr. Serafim Leite	7,87	-0,88	0	46,67	1,71	0,92	505,25	153 (0,36	0	0,28	7,57	0	0,02	0
Escola Secundária de Oliveira do Douro	15,94	-0,08	0,2	39,25	0,12	0,75	0,83	105 (0,01	0	0,15	15,46	0	0,16	0,17
Escola Secundária Oliveira Júnior	0	1,71	10,93	98,3	7,14	14,22	98,84	139						
Escola Secundária de Alfena	0	-16,01	227,86	51,71	0,1	556,04	2574,97	0						
Escola Secundária de Tondela	7,27	0	-0,03	48,32	0,09	0,91	0,91	160 (1,00	0,23	0,54	6,56	0,08	0,01	0,09
Escola Secundária Sá de Miranda	3,54	-0,36	-0,4	51,73	0	11,5	398,27	153 (0,05	0	0,66	2,84	0,04	0	0
Escola Secundária Viriato	11,7	0	-0,41	44,55	0	0,73	0,91	160 (1,00	0,23	0,92	10,33	0,17	0,19	0,09
Escola Secundária de S. Pedro da Cova	0	-30,09	-0,15	46,54	50,7	0,91	1093,13	0						
Colégio de Amorim	9,71	0	-0,19	46,14	0,09	0,82	0,91	160 (1,00	0,47	0,7	8,74	0,08	0,1	0,09
Escola Básica e Secundária Prof.António da Natividade - Mesão Frio	7,86	-15,86	-0,32	46,18	0	0,82	0,91	171 (0,86	0	0,48	7,23	0	0,07	0,08
Escola Básica e Secundária de Canelas	20,92	0	-0,09	35,18	0	0,73	0,73	160 (1,00	0,15	0,6	19,69	0,17	0,19	0,27
Escola Básica e Secundária de Macedo de Cavaleiros	13,75	-0,33	-0,63	42,05	0	0,82	0,82	160 (0,20	0	0,88	12,57	0,03	0,09	0,18
Escola Básica e Secundária de Sever do Vouga	4,69	-0,24	-0,11	50,41	0,13	0,92	0,91	105 (0,39	0	0,39	4,22	0	0	0,08
Escola Secundária de Pombal	0	-34,41	7,6	237,37	0	13,36	66,7	124						
Escola Secundária de São Pedro do Sul	4,68	0	0,29	50,7	0	0,9	0,9	160 (1,00	0,32	0,22	4,17	0,17	0,02	0,1
Escola Secundária de Cantanhede	0	-45,36	0,02	54,34	0	3,79	7,21	11						
Escola Básica e Secundária de Muralhas do Minho - Valença	6,36	-0,29	-0,11	48,8	0	0,9	0,9	160 (0,25	0	0,38	5,83	0,04	0	0,1
Colégio de Ermesinde	40,62	0,09	-1,3	16,9	0	0,2	0,8	160 (0,70	0	1,71	37,88	0,12	0,71	0,2

Table 30: DEA results for schools that place 50 students or more

DMU	Score	EntryS {I}{	YearS {O}{	Top {O}{V	NBottom {	n0ects {O}	creds {O}{	Benchmarks	{S} EntryS	{S} YearS {	{S} Top {O	{S} NBotto	{S} n0ects	{S} creds {
Externato Ribadouro	13,57	0	-0,5	38,01	0,01	0,68	0,89	56 (1,00)	0,09	0,88	12,38	0,14	0,16	0,01
Escola Secundária Garcia de Orta	7,59	0	0,06	43,33	0,04	0,76	0,89	56 (1,00)	0,04	0,32	7,06	0,11	0,08	0,02
Colégio Nossa Senhora do Rosário	6,32	0	-0,27	44,57	0,08	0,79	16,33	48 (0,61) 56 (0,39)	0,26	0,56	5,65	0,04	0,07	0
Escola Secundária da Maia	4,05	0,12	0,02	46,65	0,07	0,8	35,88	36 (0,07) 48 (0,14) 56 (0,79)	0	0,32	3,61	0,08	0,05	0
Colégio Internato dos Carvalhos	4,83	0	0	45,95	0,09	0,8	16,14	48 (0,21) 56 (0,79)	0,1	0,35	4,38	0,06	0,05	0
Escola Secundária Filipa de Vilhena	5,79	-0,43	-0,1	44,59	0,05	0,79	0,9	36 (0,43) 56 (0,57)	0	0,39	5,24	0,08	0,07	0,01
Escola Secundária Aurélia de Sousa	5,39	0,09	0,07	45,28	0,08	0,83	35,8	36 (0,06) 48 (0,08) 56 (0,87)	0	0,28	5,02	0,07	0,02	0
Escola Secundária de Almeida Garrett	7,63	-0,22	0,08	42,77	0,09	0,78	0,88	36 (0,29) 56 (0,71)	0	0,24	7,24	0,04	0,08	0,03
Escola Secundária de Rio Tinto	3,29	-0,59	0	46,79	0,08	0,81	0,9	36 (0,54) 56 (0,46)	0	0,28	2,9	0,04	0,06	0,02
Escola Secundária Eça de Queirós - Póvoa de Varzim	2,93	0	0,01	47,86	0,08	0,83	16,12	48 (0,15) 56 (0,85)	0,2	0,35	2,5	0,07	0,02	0
Escola Secundária de Penafiel	3,92	-0,88	-0,15	46,02	0,07	0,82	0,91	36 (0,73) 56 (0,27)	0	0,39	3,42	0,04	0,05	0,01
Escola Secundária Santa Maria Maior	5,09	-0,19	-0,2	45	0,07	0,77	36,43	36 (0,63) 48 (0,15) 56 (0,22)	0	0,44	4,52	0,03	0,1	0
Externato Paulo VI	9,27	0	-0,15	41,77	0,08	0,74	16,1	48 (0,11) 56 (0,89)	0,16	0,51	8,59	0,07	0,11	0
Escola Secundária de Santa Maria da Feira	7,01	0	0,13	43,78	0,09	0,77	0,89	56 (1,00)	0,08	0,24	6,62	0,07	0,07	0,01
Escola Secundária Dr. Manuel Gomes de Almeida	0	0,03	39,84	46,66	13,93	3,24	1307,19	0						
Escola Secundária de Ermesinde	4,62	-0,61	0,02	45,41	0,08	0,79	0,91	36 (0,55) 56 (0,45)	0	0,26	4,25	0,04	0,07	0,01
Escola Secundária João Gonçalves Zarco	6,81	-0,77	-0,01	43,17	0,04	0,79	0,88	36 (0,66) 56 (0,34)	0	0,26	6,36	0,08	0,08	0,04
Escola Secundária Dr. Joaquim Gomes Ferreira Alves	8,77	0	-0,24	42,54	0,02	0,7	0,88	56 (1,00)	0,04	0,62	7,85	0,14	0,14	0,02
Colégio Luso-Francês	1,24	0	0,06	47,99	7,39	24,06	178,89	34 (0,03) 44 (0,42) 48 (0,50) 56 (0,05)	0,24	0,06	1,18	0	0	0
Escola Secundária de Paredes	7,92	-0,59	-0,15	42,44	0,06	0,73	0,86	36 (0,54) 56 (0,46)	0	0,42	7,25	0,06	0,13	0,06
Escola Secundária de Gondomar	1,7	-10,8	-0,04	43,95	0,04	0,79	0,85	36 (0,77) 51 (0,23)	0	0,01	1,57	0,03	0,02	0,07
Colégio Liceal de Santa Maria de Lamas	1,72	0,1	-0,05	47,33	2,05	0,82	83,77	36 (0,05) 44 (0,60) 48 (0,09) 56 (0,25)	0	0,15	1,56	0	0,02	0
Escola Secundária Augusto Gomes	4,24	0,15	0,05	45,97	0,07	0,81	36,38	36 (0,29) 48 (0,43) 56 (0,28)	0	0,21	3,93	0,04	0,06	0
Colégio da Trofa	11,84	-0,72	-0,76	38,99	0,01	0,74	0,91	36 (0,62) 56 (0,38)	0	1,02	10,59	0,1	0,13	0,01
Escola Secundária José Régio	8,32	-0,22	-0,08	42,33	0,04	0,75	0,87	36 (0,29) 56 (0,71)	0	0,4	7,68	0,1	0,1	0,04
Escola Secundária Alves Martins	4,5	0	-0,09	46,51	0,03	0,8	16,07	48 (0,05) 56 (0,95)	0,03	0,46	3,87	0,12	0,05	0
Escola Secundária de Monserrate	0,72	0,04	-0,15	48,59	0,07	0,84	81,2	36 (0,34) 44 (0,37) 48 (0,29)	0	0,27	0,4	0,02	0,02	0
Escola Secundária de Marco de Canaveses	2,88	-1	-0,26	47,08	0,01	0,84	0,91	36 (0,81) 56 (0,19)	0	0,49	2,25	0,09	0,04	0,01
Escola Secundária de Inês de Castro	10,08	-0,1	-0,23	40,45	0,04	0,71	36,21	36 (0,44) 48 (0,12) 56 (0,44)	0	0,51	9,34	0,08	0,15	0
Escola Secundária Dr. Manuel Laranjeira	8,15	0	-0,17	42,97	0,07	0,77	0,88	56 (1,00)	0,13	0,55	7,42	0,08	0,07	0,02
Colégio D. Duarte	17,57	-1,11	-0,63	32,91	0,04	0,57	0,89	36 (0,88) 56 (0,12)	0	0,84	16,33	0,06	0,31	0,04
Escola Básica e Secundária Clara de Resende	0	0,25	0,56	72,04	1,42	266,25	1448,61	0						
Escola Secundária de Fafe	4,06	-0,18	-0,05	45,72	3,96	0,79	101,02	34 (0,01) 36 (0,30) 44 (0,22) 56 (0,47)	0	0,27	3,72	0	0,06	0
Escola Secundária Soares dos Reis	0	-7,26	0,4	50,51	12,91	8,43	102,9	2						
Escola Secundária António Sérgio	7,75	-0,41	-0,24	42,86	0,03	0,74	0,9	36 (0,41) 56 (0,59)	0	0,54	6,99	0,1	0,12	0,01
Escola Secundária de Lousada	0	-4,61	0,82	54,2	2,21	4,51	11,21	32						
Escola Secundária de Paços de Ferreira	2,98	-8,72	-0,1	45,5	0,03	0,79	28,54	36 (0,89) 51 (0,05) 58 (0,06)	0	0,23	2,62	0,05	0,07	0
Escola Secundária de Valongo	4,95	-8,15	0,08	43,2	0,06	0,78	0,87	36 (0,93) 51 (0,07)	0	0,04	4,75	0,02	0,08	0,06
Colégio São Gonçalo	8,7	-0,13	-0,47	41,7	0,06	0,74	36,5	36 (0,61) 48 (0,24) 56 (0,15)	0	0,7	7,82	0,04	0,14	0
Colégio D. Diogo de Sousa	14,96	-0,21	-0,54	36,34	0	0,63	0,85	36 (0,29) 56 (0,71)	0	0,87	13,68	0,14	0,23	0,05
Externato Camões	11,66	0	-0,37	39,71	0,03	0,74	0,9	56 (1,00)	0,1	0,75	10,68	0,12	0,11	0
Escola Secundária de Amarante	8,62	0	-0,12	42,52	0,03	0,75	0,88	56 (1,00)	0,01	0,5	7,88	0,12	0,1	0,02
Equivalências (nº 2 Artº 20-A)	20,05	0	-0,64	31,94	0,03	0,53	0,76	56 (1,00)	0,74	1,02	18,45	0,12	0,32	0,14
Escola Secundária de Ponte de Lima	0	0,02	-0,1	61,92	5,64	11,1	339,94	4						
Escola Secundária Camilo Castelo Branco - Vila Real	12,18	-0,11	-0,12	38,69	0,05	0,72	0,81	36 (0,22) 56 (0,78)	0	0,45	11,41	0,09	0,13	0,1
Escola Básica e Secundária de Águas Santas	9,95	-0,48	-0,03	40,43	0,04	0,77	0,82	36 (0,47) 56 (0,53)	0	0,32	9,35	0,09	0,09	0,09
Escola Secundária Rocha Peixoto	7,55	-0,35	-0,25	43,05	0,09	0,75	0,91	36 (0,38) 56 (0,62)	0	0,55	6,84	0,04	0,11	0
Escola Secundária de S. Pedro	0	0,07	0,71	66,14	0,33	63,69	39,24	15						
Externato Carvalho Araújo	13,41	-13,53	-0,55	30,31	0,02	0,56	0,81	36 (0,60) 51 (0,40)	0	0,37	12,71	0,04	0,2	0,09
Colégio Novo da Maia	10,04	0	-0,25	41,3	0,02	0,7	0,87	56 (1,00)	0,33	0,63	9,1	0,14	0,14	0,03
Externato Académico	0	-37,27	-0,9	36,1	0,26	2,81	9,59	4						
Escola Secundária Ferreira de Castro	0,77	-1,1	0,17	48,62	0,08	0,83	0,89	36 (0,87) 56 (0,13)	0	0,04	0,62	0,02	0,05	0,04
Centro de Estudos Básico e Secundário - CEBES	26,62	0	-0,59	25,42	0,02	0,49	0,72	56 (1,00)	0,03	0,97	24,98	0,14	0,35	0,18
Escola Secundária D. Afonso Henriques	0	-3,12	0,19	46,32	39,9	3,53	147,58	0						
Escola Secundária Fernão de Magalhães	14,5	0,19	-0,4	37	0,04	0,63	0,87	36 (0,02) 56 (0,98)	0	0,77	13,37	0,12	0,21	0,04
Escola Secundária Dr. Mário Sacramento	0	0,39	2,52	55,64	6,26	6,05	9,12	43						
Colégio de Gaia	5,86	0,36	-0,13	44,66	0,08	0,8	36,44	36 (0,14) 48 (0,64) 56 (0,22)	0	0,39	5,38	0,03	0,06	0
Escola Secundária D. Sancho I	0	-17,33	0,43	59,07	2,91	9,23	324,19	1						