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FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

# Using Students' University Results to Benchmark Secondary Schools.

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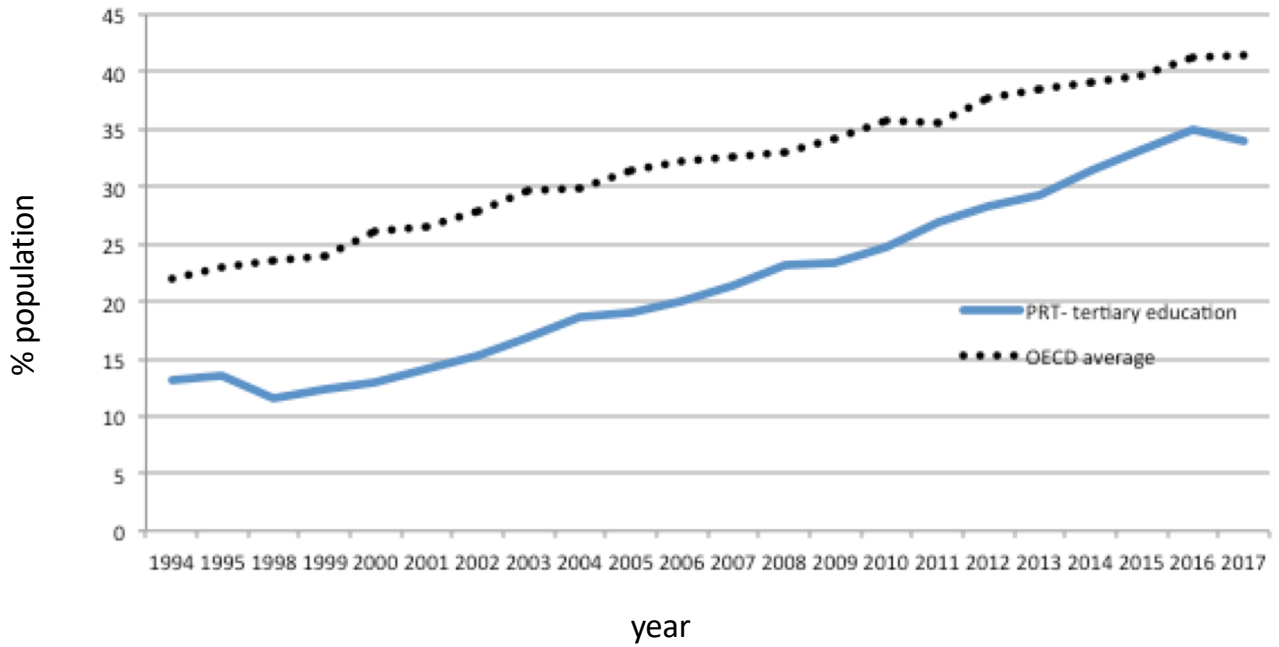
DAMSS DATA ANALYSIS METHODS FOR SOFTWARE SYSTEMS

# Outline

- Context and motivation
- Objectives
- Review of previous studies
- Data
- UP students characterisation (descriptive analysis)
- Empirical Results:
    1. Determinants of students' success (regression analysis)
    2. Benchmarking of secondary schools based on attainment in higher education (DEA)
    3. Overall picture of schools performance considering multiple perspectives
- Conclusions

# Context

- Higher Education in Portugal (recent trends)
  - Percentage of the population with tertiary education (aged 25-34) [OECD data]




  - Average age for finishing secondary education: 18-19 years old
  - Total number of vacancies in public Higher Education in Portugal: 50852 (86% filled) [Cabral and Pechincha, 2018]
  - Total number of vacancies in University of Porto: 3976 (99.8% filled)

# Context

- Higher Education vs Secondary education (contextual setting)

  - University entrance in Portugal is dominated by secondary school grades (entrance criteria is a weighted average between national exams (40 to 50% weight) and internal school grades);
    - This criteria assumes that **secondary school grades are a good predictor of university success**.

  - This topic of **school performance** is widely studied in School Benchmarking and Value Added literature, where **schools' success** is measured through:
    - Average grades in National Exams;
    - % of students approved;
    - Distribution of students per levels of achievement, etc.

  - **However, the actual achievements or success levels of students in higher education are seldom considered with the purpose of studying the performance of secondary schools.**

# Objective

- To analyse the determinants of success of first year students at University of Porto.
  - Success in Higher Education is a function of:
    - Student characteristics (abilities);
    - HE Degree characteristics, Faculty and Culture of the institution attended;
    - Features of the secondary school attended (type of ownership, average grades in national exams, socio-economic background and abilities of cohorts that attend the school)

- Benchmark secondary schools on their ability to prepare students for university success.

- Cross compare the performance of secondary schools in three dimensions related to the core objectives of secondary education:
  - **To prepare students in a way that promotes success in their future professional careers (higher education) and personal lives**.
  - To make students achieve high grades in national exams (given their abilities);
  - To place as many students as possible in the higher education degree of their choice;

# Previous studies

- **Relationship between students' university grades and high school grades**
  - Poor correlation between secondary school scores and university scores
    [Sear (1983) – in a UK study involving 1979 graduates].
  - Entry grade is the variable that least influences the score at university and the type of school attended (private/public) the one that influences the most.
    [Cabral and Pechincha (2014) – 7069 students of University of Porto, using OLS regression with gender, type of school attended (private/public) and order of preference of the degree attended in the application to higher education as the other independent variables]
  - Average grades in two Business School degrees are highly explained by secondary school attainment
    [Kaighobadi and Allen (2008) – US]
  - Students' high school grade is a good predictor of their university grade
    [Cyrene and Chan (2010) – 5136 students of the University of Winnipeg, Canada] .
  - High school leaving grade is the best predictor if the student will graduate. The impact on his/her final grades is lower.
    [Danilowicz-Gösele et al (2017) – 12.000 students of Göttingen University, Germany]

# Previous studies

- **Relationship between type of high school and university grades**
  - The type of school attended prior to entrance in the university may have a significant impact on the university performance.
    [Smith and Naylor (2005) – UK students].
  - Students coming from private schools Score better
    [Cyrene and Chan (2012) – 5136 students of the University of Winnipeg, Canada - private school sstudents increase 0,10 points the Grade Point Average (GPA) scores – but effects diminish over time]; [Smith and Naylor, (2005)- all data on all university students in the UK. On average, students who attended an Independent school are about 6% less likely to be awarded a 'good' degree compared to a student who attended State school, ceteris paribus]; [Mora and Escardibul, (2008) - sample of students for the University of Barcelona, observed over 1996-2003 (22364 students in 14 faculties].
  - **Public school students have better** performance than their peers.
    [Cabral and Pechincha (2014) – 7069 students of the University of Porto]; [Lasselle et al., (2014) - 1320 students at University of St Andrews in Scotland. School environment if important: the predicted probabilities of a good degree are slightly larger for those students from a less favourable school context. At "below average schools, those students obtaining three A grades are likely to be among the most well-motivated and brightest" (p.310)].
- **Relationship between University grades and other factors**
  - High school achievement is important in determining dropout, and students from more advantaged social classes are less likely to dropout
    [Smith and Naylor (2001) – Full population of university students in the UK].
  - Financial constraints have a positive impact in dropout rates in university students
    [Cardak and Vecci (2016) – Australia]

# Data

- Data from students of the University of Porto (UP)
  - We have data for **8609** students from 14 faculties, corresponding to the cohorts that attended the **first year** of a first cycle degree or integrated master degree at UP in the academic years 2013/14, 2014/15 and 2015/16.

| Faculty | Nº students | % students UP | % Female | % from Private Schools | % Zero ECTS |
|---|---|---|---|---|---|
| FADEUP | 296 | 3% | 32% | 35% | 8% |
| FAUP | 272 | 3% | 67% | 24% | 9% |
| FBAUP | 283 | 3% | 77% | 14% | 8% |
| FCNAUP | 137 | 2% | 93% | 35% | 15% |
| FCUP | 1315 | 15% | 48% | 21% | 17% |
| FDUP | 391 | 5% | 74% | 23% | 8% |
| FEP | 746 | 9% | 55% | 33% | 6% |
| FEUP | 1894 | 22% | 30% | 32% | 8% |
| FFUP | 408 | 5% | 82% | 32% | 16% |
| FLUP | 1297 | 15% | 67% | 15% | 14% |
| FMDUP | 134 | 2% | 69% | 50% | 10% |
| FMUP | 534 | 6% | 60% | 46% | 3% |
| FPCEUP | 336 | 4% | 88% | 20% | 7% |
| ICBAS | 566 | 7% | 69% | 46% | 6% |
| **Total** | **8609** | **100%** | **56%** | **28%** | **10%** |

# Data

- **Indicators related to students' <u>on entry</u> to higher education**:
  - Entry Score (ES)
    Classification (scale 0-20) in the national application to the UP degree (national competition for access to higher education, under the responsibility of DGES).
  - Normalised entry score (NES)
    Standardized variable (Standardized Normal distribution N(0,1)) representing the students' classification on entry in relation to the cohort of students that entered the same degree in the same academic year.

$$NES = \frac{ES - \overline{ES}}{s_{ES}}$$

# Data

- **Indicators of students' <u>at the end</u> of first year:**
  (the impact of secondary school education is higher in the first year of higher education attendance)
  - ECTS: Number of European Credit Transfer and Accumulation System (ECTS) credits completed at the end of first year.
  - First year score (FYS): Average classification (scale 0-20) obtained by the student in the courses that he/she was approved in the first year of the UP degree.
  - Normalised First year score (NFYS): standardized variable (Standardized Normal distribution N(0,1)) representing the students' average classification in relation to the cohort of students that attended the same degree in the same academic year.

$$NFYS = \frac{FYS - \overline{FYS}}{s_{FYS}}$$

  - Adjusted First year score (AFYS): Students performance taking into account the number of ECTS completed and the classifications obtained in the courses approved. This variables has the same value as the Average 1st year score if the student completes 60 ECTS, and a lower value if the number of ECTS completed is lower than expected. The variable is computed as follows:

$$AFYS = FYS \times \frac{ECTS}{60}$$

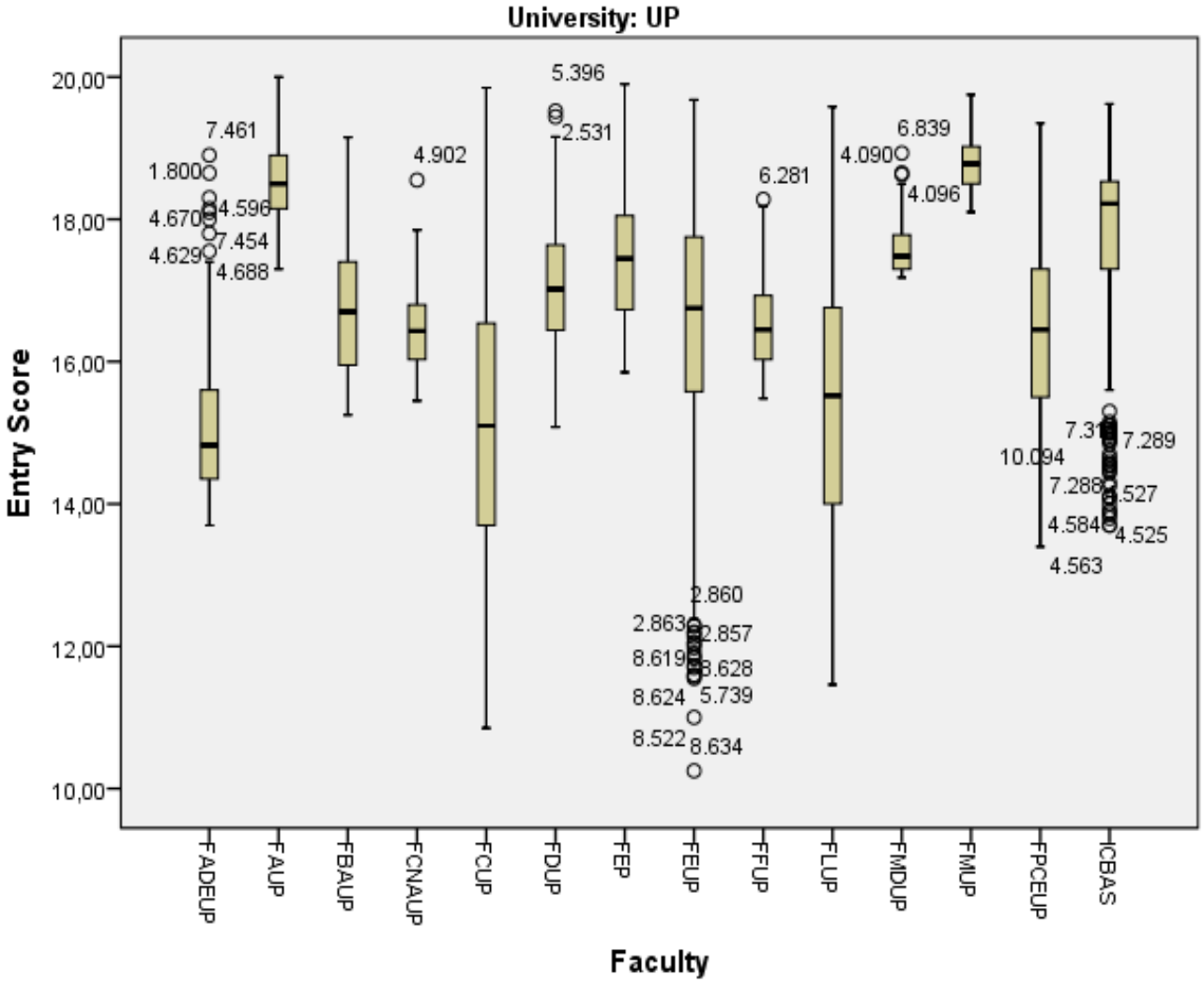
  - Normalised Adjusted First year score (NAFYS): standardized variable (Standardized Normal distribution N(0,1)) representing the students' average classification adjusted by the number of ECTS completed in relation to the cohort of students that attended the same degree in the same academic year.

$$NAFYS = \frac{AFYS - \overline{AFYS}}{s_{AFYS}}$$

  - Success: binary variable indicating whether a student has done 30 or more ECTS (Success=1) or completed less than 30 ETCS (Success=0).
  - ECTS_zero: binary variable indicating if a student completed ECTS (ECTS_zero=1 means no ECTS completed)

# UP students' characterisation

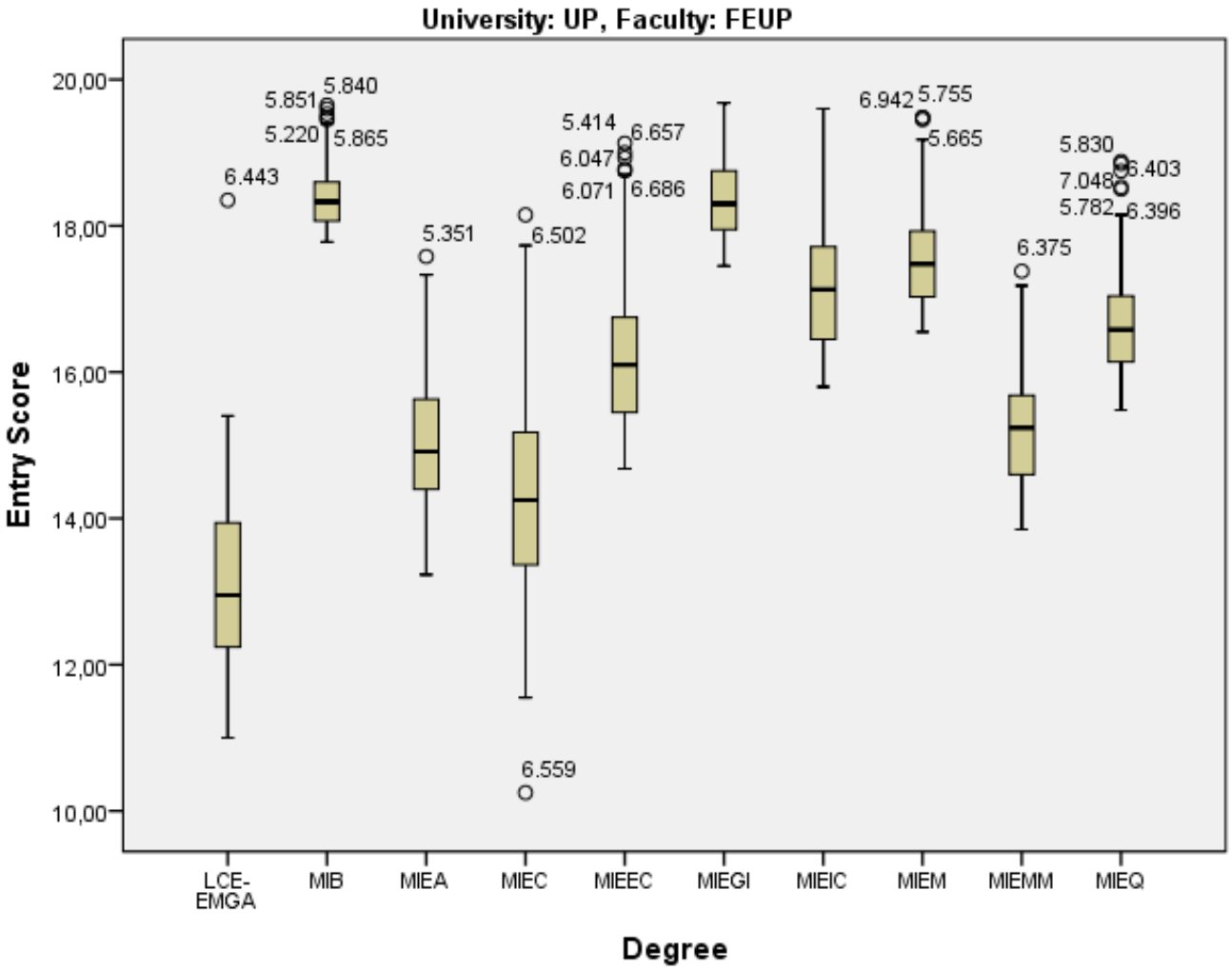
- Average Entry Score by Faculty:




| | Mean Entry_Score | St Dev of Entry_Score |
|---|---|---|
| FADEUP | 15,1 | 0,978 |
| FAUP | 18,6 | 0,521 |
| FBAUP | 16,7 | 0,875 |
| FCNAUP | 16,4 | 0,565 |
| FCUP | 15,1 | 1,811 |
| FDUP | 17,0 | 0,910 |
| FEP | 17,4 | 0,889 |
| FEUP | 16,6 | 1,582 |
| FFUP | 16,5 | 0,561 |
| FLUP | 15,4 | 1,781 |
| FMDUP | 17,6 | 0,339 |
| FMUP | 18,8 | 0,362 |
| FPCEUP | 16,3 | 1,340 |
| ICBAS | 17,8 | 1,144 |

# UP students' characterisation

- Average Entry Score by Degree (e.g., within the Faculty of Engineering):

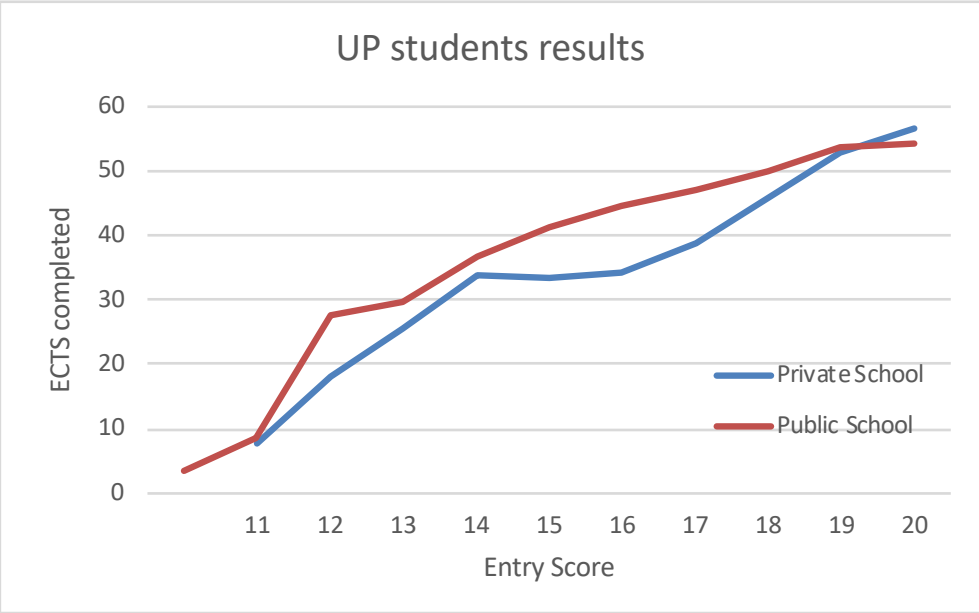


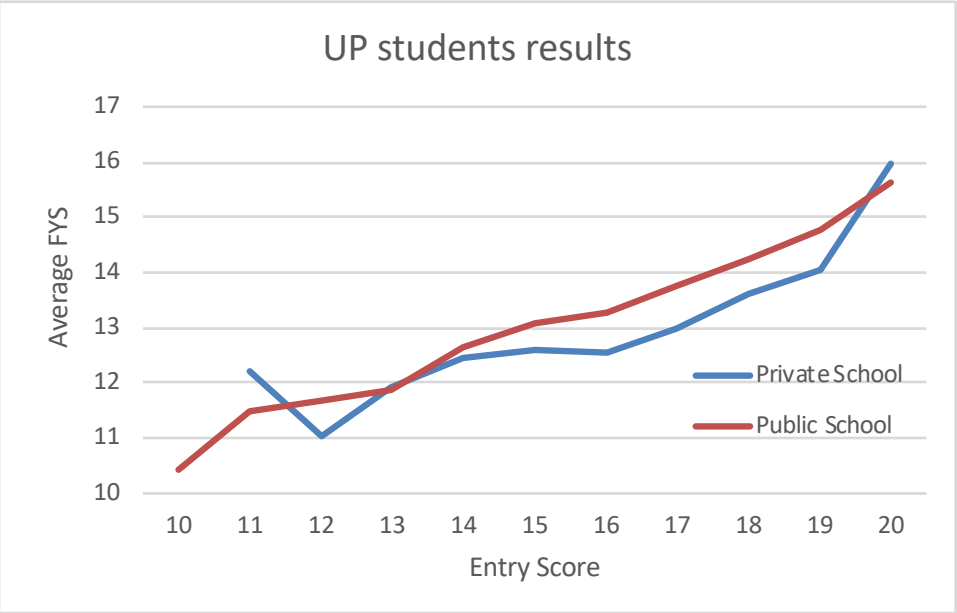

| Degree FEUP | Mean Entry Score | St Dev Entry Score |
|---|---|---|
| LCE_EMGA | 13,2 | 1,4 |
| MIB | 18,4 | 0,4 |
| MIEA | 15,0 | 1,0 |
| MIEC | 14,3 | 1,4 |
| MIEEC | 16,2 | 0,9 |
| MIEGI | 18,4 | 0,5 |
| MIEIC | 17,2 | 0,8 |
| MIEM | 17,5 | 0,6 |
| MIEMM | 15,2 | 0,8 |
| MIEQ | 16,7 | 0,7 |

# UP students' characterisation

Analysis of the influence of School Type (private/public) and Entry Score on Higher Education achievements

| | % students | % female students | Average ECTS completed (ECTS) | Average first year score (FYS) | Average Adjusted first year score (AFYS) | % students that completed 30 or more ECTS (Success) |
|---|---|---|---|---|---|---|
| Privado | 29% | 54% | 41 | 13,2 | 10,4 | 74% |
| Público | 71% | 57% | 45 | 13,6 | 11,4 | 79% |



# Methodology

## 1. Determinants of student success (overall UP and UCP analysis)

Final **sample with around 9000 students** from 2 universities (UP and UCP, with 14 and 7 faculties, respectively), taken from an original sample of **10338** students

All analyzes **excluded** students who did not complete any ECTS (ECTS_zero = 1)

- We run three OLS regressions, with **Normalised Adjusted 1st year score (NA1YS) , ECTS completed, Normalised First year score** as dependent variable and the following independent variables:
  - Normalised entry score (NES)
  - Gender (female=1; male=0)
  - Type of school (private=1; public=0)
  - School average grade on national exams (average 2014, 2015 and 2016)

- This provides an **overall picture** of the determinants of success of UP students
  - Using **normalized scores on entry and on exit** (1st year) is equivalent to a fixed effects model with dummys for the degrees.

# Results

## 1. Determinants of student success

(**overall analysis** with around 9000 students, excluding those that did not complete any ECTS)

- **Normalised Adjusted 1st year score (NAFYS)** as dependent variable

| R_square | P_value | Significant variables |
|---|---|---|
| 0.143 | 0.000 | NES(+), private(-), female (+), school Avg (-) |

  - **Entry score** alone explains **10.0%** of variability of NAFYS

- **Normalised 1st year score (NFYS)** as dependent variable

| R_square | P_value | Significant variables |
|---|---|---|
| 0.184 | 0.000 | NES (+), private(-) , female (+), school Avg (-) |

  - **Entry score** alone explains **15.8%** of variability of Normalised first year scores

- **ECTS completed (ECTS)** as dependent variable

| R_square | P_value | Significant variables |
|---|---|---|
| 0.067 | 0.000 | NES (+), private(-) , female (+) |

  - **Entry score** alone explains **3,7%** of variability of ECTS completed

- **Dependent variables (3 modelling alternatives)**
  - Normalized adjusted First Year Score
  - Normalized First Year Score
  - ECTS completed
- **Independent variables:**
  - Normalized Entry Score
  - Gender
  - Type of school
  - School average grade on national exams

# Methodology

## 1. Determinants of student success (per degree)

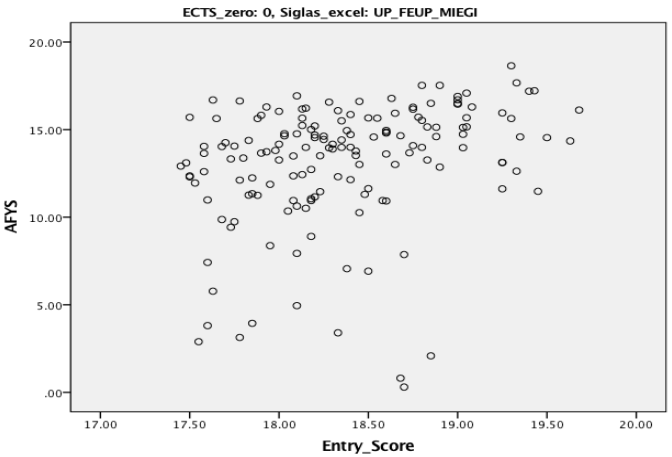
- We run three OLS regression models for **each degree**, with the Adjusted First Year Score (A1YS), ECTS completed and First year score as the indicator of students achievement (dependent variable) and the following independent variables.
  - Entry score
  - Gender (female=1; male=0)
  - Type of school (private=1; public=0)
  - School average grade on national exams

# Illustrative Results

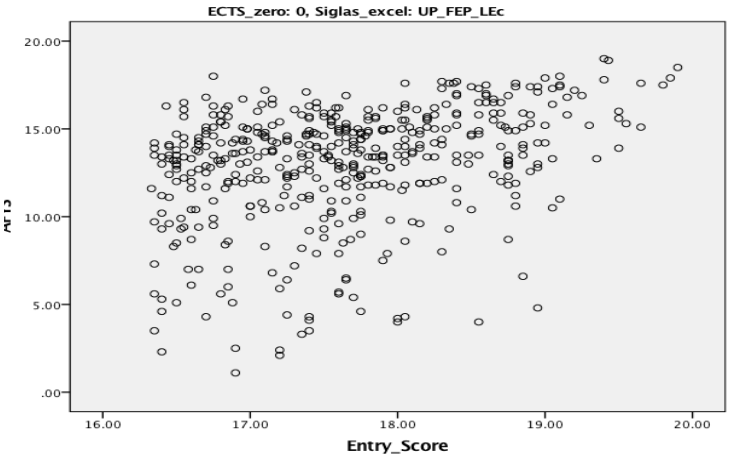
## 1. Determinants of student success (per degree)

| UP Degree | Dependent Variable | R square | P value | Significant variables |
|---|---|---|---|---|
| **Industrial Engineering** | **AFYS** | 0.161 | 0.000 | ES (+) |
| Faculty of Engineering | FYS | 0.250 | 0.000 | ES (+), private(-) |
| (159 students) | ECTS | 0.061 | 0.058 | ES (+) |
| **Economics** (FEP_LEc) | **AFYS** | 0.158 | 0.000 | ES (+), private(-) |
| Faculty of Economics UP | FYS | 0.205 | 0.000 | ES (+) |
| (499 students) | ECTS | 0.081 | 0.000 | ES (+), private(-) |
| **BioChemestry** | **AFYS** | 0.115 | 0.001 | ES (+) |
| Faculty of sciences UP | FYS | 0.213 | 0.000 | ES (+), private(-) , female (+) |
| | ECTS | 0.079 | 0.012 | School Avg (-) |

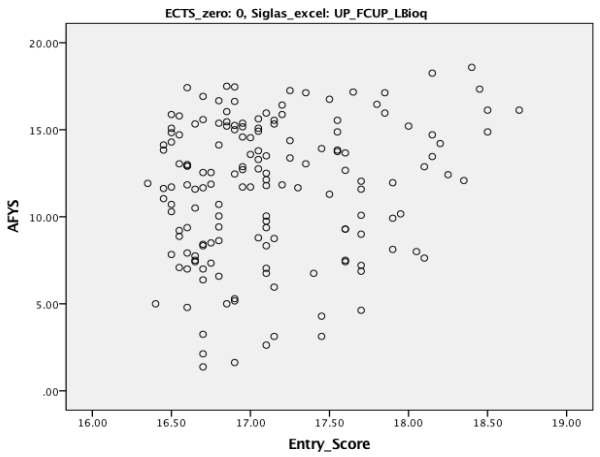
### Engineering Degree




### Economics Degree




### Biochemestry Degree



# Discussion of results

## 1. Determinants of student success

- The **entry scores** and **type of school** (private/public) are the variables that explain most of the variability of students results at the end of the first year in higher education (UP and UCP).
  - **Higher entry scores** and prior **attendance of public schools** have a positive effect both on the number of ECTS completed and on the average results at the end of the first year.
  - The influence of these variables is higher for the **average results at the end of the first year (18.4% of the variability explained by secondary education features, on average)** than for the **number of ECTS completed (6.7% of variability explained by secondary education features, on average)**.
- For the degrees that gender has a significant effect on results in higher education, it has a positive effect.
  - This is interpreted as an advantage for girls.
- For the degrees that School Average Grade on National Exams has a significant effect on results in higher education, it has a negative effect
  - This is interpreted as an advantage for schools facing more difficult socio-economic contexts, where not all students are able to obtain good grades in national exams and enter higher education.
- Previous schooling is not likely to affect equally all degrees.

# Results

## 2. Benchmarking of secondary schools based on attainment in higher education

- We analyzed **Secondary Schools** that placed at least **45 students in UP and UCP**
  - The final sample includes **64 schools** (23% of these schools are private), comprising 6341 students (70% of the students in overall sample).
  - Students that did not complete any ECTS were excluded from the sample.
- **Benchmarking model**:
  - Composite Indicator (CI) model, specified with a Directional Distance Function.
    - To deal with negative data, the directional vector represents the potential for improvement for each output indicator (difference between the maximum value observed for the indicator in the sample and the value observed in the school under evaluation for that indicator).

| Inputs | Outputs |
|---|---|
| Dummy (=1) | Normalised First Year Score<br>ECTS completed<br>% students at the Top (NFYS > 1.28 and ECTS ≥ 48) |

# Results

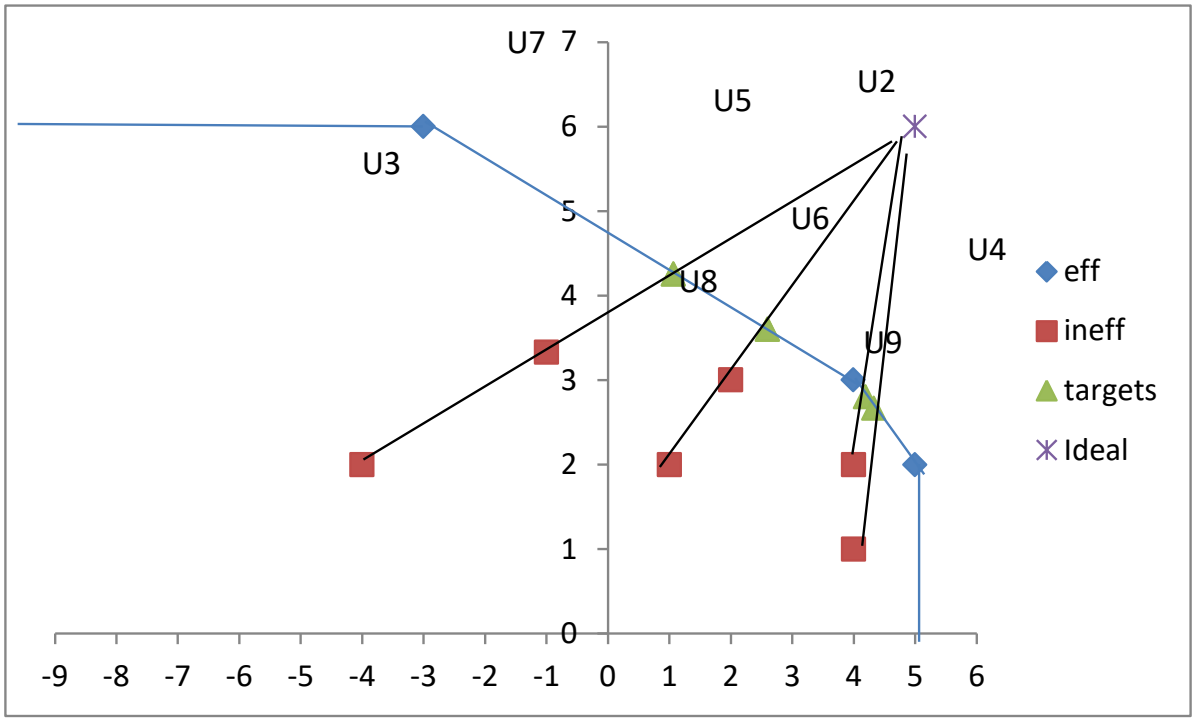
## 2. Benchmarking of secondary schools based on attainment in higher education

- **Benchmarking model**:
  - Composite Indicator (CI) model, specified as a Range Directional Model.

$$
\begin{aligned}
\max \quad & \beta_0 \\
\text{s.t.} \quad & \sum_{j=1}^{n} \lambda_j \leq 1 \\
& \sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0} + \beta_0 R_{r0},\ R_{r0} = \max_j \{y_{rj}\} - y_{r0} \\
& \lambda_j \geq 0\ \forall j
\end{aligned}
$$

# Results

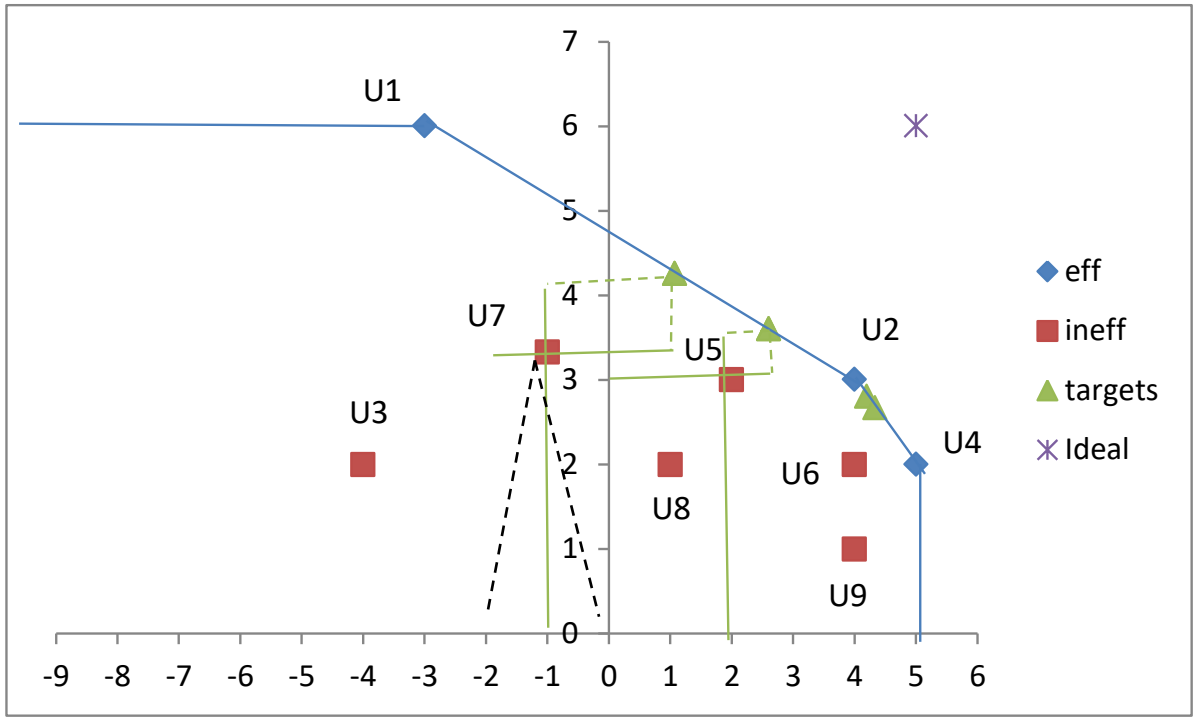
| DMUs | observed values | |
|---|---|---|
| | y1 | y2 |
| U1 | -3 | 6 |
| U2 | 4 | 3 |
| U3 | -4 | 2 |
| U4 | 5 | 2 |
| U5 | 2 | 3 |
| U6 | 4 | 2 |
| U7 | -1 | 3,33 |
| U8 | 1 | 2 |
| U9 | 4 | 1 |




Ideal reference
$= (\max_{j=1:9} output1_j,\ \max_{j=1:9} output2_j) = (5,6)$

# Results

$$\text{eff}\, y_i = \begin{cases} \dfrac{y_i}{y_i^*}, & if\ y_i > 0 \\ \dfrac{|y_i|}{2|y_i| + y_i^*}, & if\ y_i < 0 \end{cases}$$




| DMUs | observed values | | **beta** | targets | | efficiency measurement | | | |
|---|---|---|---|---|---|---|---|---|---|
| | y1 | y2 | | $y1^*$ | $y2^*$ | eff y1 | eff y2 | **eff average (y1,y2)** | DEA standard |
| U1 | -3 | 6 | **0** | -3 | 6 | 1 | 1 | **1** | - |
| U2 | 4 | 3 | **0** | 4 | 3 | 1 | 1 | **1** | 1 |
| U3 | -4 | 2 | **0,56** | 1,07 | 4,25 | 0,44 | 0,47 | **0,46** | - |
| U4 | 5 | 2 | **0** | 5 | 2 | 1 | 1 | **1** | 1 |
| U5 | 2 | 3 | **0,2** | 2,6 | 3,6 | 0,77 | 0,83 | **0,80** | 0,82 |
| U6 | 4 | 2 | **0,2** | 4,2 | 2,8 | 0,95 | 0,71 | **0,83** | 0,86 |
| U7 | -1 | 3,33 | **0,35** | 1,08 | 4,25 | 0,33 | 0,78 | **0,55** | - |
| U8 | 1 | 2 | **0,4** | 2,6 | 3,6 | 0,38 | 0,56 | **0,47** | 0,52 |
| U9 | 4 | 1 | **0,33** | 4,33 | 2,67 | 0,92 | 0,37 | **0,65** | 0,80 |

# Results

## 2. Benchmarking of secondary schools based on attainment in higher education

Best Performing Schools (TOP 10)

| rank eff | eff average | beta | School Name | Type | number of students in UP and UCP | Average ECTS | % Top | Average NFYS |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | Escola Secundária Dr. Mário Sacramento | Public | 48 | 53 | 20,8% | 0,49 |
| 1 | 1 | 0 | Escola Básica e Secundária Oliveira Júnior | Public | 58 | 54 | 19,0% | 0,42 |
| 3 | 0,91 | 0,47 | Escola Secundária Ferreira de Castro | Public | 45 | 54 | 17,8% | 0,35 |
| 4 | 0,89 | 0,58 | Escola Secundária São Pedro | Public | 54 | 54 | 16,7% | 0,34 |
| 5 | 0,87 | 0,44 | Escola Secundária de Lousada | Public | 64 | 53 | 18,8% | 0,30 |
| 6 | 0,84 | 0,81 | Escola Secundária Dr. Manuel Gomes de Almeida | Public | 113 | 49 | 17,7% | 0,34 |
| 7 | 0,82 | 0,77 | Escola Secundária D. Afonso Henriques | Public | 49 | 48 | 20,4% | 0,27 |
| 8 | 0,78 | 0,75 | Escola Secundária Carolina Michaellis | Public | 51 | 52 | 13,7% | 0,30 |
| 9 | 0,76 | 0,84 | Escola Secundária de Santa Maria da Feira | Public | 108 | 49 | 13,9% | 0,30 |
| 10 | 0,75 | 0,79 | Escola Secundária Tomaz Pelayo | Public | 47 | 52 | 14,9% | 0,23 |

Other Performing Schools (BOTTOM 10)

| rank eff | eff average | beta | School Name | Type | number of students in UP and UCP | Average ECTS | % Top | Average NFYS |
|---|---|---|---|---|---|---|---|---|
| 55 | 0,43 | 0,93 | Escola Secundária Joaquim Gomes Ferreira Alves | Public | 96 | 47 | 5,2% | -0,09 |
| 56 | 0,41 | 0,91 | Colégio de Gaia | Private | 46 | 48 | 6,5% | 0,00 |
| 57 | 0,40 | 0,95 | Externato Ribadouro | Private | 911 | 42 | 2,3% | -0,28 |
| 58 | 0,39 | 0,95 | Colégio D. Diogo de Sousa | Private | 50 | 41 | 2,0% | -0,36 |
| 59 | 0,38 | 0,92 | Colégio Novo da Maia | Private | 47 | 47 | 2,1% | -0,09 |
| 60 | 0,38 | 0,95 | Colégio da Trofa | Private | 86 | 41 | 1,2% | -0,32 |
| 61 | 0,37 | 0,95 | Externato Académico | Private | 46 | 39 | 2,2% | -0,30 |
| 62 | 0,37 | 0,93 | Colégio D. Dinis | Private | 133 | 46 | 3,0% | -0,06 |
| 63 | 0,37 | 0,94 | Externato Camões | Private | 56 | 43 | 1,8% | -0,16 |
| 64 | 0,35 | 0,96 | Externato D. Duarte | Private | 66 | 36 | 1,5% | -0,33 |

# Discussion of Results

- Distinctive features between TOP and BOTTOM Schools in our ranking:
  - TOP schools dominate BOTTOM schools in the four output dimensions characterising performance in higher education:
    - **Students from TOP schools, complete, on average, more than 50 ECTS.**
      Students from BOTTOM schools complete, on average, less than 50 ECTS.
    - **On average, 17% of students from TOP Schools are TOP students in higher education**.
      For BOTTOM schools, on average only 3% are TOP students.
    - **Students from TOP schools obtain classifications above the average of their Higher Education degrees.**
      Students from BOTTOM schools obtain classifications below the average of their degrees.
  - **All TOP schools are public** and **90% of BOTTOM schools are private**.

# Methodology

## 3. Overall picture of Secondary Schools Performance

- **Indicators** considered for the **cross comparison** of performance of secondary schools in the **three dimensions** related to the core objectives of secondary education.
  - **To prepare students in a way that promotes success in their future professional careers (higher education) and personal lives**
    - ✓ **CI Score based on attainment in higher education (CI score)**
  - To make students achieve high grades in national exams (given their abilities);
    - ✓ Portuguese secondary schools ranking constructed by the newspaper "Público" (Rank "Publico"), based on the average classification of students' in the 8 exams of secondary education with the largest number of students enrolled.
  - To place as many students as possible in the higher education degree of their choice;
    - Proportion of students from the school whose average grade in the national exams is greater or equal to 160 (out of 200 maximum classification in the exam).

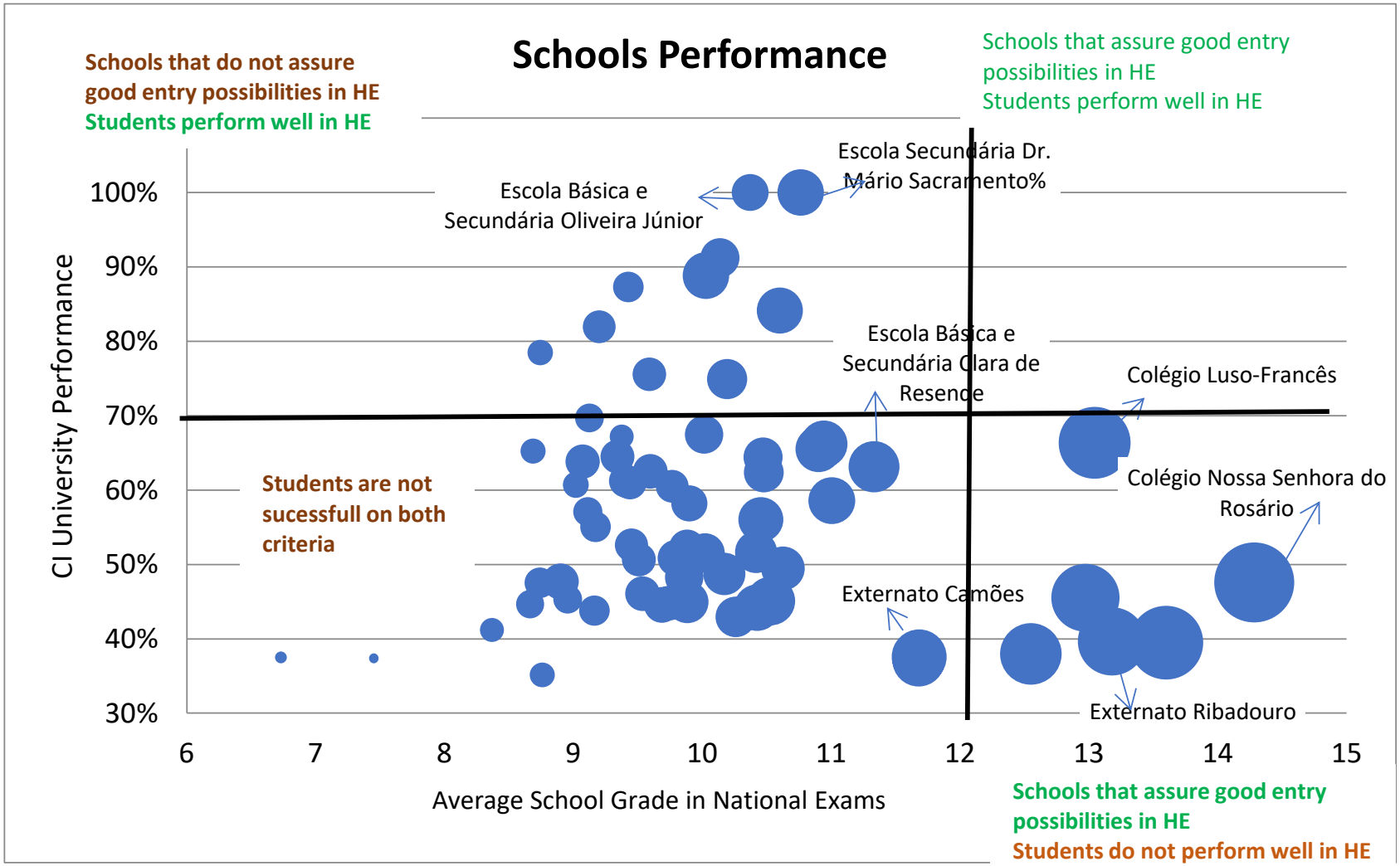
# Discussion of Results

- The secondary schools ranking based on the average classification of students' in the 8 exams of secondary education with the largest number of students enrolled (*Rank Public)* is **very different** from the ranking based on higher education results.

| rank eff | eff average | beta | School Name | Type | number of students in UP and UCP | Average ECTS | % Top | Average NFYS | rank "Público" | exams 2013/2014/2015 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | Escola Secundária Dr. Mário Sacramento | Public | 48 | 52,60 | 20,8% | 0,49 | 13 | 10,8 |
| 2 | 1 | 0 | Escola Básica e Secundária Oliveira Júnior | Public | 58 | 53,96 | 19,0% | 0,42 | 22 | 10,4 |
| 3 | 0,91 | 0,47 | Escola Secundária Ferreira de Castro | Public | 45 | 53,60 | 17,8% | 0,35 | 26 | 10,1 |
| 4 | 0,89 | 0,58 | Escola Secundária São Pedro | Public | 54 | 53,66 | 16,7% | 0,34 | 27 | 10,0 |
| 5 | 0,87 | 0,44 | Escola Secundária de Lousada | Public | 64 | 53,06 | 18,8% | 0,30 | 44 | 9,4 |
| 6 | 0,84 | 0,81 | Escola Secundária Dr. Manuel Gomes de Almeida | Public | 113 | 48,93 | 17,7% | 0,34 | 15 | 10,6 |
| 7 | 0,82 | 0,77 | Escola Secundária D. Afonso Henriques | Public | 49 | 48,41 | 20,4% | 0,27 | 48 | 9,2 |
| 8 | 0,78 | 0,75 | Escola Secundária Carolina Michaellis | Public | 51 | 52,20 | 13,7% | 0,30 | 58 | 8,7 |
| 9 | 0,76 | 0,84 | Escola Secundária de Santa Maria da Feira | Public | 108 | 49,01 | 13,9% | 0,30 | 39 | 9,6 |
| 10 | 0,75 | 0,79 | Escola Secundária Tomaz Pelayo | Public | 47 | 51,82 | 14,9% | 0,23 | 24 | 10,2 |
| 43 | 0,48 | 0,91 | Colégio Nossa Senhora do Rosário | Private | 197 | 48,09 | 8,6% | 0,04 | 1 | 14,3 |
| 14 | 0,66 | 0,80 | Colégio Luso-Francês | Private | 100 | 51,23 | 8,0% | 0,28 | 4 | 13,0 |
| 46 | 0,46 | 0,92 | Colégio Paulo VI | Private | 135 | 46,56 | 8,9% | 0,02 | 5 | 13,0 |
| 21 | 0,63 | 0,87 | Escola Básica e Secundária Clara de Resende | Public | 110 | 48,43 | 10,0% | 0,22 | 9 | 11,3 |
| 28 | 0,59 | 0,86 | Escola Secundária Eça de Queirós - Póvoa de Varzim | Public | 142 | 50,85 | 9,2% | 0,15 | 10 | 11,0 |
| 55 | 0,43 | 0,93 | Escola Secundária Joaquim Gomes Ferreira Alves | Public | 96 | 47,04 | 5,2% | -0,09 | 23 | 10,3 |
| 56 | 0,41 | 0,91 | Colégio de Gaia | Private | 46 | 48,34 | 6,5% | 0,00 | 62 | 8,4 |
| 57 | 0,40 | 0,95 | Externato Ribadouro | Private | 911 | 42,47 | 2,3% | -0,28 | 3 | 13,2 |
| 58 | 0,39 | 0,95 | Colégio D. Diogo de Sousa | Private | 50 | 41,42 | 2,0% | -0,36 | 2 | 13,6 |
| 59 | 0,38 | 0,92 | Colégio Novo da Maia | Private | 47 | 47,45 | 2,1% | -0,09 | 6 | 12,6 |
| 60 | 0,38 | 0,95 | Colégio da Trofa | Private | 86 | 41,37 | 1,2% | -0,32 | 7 | 11,7 |
| 61 | 0,37 | 0,95 | Externato Académico | Private | 46 | 38,99 | 2,2% | -0,30 | 64 | 6,7 |
| 62 | 0,37 | 0,93 | Colégio D. Dinis | Private | 133 | 46,11 | 3,0% | -0,06 | 63 | 7,5 |
| 63 | 0,37 | 0,94 | Externato Camões | Private | 56 | 43,47 | 1,8% | -0,16 | 8 | 11,7 |
| 64 | 0,35 | 0,96 | Externato D. Duarte | Private | 66 | 36,36 | 1,5% | -0,33 | 57 | 8,8 |

# Discussion of Results

- Cross comparison of the three indicators of secondary schools performance:
  - X-axis: average grade of school students in national exams (end of secondary education)
  - Y-axis: Composite indicator rank reflecting performance in higher education (the higher the better)
  - Size of bubble: % of students with average classification greater or equal to 160



# Conclusions

- **In Portugal, students' success in higher education** is significantly influenced by Entry Grades.
  - This is the most influential factor directly linked with **secondary education**, with a strong influence on the grade obtained at the end of the first year in HE.
- Other factors also have a significant influence on success in higher education.
  - Good performance in higher education is positively associated with **high entry grades**, **female** gender, and attendance of a **public school** in secondary education with **cohorts with low average grades in national exams** (disadvantaged socio-economic environment at the secondary school).
- Rankings of schools based only on the results in national exams do not reflect the way schools prepare students for **university success**.
  - Rankings of school performance should also consider students **success in further educational stages (Higher Education)**.
  - This dimension of performance should be publicly disclosed, to allow social **acknowledgment of other educational achievements pursued by schools** beyond the preparation for national exams.
  - Although not all secondary school students enter university, this is a very important dimension of education: preparation for **success in future challenges.**

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# Using Students' University Results to Benchmark Secondary Schools.

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