

# THE CASE OF WEIGHTED GPA IN SPANISH UNIVERSITIES

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## Abstract

The purpose of this paper is to examine the convenience of using a weighted grade point average over the commonly used grade point average to incorporate a penalisation in the case a university student does not pass a course in the first possible call. The authors consider this measure more suitable than the standard GPA to incorporate the peculiarity of Spanish universities where students are able to re-sit for a course up to seven times.

Keywords: Assessment, GPA, Higher education.

## 1 INTRODUCTION

Many of the universities around the world use a single metric to represent a student's overall level of achievement, namely the Grade Point Average (GPA). This metric is calculated in Spain (Royal Decree 1125 / 2003 of 5 September) as the sum of the ECTS credits earned by the student multiplied by the value of the corresponding qualifications, divided by the number of total ECTS credits earned by the student. With this single metric students are acknowledged with Honors degrees and scholarships, and curricular internships, final projects, or Erasmus destination universities are allocated. As this metric has such a potential impact, it is important that the used metric should only reward the outstanding achievers.

Paraphrasing the beginning of Prof. Raich [1] paper on "Weighted Grades: Solution or Problem", does it seem fair to you that a student that has completed all his/her degree courses in the first possible call and is applying for a specific final degree project, is left out because all the positions are granted to students having a better grade in just one course but took double time to complete?

Some Spanish universities, like Universidad de Alcalá de Henares, Universidad de Valladolid or Universidad Carlos III de Madrid, are already using some type of penalisation to award Honours degrees (<https://escuelapolitecnica.uah.es/escuela/documentos/normativa-premios-extraordinarios.pdf>), to the selection of curricular internships (<https://www.feyts.uva.es/sites/default/files/CRITERIOS%20CALCULO%20NOTA%20MEDIA-1.pdf>), or for all internal procedures (<https://e-archivo.uc3m.es/handle/10016/19428#preview>). However those penalizations are not uniform and are not transferable between institutions.

Like these universities, the authors also believe some type of penalization should be applied to any student for not passing a course in the first possible call. Concretely, the authors propose to use a weighted GPA (w-GPA) instead of the commonly used GPA, to incorporate the peculiarity of Spanish universities where students are able to re-sit for a course up to seven times. This paper proposes that such a student's w-GPA would be computed by multiplying the ECTS credits of each course by the grade points earned in each particular course and then dividing the total number of grade points by the total number of attempted ECTS. If a student had to retake a course, both the initial and all retake exam grades are recorded on the student's permanent academic record, and all those grades are included in the calculation of the proposed w-GPA.

This paper presents an analysis of both grading systems (GPA vs. w-GPA) using anonymized official data provided by the Complutense University, a well-known Spanish public university and the third largest on-site university in Europe.

First results show there is grade inflation when using the GPA (non-penalized) versus the w-GPA. This easily avoidable phenomenon of grade inflation limits the ability of universities rewarding the outstanding achievers, or of employers distinguishing superior academic performers from the majority of their colleagues, since students can retake a course almost endlessly until they pass it.

## 2 METHODOLOGY

### 2.1 Study context

The Complutense University is Integrated Institutional Data System (Sistema Integrado de Datos Institucionales—SIDI) provided the authors with access to data already anonymized for all the students who first enrolled in the bachelor's degree in Business Administration at the Universidad Complutense de Madrid (UCM), from the years 2009/10 through to 2018/19. The 2018/19 cohort is the last possible cohort that might have finished all the 240 required credits (ECTS) of the Spanish four year degree in Business Administration.

This information consisted of demographic information as well as the full account of the student's academic record. In particular, there is the students' detailed transcript of all their compulsory core courses as well as their optional ones, specifying the students' grades. This data also includes whether each student had to retake the final exam (there are two calls per academic year), whether they had to retake the course (re-enrolling and paying the corresponding fee), and the number of times they re-enrolled.

Two metrics are included and compared in this paper, namely the Grade Point Average (GPA) and a weighted GPA (w-GPA). The GPA is calculated in Spain (Royal Decree 1125 / 2003 of 5 September) as the sum of the ECTS earned by the student multiplied by the value of the corresponding qualifications, divided by the number of total ECTS earned by the student.

The authors propose to compute a student's w-GPA by multiplying the term ECTS credits of each course by the grade points earned in each particular course, and then dividing the total number of grade points by the total number of attempted ECTS. If a student had to retake the final exam or re-enroll in a course, all the initial and the retake(s) course grades are recorded on the student's permanent academic record, and are all included in the calculation of the w-GPA.

In both cases, GPA and w-GPA, the calculation takes into account the relative size of courses (ECTS) so that larger courses contribute more.

### 2.2 Sample

The initial data set consisted of all the students who first enrolled in the bachelor's degree in Business Administration at the Universidad Complutense de Madrid (UCM), from the academic year 2009/10 through to 2018/19. Academic year 2009/10 was selected as the starting year for this study, as that was the academic year the Faculty of Economics and Business Administration of the Complutense University of Madrid (Spain) introduced the new Bologna adapted four-year degrees. Academic year 2018/19 is the last cohort that might have finished the bachelor's degree in Business Administration with a duration of four academic years.

A total of 1877 students completed all the courses and the final thesis and have, therefore, been able to request the graduate diploma. The distribution by academic year can be seen in Table 1. Out of those 1877 that have already finished their degree, 914 were female (48.69%).

Table 1. Distribution by academic year cohort

	<i>Count</i>	<i>Percent</i>
2009/10	296	15.77
2010/11	262	13.96
2011/12	239	12.73
2012/13	246	13.11
2013/14	205	10.92
2014/15	199	10.60
2015/16	153	8.15
2016/17	123	6.56
2017/18	59	3.14
2018/19	95	5.06
Total	1877	100

As can be expected, as the years go by, the sample size decreases, since students have had fewer opportunities to complete all the necessary courses (240 ECTS in Spain) to obtain their Bachelor in Business Administration degree diploma.

### 3 RESULTS

The impact of penalising the GPA calculation for students who enrolled in a major of Business Administration at the Universidad Complutense de Madrid, was analysed. Characteristics for the two quantitative variables (GPA and w-GPA) for this study are presented in Table 2 (for the total sample). It has to be noted that a 10-point grading scale is used in Spain, with 5 being considered passing.

Table 2. Statistical summaries

	Mean	St.Dev.	CV	Skewness	Kurtosis	Min	Q1	Median	Q3	Max
<b>GPA</b>	6.59	0.58	0.09	1.20	1.75	5.49	6.17	6.47	6.86	9.42
<b>w-GPA</b>	5.72	0.99	0.17	0.67	0.12	3.52	5.00	5.55	6.29	9.42

On average, as well as for the minimum value, first quartile (Q1), Median, third quartile (Q3) and maximum value, GPA is much higher than w-GPA. Also standard deviation (St.Dev.) and coefficient of variation (CV) is significantly smaller for GPA. These differences can also be seen in Figure 2, where notched box plots for both GPA and w-GPA are represented. The difference between the usual square box plot and the notch box plot is that the later displays with the V-shape a confidence interval around the median. The top and bottom of the notches are calculated as  $\text{Median} \pm 1.57 \cdot \text{IQR} / \sqrt{n}$ , where IQR and n are the interquartile range and number of observations, respectively, for each subset of data (GPA and w-GPA in this case). Although it is not a formal test, if two boxes' notches do not overlap there is strong evidence (95 % confidence) their medians differ [3].

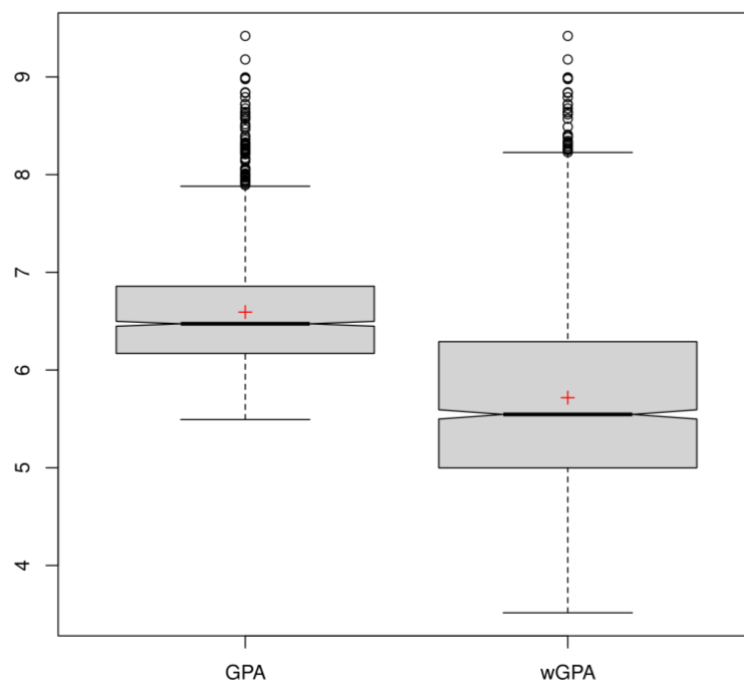


Figure 1. Notched boxplots

It can be easily seen that the notches do not noticeably overlap, hence there is a significant difference between the grades calculated through GPA versus those penalised calculated through wGPA. However a more formal hypothesis test will be used to confirm that difference. As both GPA and w-GPA are significantly non-normally distributed (see Table 3 for results of the Shapiro-Wilks normality test), a non-parametric test is needed. Hence the two-sample Kolmogorov-Smirnov test will be used.

Table 3. Shapiro-Wilks normality test results

	<i>W</i>	<i>p-value</i>
<b>GPA</b>	0.92149	< 2.2e-16
<b>w-GPA</b>	0.9667	< 2.2e-16

The results of the one side two-sample Kolmogorov-Smirnov hypothesis test ( $D^{\wedge} = 0.57006$ ,  $p\text{-value} < 2.2e-16$ ) reject the null hypothesis. Hence we have sufficient evidence to say that the two sample datasets do not come from the same distribution and that GPA is significantly higher than the penalised measure w-GPA.

## 4 CONCLUSIONS

As has been shown in this work, when summarising the academic performance of students in a university degree, there are statistically significant differences between the traditionally average (GPA) and the one proposed by the authors (w-GPA). Academic merit is usually the main criterion used in much of the future life of graduate students. This is clear in the academic world, for those competing for a place in postgraduate studies, or for a scholarship. But also, although to a lesser extent, these measures are taken into account in their professional development, mainly when it comes to obtaining their first job. Using the average GPA can lead to an unfair assessment of students' merits. Therefore, academic authorities must evaluate the possibility of introducing alternative proposals, such as the w-GPA. In addition to offering a lower average, w-GPA is a more heterogeneous measure, which allows obtaining a more precise measure of academic performance.

The authors are aware that the results obtained should be taken with caution, mainly due to the limitations of the sample. Firstly because although the sample is made up of 2000 students, all of them have studied a bachelor's degree in Business Administration at the Universidad Complutense de Madrid. Even so, it is to be expected that similar results would be obtained in other degrees and other universities. Secondly because of the very special moment in which it refers. The year 2020 has had an impact on the academic life of students, and may have affected the number of students who have completed their studies and the average grade that students have obtained. This is an extension that the authors are already working on. Another question of interest is also to analyse whether these differences are more or less pronounced distinguishing by gender and by cohort.

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