
A STUDY OF DROPOUT BEHAVIOR IN THE PORTUGUESE HIGHER
EDUCATION SYSTEM, WITH AN APPLICATION TO MASTERS PRO-
GRAMS IN ECONOMICS

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Biographical Notes

Luís Paulo Sá Gonçalves was born on the 14th of July of 1990 in Funchal (Portugal), where he lived and studied until the age of 18. In 2008 he moved to Oporto, in order to enroll at Faculdade de Economia do Porto. This would become his *alma mater*, from which he obtained his degree in Economics in 2015. During this time, he was a part of the Tuna Académica da Faculdade de Economia do Porto, having organized music tours through numerous European countries, as head of the travel department.

In late 2015 he entered the Master in Economics program, again at Faculdade de Economia do Porto. Around the same time, he enjoyed his first experience on the labor market, working as a Financial Assistant at Nilorn Portugal. He currently works as a Sales Assistant at Novo Banco.

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Abstract

Despite continued efforts towards improving higher education, not much has been written on dropout behavior in Portugal. This work aims to fill this gap by studying dropout behavior in the Portuguese higher education system.

An extensive review of the existing literature is presented, tackling the subject matter of this dissertation from various perspectives. It is accompanied by a brief history of the Portuguese higher education, which helps understand the current landscape of the system. Both of these aid in understanding dropout behavior and contribute towards the selection of the determinants included.

Using these select determinants of dropout, we analyze how this behavior relates to Portuguese students. Three different regressions were calculated, with the first regarding the entire student population, the second focusing in master's degrees in general and the third on 2nd degrees in the field of Economics.

We employ a Negative Binomial Regression Model on the chosen database, in order to measure the impact of the selected variables on dropout in Portuguese tertiary education.

Finally, we formulate and answer a set of research questions related with dropout behavior. This allows us to reach several conclusions regarding dropout in Portuguese higher education, paying particular attention to master's degrees in Economics.

JEL Codes: I21, I23

Keywords: Dropout - Higher education – Master in Economics – Portuguese Universities

Resumo

Apesar de contínuos esforços efetuados no sentido de melhorar o ensino superior, pouco foi escrito sobre abandono escolar em Portugal. Este trabalho tenta preencher este vácuo, através do estudo do abandono escolar no Ensino Superior português.

Uma extensa revisão da literatura existente é apresentada, abordando o tema desta dissertação de várias perspetivas. É acompanhada por uma breve história do ensino superior Português, que ajuda a compreender o panorama atual do sistema. Ambas auxiliam a compressão do abandono escolar e contribuem para a seleção dos determinantes incluídos.

Utilizando os determinantes de abandono escolhidos, analisamos como este comportamento se relaciona com os estudantes portugueses. Três regressões diferentes foram calculadas, sendo a primeira referente a toda a população estudantil, a segunda focada nos mestrados em geral e a terceira nos mestrados na área de Economia.

Empregamos um Modelo de Regressão Binomial Negativa na base de dados escolhida, de forma a medir o impacto das variáveis selecionadas no abandono escolar na educação superior portuguesa.

Finalmente, formulamos e respondemos a um conjunto de questões de pesquisa relacionados com abandono. Isto permite-nos chegar a várias conclusões quanto ao abandono escolar no ensino superior, com especial atenção nos mestrados em Economia.

JEL Codes: I21, I23

Keywords: Abandono Escolar – Ensino Superior – Mestrado em Economia – Universidades Portuguesas

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1. Introduction

Higher education is fundamental for economic development and citizenship. Sovereign states, such as Portugal, benefit greatly from investments in tertiary education, as the system produces more skilled and educated individuals, leading to higher tax revenue and less public spending on social welfare programs (OECD, 2017). Additionally, higher education yields benefits at an individual level. When compared with secondary education graduates, college graduates are less likely to be unemployed (12% vs 8% for Portugal in 2015), enjoy higher job stability (50% vs 60% in terms of full time jobs within the OECD in 2014) and receive higher wages (70% higher for college graduates in Portugal) (Figueiredo et al., 2017).

Thus, it is not surprising that the European Union strategically targets the reduction of inequality in access and completion of higher education, aiming to raise the number of young people with higher education degrees (Contini, Cugnata, & Scagni, 2017). Reducing the number of dropouts from higher education plays an important role in achieving the objectives set by the European Commission, as seen in the “Europe 2020” strategy. This program specifies two major goals for Portugal in terms of education: reducing the rate of early abandonment in education and training to 10%, and raising the rate of higher education degree attainment for individuals between the ages of 30 and 34 to 40% (PORDATA, 2018a).

Historically, Portugal has struggled with a significant skill gap (Figueiredo et al., 2017) that lasts to this day, despite 30 years of measures to increase attainment. For instance, tertiary degree attainment for individuals between the ages of 30 and 34 diminished during the nineties (15,1% in 1992 vs 11,1% in 1999), but has significantly increased in more recent years, reaching 18,3% in 2006 and 34,6% in 2016 (PORDATA, 2018b). Still, despite these results, the country continues to lag behind the OECD average. (OECD, 2016)

Of the Portuguese population between 18 and 25, 53,6% of individuals are students, either full or part time. This is slightly higher than the OECD average of 52,5% students versus 47,5% non-students. Enrollment in tertiary education is at 26% for 18-year-olds, 35% for 19-year-olds and 39% regarding 20 year old individuals, values which are aligned with the OECD average(17%, 33% and 39%) (OECD, 2017). As for young adults above 20, the OECD states that 37% of 20 to

24-year-olds are students. Comparatively, within the OECD this figure is at the 42% mark, which suggests that Portuguese individuals in this age group are less inclined towards education at all levels, including tertiary education (OECD, 2017).

One of the most significant problems that the Portuguese education system struggles with is early abandonment. The rate of early abandonment in education and training, i.e. the percentage of the population between the ages of 18 and 24 who have not obtained a secondary education degree, has shown a decreasing trend, from 50% in 1992, to 44,8% in 1999, down to 38,5% in 2006, and finally to only 12,6% of the population in 2017 (PORDATA, 2018c). Despite this downward tendency, the end results are lackluster when compared with other developed nations (OECD, 2018). This segment of the population is also of interest to the work at hand, as 91% of first time entrants in tertiary education are younger than 25 years old, with the average age of entry being 20 years old for the entire system (OECD, 2017), and the typical age of entry gap being between 18 to 23 for master degree programs. (OECD, 2017).

Thus, considering the country's situation and the problems highlighted in the previous paragraphs, it is important to understand success in higher education. Despite the efforts of the European Commission and the Portuguese government to promote the pursuit of higher education, not many scientific works have been written on the subject of dropout behavior in Portugal. Except for the regular reports published by DGES (*Direção Geral do Ensino Superior*), DGEEC and entities related to the European Commission, such as Eurydice, not much has been written concerning this problem in the country. Furthermore, government policy should be theory and evidence based. Policy is more efficiently drafted and implemented if based on an understanding as to why students from a certain group are more likely to dropout (Johnes & McNabb, 2004). With all these different factors in mind, the present dissertation concerns itself with a better understanding of dropout in the context of Portuguese higher education in general, while highlighting the specificities pertaining to master's degrees.

The focus on master's degrees has been motivated by recent reports that show an interesting dichotomy regarding master's degrees and the students that are part of them: although the percentage of students who achieve this degree is rising - increasing more than fivefold between 2006 and 2012 according to DGEEC

(Conselho Nacional de Educação, 2015), abandonment in the first year of the course is more frequent for Portuguese master's degree students, than for their first cycle counterparts (Conselho Nacional de Educação, 2014). These figures, together with the aforementioned focus of the EU on higher education goals, justify the choice of 2nd cycle degrees as worthy of a certain focus. We will also analyze master's degrees in Economics separately, in an attempt to see the effect of dropout in a more homogenous backdrop. Master's degrees can be obtained in a plethora of different subject matters, which differ in terms of entry requirements, teaching staff, pool of course units offered or the degree of freedom when deciding on the former. Therefore, examining the field of Economics individually will allow us to somewhat eliminate the influence of these differences on dropout, by tackling a more standardized database which only includes one field of study.

Lastly, an important disclaimer must be made. This study does not attempt to offer solutions that would reduce the problem of higher education abandonment in Portugal; instead, it aims to help better understand this problem, by studying how it impacts the country's institutions of higher education.

The next section will concern itself with the existing literature regarding the subject of higher education dropout. We will also present the past and present of Portuguese higher education, as well as its possible path towards the future. Next, we will cover the methodology employ, specifying the details regarding our dependent and independent variables, database and estimation method. We will also formulate a set of research questions, which will be then answered as we, finally, interpret the estimations calculated and present our conclusion based on them.

2. Existing Research on Dropout

The complexity of the college experience allows for the study of dropout from a multitude of perspectives. In this section, we cover some of the main results put forward in the literature. First, we show that the definition of dropout is not straightforward. Next, we cover the sociological approach to the study of dropout, primarily through the contributions of Tinto (1975) and Spady (1970). Afterwards, we study the impact of the costs of attending higher education and the ways to finance them on students' decisions to abandon their studies. Finally, we discuss other aspects of the provision of higher education, such as enrollment and performance, on their influence on dropout behavior.

2.1 Defining Dropout

Clarifying the definition of college dropout is vital for this study. According to Spady (1970), there are two definitions of dropouts. The first, and most traditional, takes a dropout to be any student that leaves the institution of higher education without a degree. This is a definition close to that found in most official reports, which take dropouts to be students that enrolled in a particular academic year, but neither graduated nor are enrolled in the following year (European Commission/EACEA/Eurydice, 2014). The second definition requires that the student never obtain a degree from any institution (Spady, 1970).

These definitions, however, do not distinguish between dropout and what Stratton et al (2008) call stopout. This phenomenon occurs when a student abandons studies temporarily, usually with a one-year mark as the threshold that differentiates dropouts from stopouts. These authors found that the factors typically associated with dropout need not affect temporary withdrawal, or at least not in the same way. Since 40% of student abandonment in the first year of college is temporary (Stratton, O'Toole, & Wetzel, 2008), the distinction seems important. That said, the two phenomena are not independent, as stopout is a predictor of dropout behavior (S. L. DesJardins, Ahlburg, & McCall, 2006).

Unfortunately, the distinction is not easy to make given available data. For the purposes of the work at hand, the first definition of dropout will be utilized, since it is observable giving extant databases, and more aligned with the official definition.

2.2 Sociological Approaches to Dropout

Spady (1970) and Tinto (1975), two often cited authors that have had a “formative influence on subsequent research” (Georg, 2009) regarding dropout, were inspired by Durkheim’s theory of suicide, which argues that individuals who are insufficiently integrated into the society surrounding them are more likely to commit suicide (Tinto, 1975).

The basis for the model proposed by Spady is that the decision to drop out of higher education is a response to the interactions between the student and the college environment. These interactions take shape in the way the student’s individual attributes relate with the influences, expectations and demands of the entities that make up the higher education institution’s fabric. These interactions and particularly their outcome, produce different levels of success, which in turn might influence the student’s decision to drop out. For instance, the degree of success regarding the academic system takes the form of both grades and, although more subjective, intellectual development. Meanwhile, in what pertains to the social system, success is obtained via “normative congruence” – compatibility with the surrounding environment – or through friendship support. Thus, the model suggests that grade performance, intellectual development, normative congruence and friendship support directly influence a fifth concept, social integration. This concept in turn has a direct impact on student’s satisfaction and consequently on their decision to dropout (Spady, 1970).

Similarly, Tinto (1975) argues that the causes for dropout are twofold, also focusing on the social and academic aspects of higher education. On the one hand, low integration into the collegial social system may be to blame, following the reasoning that a reduced level of commitment towards that social system might lead students to pursue activities other than higher education. On the other hand, insufficient academic performance or improper social/academic behavior might also play an important role in the abandonment decision. Both cases can ultimately culminate in voluntary withdrawal or academic dismissal.

It is important to expend a few words on these two concepts, since they refer to different types of dropout behavior. In fact, according to Tinto, “because of the failure to make such distinctions, past research has often produced findings contradictory in character and/or misleading in implication”. Academic dismissal,

for instance, is closely associated with grade performance, more specifically to failure to meet the demands determined by the institution of higher education. In respect to voluntary withdrawal, it seems to befall individuals whose beliefs are not in harmony with the intellectual climate of the institutions they are a part of, or their social system, e.g. “social isolates” or “deviants”. This concept is intriguing to the work at hand, since one can assume that the dimension of an institution can affect the decision of a student to withdraw from college (Tinto, 1975). Unfortunately, as with these case of dropout vs stopout, the available data does not allow us to discern between academic dismissal and voluntary withdrawal. However, given the nature of the Portuguese higher education system, particularly in terms of the Master’s Degree, it seems plausible that academical dismissal does not play a significant role.

2.3 Costs, Financing and Dropout Behavior

Besides the social/psychological based theories provided by Tinto and Spady, other authors have approached university abandonment problem from alternative angles. An extensive number of studies have attempted to dissect the relation between dropout and costs of attending higher education. Indeed, attending higher education is a costly endeavor, especially for low-income students, not only due to tuition fees, but also to the general expenses that the experience demands. Not only do dropout rates vary between different income groups (R. Chen & St John, 2011; S. DesJardins & Chen, 2008; Melguizo, Sanchez, & Velasco, 2016), but there is also a wide gap between students of different opposing economic backgrounds, particularly in terms of enrollment and persistence in higher education (Alon, 2011).

Individuals from a well-off background can rely on their family’s wealth to cover these costs associate with college, while low-income students often have to find alternative ways to fund their education, which may lead to mixed results. A significant percentage of this group manage to cope with their financial burden by working while in college. This decision, counterintuitively, is not necessarily detrimental to academic success, as time spent working per se does not affect students’ outcome. (Glocker, 2011). In fact, recipients of “Work-Study Aid”¹ in the

¹ A state-funded program that helps college students in need to find part-time jobs.

United States of America have been found to have a lower risk of dropout during their freshman year (S. DesJardins & Chen, 2008). However, given that academic success depends on the time a student chooses to devote to study, the risk of dropout may increase if the students spends less time studying as a consequence of being employed (Glocker, 2011).

Reducing disparities between students with different financial means has been a focus of higher education policies and the relation between dropout and the mean by which students finance their studies has been the focus of many studies. One way in which this goal can be achieved is by providing financial aid to students. This type of aid can be awarded either by need or merit, and generally takes the form of grants, loans, tuition remission and scholarships (M. Ganem & Manasse, 2011).

When the objective of policy makers is to reduce inequality, need-based financial aid seems to be their first choice, given that it mitigates the inverse correlation between parental income and dropout. (S. DesJardins & Chen, 2008). These types of programs reduce the pressure imposed by tuition, helping students focus on academic activities (Alon, 2011), and allowing low-income students to cover the costs associated with the degree, thus permitting more time to be devoted to leisure and study (Glocker, 2011). Evidence of the positive effect of financial aid can be found in Chen and St. John's national study of American college student's persistence. The authors illustrate this point by calculating a ratio between each state's financial aid and public tuitions, and subsequently analyzing its impact regarding student abandonment. Their findings show that a one percent increase in said ratio translates into a 2% rise in the odds of persistence. Furthermore, the results obtained also emphasize the importance of coordination between the value of the grants attributed and the tuitions these are meant to cover (R. Chen & St John, 2011).

Loans are another means by which students may finance higher education. In some regards, their influence is similar to financial aid, providing students with the same freedom to focus on their studies by reducing the pressure to work (McKinney & Burrige, 2015). Yet, although loans have been shown to influence the persistence of low-income students, they are more strongly correlated with these individuals' enrollment in higher education (Melguizo et al., 2016). Furthermore, the results found in the existing literature on loans *vis a vis* dropout/persistence have been

mixed. In other words, while there is evidence that this alternative does reduce college dropout (Melguizo et al., 2016), some authors find that loans may contribute to abandonment (Dowd & Coury, 2006; McKinney & Burrige, 2015). This is especially true when it comes to low-income students, who are typically less inclined to contract debt, due to their higher risk of loan default (Chen, 2008; Dowd & Coury, 2006)

2.4 Other Factors

On what concerns the academic part of the experience, we turn to Stinebrickner and Stinebrickner (2012), who found that the decision to drop out at a certain point in time is linked both with the student's current grade point average and her expectation of its evolution. The work produced by these authors suggests that at enrolment most students underestimate the probability of not succeeding academically. As such, the "temptation" to drop out increases as students become better informed about their academic ability, in the form of the grades they receive. The authors estimate that dropout would be reduced by 41% if students did not learn about their academic performance, as they would not review their initial overoptimistic expectations regarding their grade achievements (Stinebrickner & Stinebrickner, 2012).

Information also plays an important role in student's decisions in terms of expected earnings and costs. When building their college application, students try to maximize their chances of enrolling in a degree of their liking, be it in terms of financial characteristics (low costs or high returns on the labor market), interest on the program's courses, travel expenses, among others (Hastings, Neilson, Ramirez, & Zimmerman, 2016). Research has found that, in general, the benefits of higher education in terms of expected earnings greatly surpasses the cost of obtaining a degree and the salaries that would be received during the years dedicated to obtaining the degree (Figueiredo et al., 2017), but even still, students pay close attention to the costs and benefits of their desired degree when drawing up their applications.

When considering their application, students overestimate the income of past graduates of their preferred degree program and predict their own future earnings based on this error. These miscalculations in terms of earnings are greater for both

students from the lower social strata and students with lower scores and are less likely to occur for students who make their enrollment decision based on the labor market. Interestingly, students who overrate their expected earnings tend to enroll in degree programs with lower earnings, while the opposite is true for students who correctly predict their future income. In terms of costs, students with higher estimates are less likely to enter college or even their preferred degree program. Students have more accurate understanding of the costs involved with higher education than past graduates' earnings (Hastings et al., 2016).

This cost/benefit analysis can have some impact in the decision to drop out. Once students have enrolled in their chosen program, they are able to get a better understanding about it, possibly dissipating any leftover uncertainties, thus leading to dropout. And although it is difficult to assert how the miscalculations about earnings impacts the higher education journey of individual, the fact remains that students who overestimate the returns of graduation tend to enroll in programs where students graduated less. Also, and quite surprisingly, students who overestimate the costs associated with higher learning are more likely to drop out than students who underestimate these costs. This phenomenon may come from the fact that cost expectations are not immediately updated after enrollment (Hastings et al., 2016).

3. Overview of the Portuguese Higher Education Landscape

3.1 Past

Since the aim of this paper is to study dropout, it is vital to understand the current landscape of higher education, not only within the selected institution, but also, and perhaps more importantly, in Portugal in general. To do so, the following paragraphs aim to explain the recent history of higher education in Portugal, in order to better understand the current state of the field.

Currently, Portugal has a binary system of higher education, with polytechnics and universities. The binary divide has its roots in the early 1970s with the “Veiga Simão Reform”. At the time, obtaining a higher education degree was largely uncommon, with only 3% of the population in the early 20s - i.e. between 20 and 24 years old – attending a higher education institution (Amaral, 2012). In its genesis this binary system was devised with the objective of achieving a broader student body, focusing on attracting individuals from different social and educational backgrounds to achieve this goal. Thus, this system included both a short-cycle and long-cycle approach to higher education. The former focused on students of less wealthy families, by being predominantly vocational and prioritizing the transition of students into the labor market, while the latter held on to the classic university approach, more theoretic than its counterpart and more consistent with the preferences of well-off students (Amaral, 2012).

Another measure taken with the goal of expanding higher education to a wider part of the population was the decentralization of its supply, by making it available to students outside the three cities where higher education institutions were previously concentrated (Coimbra, Lisbon and Oporto). And although the Revolution of 1974 hampered the efforts of the “Veiga Simão Reform”, it still paved the way for the binary system present in today’s educational structure. Short cycle education lives on through a network of polytechnic institutes, initially created between 1974 and 1983 as a means to provide students with vocational training (Amaral, 2012) and through programs such as the *Cursos Técnicos Superiores Profissionais*, a short-cycle program created in 2014 with the goal of providing new

study options that could attract individuals who had not enrolled in tertiary education previously (D. G. P. L. S. R. T. W. OECD, 2018).

Regarding the 1974 Revolution, the event shaped higher education in the country, due in part to the hope for social equality through education that rose from it (Magalhães, Amaral, & Tavares, 2009). This sentiment took form in the increased number of students registering in higher education institutions (Nunes, 1968). To relieve the pressure created by the large number of applications, a *numerus clausus* was created in 1976-1977, thereby restricting the number of places available and placing students into institutions in order of grades obtained (Amaral, 2012). Not only did this intensify grade competition in secondary education but it also caused competition between higher education establishments in order to attract the best students. This supply /demand asymmetry has since become a staple of Portuguese higher education, with the older and more prestigious universities thriving and the polytechnic system falling behind (Amaral, 2012). Still, thanks to broadening student recruitment, diversifying the courses offered and increasing the supply of higher education throughout the country (Figueiredo et al., 2017), the number of applicants continually expanded in the following decades (Amaral, 2012). The number of students enrolled in higher education grew from merely 60 000 in 1974, to breaking the 100 000 barrier in 1985, closing in on 300 000 in 1995 and finally reaching 400 000 in the early 21st century (Figueiredo et al., 2017). This growth allowed the private sector of higher education (relatively small in scale until the early 1980s) to gain traction, skyrocketing from 9% of total students enrolled in 1980 to 36% in 1996 (Amaral, 2012).

At the turn of the century, roughly 6% of the population had a higher education degree. Ten years later this percentage was around 10%. The more recent number from 2017 estimate that approximately 20% of the Portuguese population has a degree in higher education, with the number being even higher when only considering younger individuals. The evolution of the Portuguese education system described in the paragraphs above is enough to explain why the number of degree recipients drops as we move further up the age ladder. But the inequalities of the system are far from being only attributed to age, with region and sex also assuming an important role in the existing discrepancies. Region inequalities for instance, materialize in the form of the distinctions in terms of college graduates when we

compare the urban or coastal communities to the rural or inland based population. Finally, in recent years the numbers show a higher completion rate for female students when compared to their male counterparts (1 in 7 for men vs 1 in 5 women, in 2017) (Figueiredo et al., 2017).

3.2 Present

Moving to the present, the following subsections aim to reveal the current state of Portuguese higher education. Such is done by first offering the raw figures concerning both institutions and students, then looking into DGEEC’s review of the path students take towards attaining a degree.

3.2.1 Students and Institutions in numbers

The most recent figures for the current curricular year of 2017/2018 show a total of 289 tertiary education units, across the entire spectrum of the Portuguese higher education system. These units can be Public or Private, Universities or Polytechnics² (Table 1).

Table 1: Number of Organic Units by Type

	Public	Private	Total
University	79	42	121
Polytechnic	102	66	168
Total	181	108	289

Based on: (DGES, 2017)

In terms of the number of units, there is a greater number of public institutions, and of polytechnics. However, since institutions of higher learning provide a wide array of degrees in numerous fields, in order to get a better idea of how the offering of higher education programs is distributed, we turn to Table 2.

² The 5 existing military and police higher education institutions are not considered, given that they are structured differently from other programs (P. E. J. O. B. DGEEC, 2018) and as such are dismissible to the work at hand.

Table 2: Number of Degrees by Cycle of Education

Educational Subsystem		Cycle of Education				Total
		Bachelor	Integrated Master	Master 2nd Cycle	Doctoral	
Private	University	349	28	365	91	833
	Polytechnic	193	0	77	0	270
Public	University	905	170	1 456	1 344	3 875
	Polytechnic	876	0	613	0	1 489
Total		2323	198	2511	1435	6467

Based on: (DGEEC, 2017)

Out of the total 6467 degrees that are divided amongst the 4 levels of education highlighted, the majority belong to the public system. Private universities and polytechnics, despite making up more than a third of the total number of institutions, only offer roughly a fifth of the total number of programs. Also noteworthy is the fact that polytechnics offer less than a third of the total number of degrees, despite being more numerous than their counterparts.

But more important than the number of existing facilities and degrees is the actual number of students that attend them. Table 3 contains the figures the total number of students who attend each different subsystem, while also illustrating how each gender is represented.

Table 3: Enrollments by Gender

Educational subsystem		Gender		
		Men	Women	Both
Public	University	87 777	99 301	187 078
	Polytechnic	52 199	57 953	110 152
Private	University	18 858	25 190	44 048
	Polytechnic	7 287	10 354	17 641
Total		166121	192798	358919

Source: (DGEEC, 2018a)

The fact that the majority of students is enrolled in the public system is unsurprising, given that public universities and polytechnics offer a far higher number of degrees than their private counterparts. The number of female students is higher both in total and regarding each subsystem specifically.

It is also relevant to understand how students are distributed geographically, as Portuguese higher education is often thought to be concentrated in the country's

two major urban areas, those of Oporto and Lisbon. Table 4 illustrates how students are divided regionally, by NUTS II.

Table 4: Enrollments by NUTS II

		NUTS II							
Educational subsystem		North	Center	Lisbon	Alentejo	Algarve	Madeira	Azores	Total
				Metropolitan Area					
Public	University	52 227	37 879	82 413	6 159	3 685	2 400	2 315	187 078
	Polytechnic	35 991	38 273	23 082	8 386	3 735	258	427	110 152
Private	University	19 054	1 644	23 063	0	287	0	0	44 048
	Polytechnic	9 691	589	6 468	318	113	462	0	17 641
Total		116963	78385	135026	14863	7820	3120	2742	358919

Source: (DGEEC, 2018a)

As we can see, there is a high concentration of students in the Lisbon Metropolitan Area and in the North. At the other end of the spectrum, the lowest number of enrollments correspond to the island territories of the country. Public polytechnic students are more evenly distributed throughout the country, when compared with the other subsystems. This emanates from the previously mentioned decentralization efforts made in 1980's, which resulted in the public polytechnic institutes being more evenly divided over the country, when compared to public universities (Sá, Amado Tavares, Justino, & Amaral, 2011).

Finally, we turn to Table 5 in order to understand students' choices in terms of their preferred education and training area.

Table 5: Enrollments by CNAEF

Educational subsystem	Public		Private		Total
	University	Polytechnic	University	Polytechnic	
Education and Training Area (CNAEF) Agriculture, Silviculture, Fishery and Veterinary Sciences	4 186	3 156	716	0	8 058
Arts and Humanities	22 149	9 796	3 869	1 592	37 406
Corporate, Administrative and Law Sciences	28 269	28 213	16 264	4 663	77 409
Education	6 467	3 981	785	1 073	12 306

Table 6: Enrollments by CNAEF (continuation)

	Educational subsystem	Public		Private		Total
		University	Polytechnic	University	Polytechnic	
Education and Training Area (CNAEF)	Engineering, Transforming Industries and Construction	46 831	25 682	3 033	493	76 039
	Health and Social Protection	21 494	23 060	4 922	6 355	55 831
	Information and Communication Technologies	3 977	3 802	595	1 020	9 394
	Natural, Mathematical and Statistical Sciences	19 935	738	654	102	21 429
	Services	6 307	9 929	3 572	2 305	22 113
	Social Sciences, Journalism and Information	27 210	1 795	9 595	38	38 638
	Miscellaneous	253	0	43	0	296
	Total	187078	110152	44048	17641	358919

Source: (DGEEC, 2018a)

Within the fields listed, the “Engineering, Transforming Industries and Construction” and “Corporate, Administrative and Law Sciences” areas stand out, with their combined total adding up to roughly 42% of the student population. “Health and Social Protection” also deserves special mention, attracting approximately 15% of all students.

A student who wants to pursue a second degree in the field of Economics has a plethora of options to choose from. The bulk of the programs made available are part of the public university system, but there are also a significant number of private universities that offer second degrees in this field. There is even an option for those who wish to enroll in polytechnic education.

Table 7: Degrees in Economics

Educational subsystem	Number of Master's Degrees with Economics in their name	
	2016/2017	2010/2011
Private Higher Education - University	10	6
Public Higher Education - Polytechnic	1	1
Public Higher Education - University	40	49
Total	51	56

Source: (DGEEC, 2011, 2017)

Despite the significant range of programs offered, the total number of second degrees in the field has diminished slightly since 2010/2011, due entirely to a scaling back in the public offering. The number of private programs made available has increased since 2010/2011, but not enough to counterbalance the contraction in the public system.

Table 8: Enrollments in the Field of Economics

Educational subsystem	2016/2017			2010/2011		
	Men	Women	Both	Men	Women	Both
Private Higher Education – University	60	63	123	30	41	71
Public Higher Education – Polytechnic	5	25	30	0	11	11
Public Higher Education - University	778	776	1554	779	899	1678
Total	843	864	1707	809	951	1760

Source: (DGEEC, 2011, 2017)

Regarding enrollments, the total number of students in the field has remained similar to 2010/2011. While the public university system seems to have slowed down, mostly due to the lower number of women enrolled, the other systems seem to have experienced some degree of growth. This seems to mirror the transformation felt in terms of supply, with fewer Public University degrees available and more Private programs in their place, as seen above. Regarding gender specifically, the trend of more female students studying Economics seen in 2010/2011 is still noticeable to this day, although this discrepancy is at a lower level currently.

3.2.2 Attainment

To further understand students' success, we turn to DGEEC's study on higher education attainment in 2017, which garnered numerous headlines and significant

media coverage, given its depiction of the current state of the Portuguese educational system and recommendations towards attaining the goals of the Europe 2020 strategy (Gonçalves, 2018; Inácio, 2018; Silva, 2018b). The study focused on students who enlisted in 3-year first degree programs, after 4 years have passed since their entry in the higher education system, stating that only 46% of them had concluded their degree after this period, while a significant percentage remained in the higher education system, either in the same program (14%), or in a different program to the one in which they first enrolled (11%). Finally, and most notably, 29% of students did not attain a diploma and were not registered in any institution of higher learning, having effectively dropped out of tertiary education.

Despite only covering first degrees, the study reaches many conclusions that can be of interest to our work. For instance, although the percentage of graduates does not shift significantly for all subsystem of higher education, there is a large difference in terms of dropout among them, with the phenomenon being more likely to occur for polytechnic students than for university students and for students enrolled in private institutions when compared with those in the public system (P. E. J. O. B. DGEEC, 2018). The report also confirms the positive effect of a student enrolling in his most preferred program, as well as an inverse relation between the rate of abandonment and the student's grade of entry. Also mentioned is the negative correlation between parental education attainment and dropout. Finally, the study touches upon gender disparities, concluding that female students achieve better results across all fields of study than their male counterparts, both in terms of timely attainment and abandonment (P. E. J. O. B. DGEEC, 2018).

Regarding timely attainment, and taking into account all educational subsystems (polytechnic and university, private and public), the most recent figures provided by DGEEC report a total of 65 391 students graduated from either the first, second or third cycles of tertiary education in the 2015/2016 curricular year (DGEEC, 2018b). Table 9 provides a closer look at graduates from all master degrees in the system.

Table 9: Number of Graduates and Average Number of Enrolments

Educational Subsystem	2015/2016	
	Graduates	Average Number of Enrollments
Private Higher Education - Polytechnic	33	2,40
Private Higher Education - University	145	2,60
Public Higher Education - Polytechnic	278	2,52
Public Higher Education - University	529	2,45
Total	985	2,48

Based on: (DGEEC, 2018b)

These figures are not of much use to us by themselves, but together with Table 10, allow for better understanding of how 2nd degrees with Economics in their name fair within their subsystem.

Table 10: Number of Graduates and Average Number of Enrolments in Economics

Educational Subsystem	2015/2016	
	Graduates	Average Number of Enrolments
Private Higher Education - University	180	2,80
Public Higher Education - Polytechnic	5	2,60
Public Higher Education - University	1563	2,65
Total	1748	2,67

Based on: (DGEEC, 2018b)

At first glance we can see that, on average, students in the field of Economics do not finish their second degree in a timely fashion. Despite this being also the case for the system as a whole, Economics students on average take longer to graduate. Furthermore, public institution students fair quite well compared to their colleagues from the private subsystem, a trend that is only seen for University students in the complete sample.

3.3 Future

Since we have covered the past history of the Portuguese higher education system and painted a portrait of the current state of affairs, it is only logical to take a glimpse into the future, bearing in mind the important goals set by the Europe 2020 program. In July of 2016, DGEEC published their projections for the evolution of the rate of higher education degree attainment for individual between the ages of

30 and 34 until the deadline of the Europa 2020 program. The study estimates four possible outcomes regarding this index, with the “base”, “optimist” and “pessimist” scenarios projected all falling short of the 40% mark desired for the year 2020 (the numbers predicted are 31,3%, 33,6% and 31,1% respectively). Only in the “convergence” scenario does the Portuguese education system accomplish the desired objective, but only if the system experiences a substantial increase in the number of graduates between the age of 26 and 32. These would have to come from short-cycle degrees, returning dropouts/stopouts or from outside the country, either in the form of returning nationals or foreign graduates (DGEEC, 2016).

As a side note, according to a recent report by Eurostat, the actual value for this index in 2017 was 33,5% (LUSA, 2018). At first glance this number seems encouraging, since it actually exceeds DGEEC’s “base”, “optimist” and “pessimist” projections for the year (31,4%, 32,1% and 31,2% respectively). Unfortunately, it still falls short of the 34,4% projected by the “convergence” scenario, which is a setback to the hopes of achieving the 40% mark in 2020 (DGEEC, 2016).

But what of the road towards these goals and the future of Portuguese higher education in general? The Portuguese Natural Reform Plan mentions stimulating student R&D initiatives in order to reduce dropout and promote academic success. Additionally, it specifies closely monitoring the actions of the institutions that focus on the promotion of academic success. Presently, the Portuguese educational system is in the midst of a slight restructuring, with policies such as the reduction of available vacancies in Oporto and Lisbon (with the goal of reducing discrepancies between these cities and the rest of the country)(Jornal de Notícias, 2018b), the end of integrated master degrees (Jornal de Notícias, 2018a) and the possibility for polytechnic institutes to offer doctoral degrees (Silva, 2018a), among others, being implemented.

These adjustments were conceived in response to the OECD’s “Review of TERI in Portugal”, published in February of this year. This report not only contains an assessment of the Portuguese tertiary education, research and innovation system, but also identifies key opportunities for improvement and suggests interesting policies for the Portuguese State to achieve it (D. G. P. L. S. R. T. W. OECD, 2018). Commissioned by the Government of Portugal, this review is of crucial importance

to our work, particularly in what pertains to the tertiary education portion of the report.

Among the numerous criticisms put forward by the OECD is the lack of an overarching national strategy regarding tertiary education. Such a strategy is necessary to guide the organizations responsible for higher education, research and innovation. Also touched upon are the sub-par tertiary attainment rates and the limited flexibility in terms of degree program offering. As noticed, Portugal's tertiary education attainment rate remain lower than the OECD average and falls short of the goals determined by the EU or the country itself. As a response, the OECD suggests widening access to tertiary education, and providing more diversity to the educational offer, thus broadening the spectrum of students recruited. To the OECD, the entry process into higher education also needs some fine tuning, as the Regime Geral de Acesso (RGA) neglects students from the vocational upper secondary education, who mostly from the lower socio-economic spectrum of Portuguese society. Finally, there is a need to complete the unfinished student-level data system, regarding enrolment, completion and labor market outcomes. This information not only allows students to make more informed decisions, but can also be used to improve the upper secondary education system, raising its quality and strengthening its coordination with tertiary education (D. G. P. L. S. R. T. W. OECD, 2018). The recommendations put forward by the OECD clearly center more on increasing attainment rates by widening access to higher education (D. G. P. L. S. R. T. W. OECD, 2018), than on targeting dropout and effectively reducing it. However, some of the suggestions put forward, such as the increase in the diversity and relevance of the degrees offered, may in fact reduce the occurrence of the problem.

4. Methodology

4.1 Research Goals and Dataset

In an attempt to produce streamlined and relevant results and conclusions, we defined a set of questions we wish to answer. This section will concern itself with presenting the questions selected, in no particular order, as well as the variables that will contribute towards the corresponding answers.

Since we are concerned with dropouts, we need a measure of the relevant phenomenon. Our dataset includes the total number of enrollments in 2016 and 2017, the most recent available, of first-time enrolments in 2017, and of graduates in 2016, for every pair of organic unit and course. We chose the most recent years with reliable data available. Our source is DGEEC.

With these variables, we calculated an indicator for the magnitude of dropout behavior in 2016 (D_{16}):

Equation 1: Calculating the Number of Dropouts

$$D_{16} = E_{16} - (E_{17} - E^{st}_{17}) - G_{16}$$

Here, E_{16} refers to enrollments in 2016, E_{17} to enrollments in 2017, E^{st}_{17} to first time enrollments in 2017 and G_{16} to 2016 graduates. The thought process behind Equation 1 is to subtract the students that either graduated or continued their studies from the group of students enrolled in 2016, thus obtaining an indicator of the magnitude of dropouts for that year. While simple, this method does not yield the actual number of dropouts, as it does not account for transfers across organic units, or cases of students that graduate without enrolling. Indeed, the indicator is negative in almost 10% of pairs. For this reason, we emphasize that this indicator is a *measure* of dropout behavior. Fortunately, there is no reason to expect those unobserved phenomena to be correlated with any variable of interest. Still, we apply several estimation strategies to ensure robustness.

All pairs of organic units and courses are included, except for those belonging to the University of Azores and a few other units in institutions that underwent

administrative restructuring during the years we focus on³. Military schools were also eliminated.

Besides the variables used to calculate the measure of dropout, courses were also characterized by name, official code, degree level, field of study, institution, organic unit, their corresponding subsystems (public or private, university or polytechnic), as well as regional location (NUTS II, NUTS III, district and municipality). A measure of employability was also included, given by the number of graduates enrolled in an employment center in 2016 divided by the number of graduates between 1984 and 2015.

The role of teachers in education is self-explanatory and their influence on students is unquestionable. With this in mind, we included in our dataset the number of permanent and guest teachers employed in each organic unit. While the impact of educators and their methods on student's decisions is hard to measure, we can infer their importance through two selected ratios: the number of teachers per enrolled student and the percentage of guest teachers employed. The former provides us with a proxy for class size, while the latter allows us to measure the impact of teacher motivation/commitment. We are aware that measuring the influence of teachers using only their numbers is flawed, as the quality of their craft is not quantifiably measured. Still, it stands to reason that the performance of a teacher is constrained by the number of students under his care and that student performance suffers in classes excessive pupils (Matta, Guzman, Stockly, & Widner, 2015).

Quite a few authors relate the decision to abandon higher education with social integration, while others choose to focus on monetary constraints in order to better understand dropout. Regardless of which of the two approaches is more adequate or relevant, it is clearly vital to describe the student population beyond the total number of enrollments. With this in mind, we aim to find patterns between specific features of students and dropout. To achieve this, we collected data on the student-body enrolled in each course, namely the number of grant recipients, of workers and part time students, both in total and for each gender. All of these will be calculated as ratios in our estimation, in relation to the the total number of students.

³ Higher School of Industrial Studies and Management, D. Afonso III Superior Institute, Institute of Art, Design and Enterprise and Arts University School of Coimbra .

Finally, as covered previously, Portugal suffers from a notorious skill gap, consistent with the country's low average level of education. In this context, obtaining a higher education degree enables individuals to collect higher wages when entering the workforce, that should compensate the financial effort associated with their studies. If students expect this not to be the case, the temptation to drop out will grow larger and their motivation to complete the degree might waver. Given this dynamic, we deemed vital to obtain a grasp of how the labor market influences persistence and abandonment in the context of higher education.

Thus, the average monthly wage disparity, i.e. the dispersion in wages among individuals with different levels of education, was included, in hope of illustrating the reward for obtaining higher education. Likewise, the average income received in the institution's municipality was also included, to represent the choice tertiary education students face between receiving a salary corresponding to a secondary education diploma (by dropping out and entering the workforce), or enduring the present-day costs associated with their degree, in order to obtain higher wages post-graduation.

With this data, we wish to answer the following Research Questions:

RQ 1: What is the impact of wages on dropout behavior?

RQ 2: Do observed determinants of dropout behavior have a different impact on programs leading to a Bachelor degree or a Master's degree?

RQ 2.1.: What is the impact of the several determinants of dropout behavior on programs leading to a Masters degree?

RQ 3: Do observed determinants of dropout behavior have a different impact on courses in different fields of study?

RQ 3.1.: What is the differential impact of the several determinants of dropout behavior on Masters in Economics?

RQ 4: Do observed determinants of dropout behavior have a different impact on programs depending on the subsystem of the organic unit?

RQ 5: What is the impact of teaching personnel on dropout behavior?

RQ 6: Do the determinants of dropout behavior have a different impact on each gender?

4.2 Estimation

Since dropouts are a number of students per year, our estimation employs count models. Count data reports the number of incidences that occur in a given period, which in our case is the number of individuals that decided to drop out of higher education in the 2016/2017 curricular year. This section will concern itself with estimating three different regression models, namely, Ordinary Least Squares (OLS), Poisson and Negative Binomial.

The OLS regression is a staple of econometric studies, and as such will be used as a tool to assess the data at hand and its characteristics. In particular, it will serve to bolster our belief that our dependent variable is a good measure of dropout behavior. However, while it is theoretically possible to apply this model to count data (Greene, 2012), the model suffers from numerous shortcomings in such scenarios (Winkelmann, 2008). In cases such as ours, multiple linear regression tends to generate inaccurate or inefficient results, due to the discrete nature of the values and the predominance low values present in the database (Greene, 2012). Therefore, the OLS model will serve merely as a tool for exploratory purposes.

Next, we will employ maximum likelihood methods to estimate the Poisson Regression Model (PRM), the most important count data model (Winkelmann, 2008), and its most common alternative (Greene, 2012), the Negative Binomial Regression Model (NBRM). If the density function does not follow a Poisson distribution, the Poisson Regression is still able to produce consistent results, provided that the conditional expectation is correctly specified – in which case the estimation is obtained through pseudo-maximum likelihood (Winkelmann, 2008). These estimation methods generally provide the best results for count data, but our database needs a bit of fine-tuning in order to utilize them, given that these models only include non-negative integer values (Greene, 2012). As the negative values in our database are a product of flaws in sampling, we will consider two scenarios: in the first, we will assume that the negative values are equal to zero, and in the second we will simply disregard them and remove them from the database. Both models will be tested for each of these situations, allowing us to decide which options produces the more robust results. The OLS model will also be tested under these last two scenarios, as it may provide clues towards a more enlighten decision.

4.2.1 OLS

We will begin by analyzing and comparing the results obtained by using an OLS regression in each of the three possible scenarios. The multiple linear regression model being utilized is as follows:

Equation 2: OLS Model

$$y_i = x_{i1}\beta_1 + x_{i2}\beta_2 + \dots + x_{ik}\beta_k + \varepsilon_i$$

Three separate estimations were calculated using the OLS regression: the first with the database in the original state, another with the negatives figures being equal to zero and, lastly, with the negatives values being disregarded. These estimations were done with robust standard errors, to account for heteroskedasticity and other phenomena that might invalidate inference. The results obtained can be found in an appendix.

First and foremost, the OLS model has some explanatory power for all iterations of the database, given that the p-value for each F test indicates that all three estimations are statistically significant for all confidence levels. As such, to determine which estimation produces the best results, we will consider each coefficient of determination, or R-squared. This coefficient expresses how well the regression fits the data, as it measures the percentage of the variation in the dependent variable that is explained by variations on the regressors (Greene, 2012). The OLS estimation regarding the database that disregards the negative values seems to be superior, as % of the variation in Dropout is explained by the independent variables selected.

As for the coefficients produced, their estimated value is similar across the three scenarios. This justifies our decision to tackle the negative values in our database, as their treatment does not seem to affect the outcome of the estimation. The same conclusion can be drawn from observing the R-squared statistic, as it also remains similar for all iterations of the OLS estimation.

We will spend no more words on the product of this estimation (which can be found in the attachments of this dissertation), as it is not the most effective way to approach the task at hand. The next section will concern itself with models that are tailored towards count data and, thus, are worthier of our time and attention.

4.2.2 PRM VS NBRM

The more adequate alternatives to tackle count data are the Poisson regression and the Negative Binomial Regression (Greene, 2012). According to the Poisson model, the probability of the dependent variable Y assuming a certain value y is:

Equation 3: Poisson Probability Function

$$P(Y = y|x_i) = \frac{e^{-\mu_i} \mu_i^{y_i}}{y_i!}, \quad y_i = 0, 1, 2, \dots$$

The most common formulation for μ_i is the loglinear model:

Equation 4: Formulation for μ_i

$$\ln \mu_i = x_i \beta$$

This formulation for μ is appropriate to the model, as it ensures that the parameter remains positive regardless of the estimation's remaining values. As for the expected number of events it is expressed as:

Equation 5: Expected Number of Events

$$\frac{\partial E[y_i|x_i]}{\partial x_i} = \mu_i \beta$$

As the dependent variable is a count variable, the Poisson regression models the dependent variable as the log of the expected count. Consequently, the coefficients obtained can be interpreted as semi-elasticities, i.e. the variation in the log of expected counts generated by a one-unit increase/decrease in the corresponding independent variable. In other words, if the independent variable increases by 1, the dependent variable increases by $\beta\%$, and vice-versa.

The benefit of the Poisson regression is that it acknowledges the non-negative integer properties of Y (Winkelmann, 2008). The model assumes a distribution with the parameter μ , which is a positive value equal to the mean and variance. This leads to one of the main characteristics of the model, *equidispersion*, i.e. the fact that the mean and variance are identical (Winkelmann, 2008). The restrictiveness of this property can be problematic, as the model does not hold up if the variance of the distribution is higher than its mean (*overdispersion*) (Greene, 2012). However, the regression is still robust, even without the presence of *equidispersion*, i.e. when the variance takes a value different than the mean (Winkelmann, 2008).

In such situations, the Negative Binomial Model might be more appropriate. The Negative Binomial Regression model is similar to the Poisson model, but with the addition of a more flexible variance function. This is done by adding δ as a representation for unobserved error (which follows a gamma distribution of $E(\delta_i)=1$) to the probability function.

Equation 6: Negative Binomial Distribution

$$X \sim \text{Negbin}(\alpha, \delta), \alpha \geq 0 \cap \delta \geq 0$$

Equation 7: Negative Binomial Probability Function

$$P(Y = y|x_i) = \frac{\Gamma(\alpha + y_i)}{\Gamma(y_i + 1)\Gamma(\alpha)} r_i^{y_i} (1 - r_i)^\alpha, \quad \ln \mu_i = x_i' \beta, r_i = \frac{\mu_i}{(\alpha + \mu_i)}$$

The model can be interpreted as particular form of a Poisson model that attributes a value to the randomness of μ (Winkelmann, 2008). Just as in the case of the Poisson regression, the model computes the dependent variable as the log of the expected count. The coefficients generated can be interpreted as the variation in the log of expected counts of y generated by a one unit increase in x_i . The mean and variance of the model are:

$$E(X) = \alpha\delta$$

$$\text{Var}(X) = E(X)(1 + \delta)$$

These specifications almost guarantee that the variance of the distribution is higher than its mean, making the Negative Binomial Model capable of fulfilling the flaws of the Poisson Model in what concerns overdispersion. Thus, the model is substantially more flexible than its counterpart, particularly in terms of the variance (Winkelmann, 2008).

With these specification in mind, we set out to decide which of the two models can better accommodate the necessities of our intended estimation, in each of the two scenarios considered. Considering the database, it seems more likely that it would follow a Negative Binomial Distribution, with the individual Bernoulli tests representing each student's decision to abandon higher education. Furthermore, the finite number of individuals in the sample provides a "ceiling" that might be incompatible with the specifications of the Poisson distribution.

We begin by estimating each model using the two alternatives for correcting the negative values regarding the dependent variable. Table 11 provides the resulting

coefficients and standard errors. Most importantly, these estimates show that, whatever the selected strategy for dealing with the negative values, the results are similar within each model.

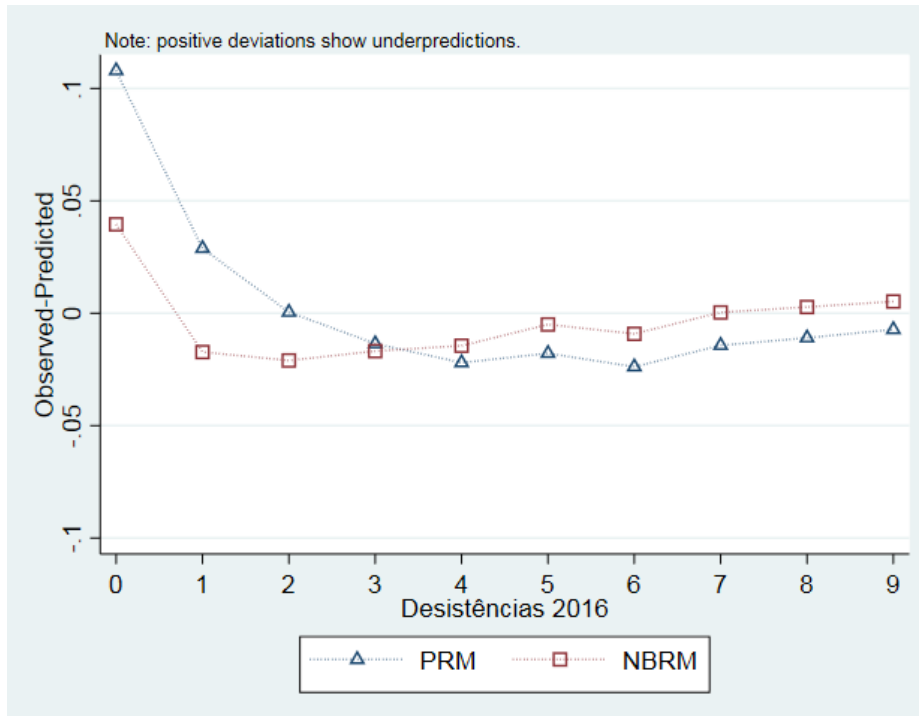
Table 11: PRM and NBRM coefficients

	Neg=zero		No neg	
	PRM	NBRM	PRM	NBRM
Monthly Wage Disparity	-0.00873 (0.00590)	-0.0129** (0.00578)	-0.00395 (0.00564)	-0.00726 (0.00543)
Average Monthly Wage	0.000323*** (0.000109)	0.000190* (0.000109)	0.000274*** (0.000106)	0.000157 (0.000102)
Log of Enrolments 2016	0.667*** (0.0174)	0.680*** (0.0147)	0.639*** (0.0172)	0.637*** (0.0139)
Enrolments 2016 – Student Workers	0.831*** (0.129)	0.854*** (0.114)	0.837*** (0.122)	0.837*** (0.107)
Enrolments 2016 – Scholarship	-0.799*** (0.122)	-0.697*** (0.114)	-0.800*** (0.121)	-0.655*** (0.107)
Enrolments 2016 – Part-Time	-0.253 (0.186)	-0.503*** (0.182)	-0.251 (0.179)	-0.523*** (0.176)
Teacher-Student Ratio	-0.00170** (0.000687)	0.00208*** (0.000583)	-0.000980 (0.000604)	0.00164*** (0.000498)
Percentage of Guest Teachers	-0.133 (0.130)	0.0791 (0.0878)	-0.127 (0.129)	0.0633 (0.0847)
Education Subsystem – Public	0.192*** (0.0568)	0.229*** (0.0431)	0.181*** (0.0556)	0.223*** (0.0411)
Type of Institution - University	0.117*** (0.0446)	0.137*** (0.0406)	0.122*** (0.0437)	0.142*** (0.0387)
Cons	-0.631*** (0.143)	-0.503*** (0.128)	-0.538*** (0.139)	-0.392*** (0.120)

Note: *** p<0.01, ** p<0.05, * p<0.01

To compare between the Poisson and the NBR, we employed Stata’s “countfit” command. We will first instruct the software to change the negative values to zero and then run “countfit”, which generates two noteworthy outputs that can aid our decision. The first, displayed in Figure 1, compares the residual values of each of the estimation models, while the second, presented in Table 12, indicates which is more adequate through the three fit measures: the Bayesian Information Criterion (BIC), Akaike’s Information Criterion (AIC) and The Likelihood.Ratio Chi-Square (LRX2).

Figure 1: Deviations for PRM and NBRM models



Both estimations seem to generate higher residuals for lower values, with the zero count being that at which they are least effective, which is unsurprising. Besides that, the Negative Binomial Regression Model seems to perform better overall, generating residuals closer to null.

Table 12: PRM vs NBRM

PRM	BIC=33118.117	AIC= 33051.052	Prefer	Over	Evidence
Vs NBRM	BIC= 20283.281	dif= 12834.836	NBRM	PRM	Very strong
	AIC= 20210.119	dif= 12840.933	NBRM	PRM	
	LRX2=12842.933	prob= 0.000	NBRM	PRM	p=0.000

Across the board, each of the fit measures utilized give the advantage to Negative Binomial Regression Model over its counterpart, with a very strong statistical significance. This evidence supports the finding provided by Figure 1, leading us to believe that the Negative Binomial Regression is the most adequate model for the task at hand.

Let us now instruct Stata to consider only the non-negative values in our database and run the “countfit” command.

Figure 2: Residuals for PRM and NBRM models

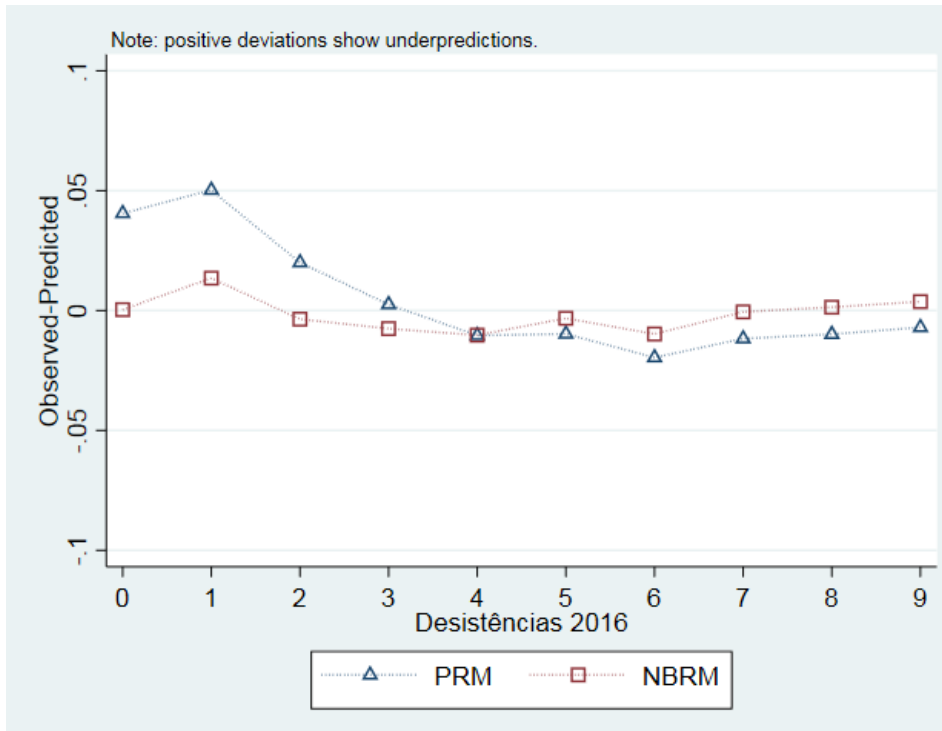


Table 13: PRM vs NBRM

PRM	BIC= 29904.210	AIC= 29838.114	Prefer	Over	Evidence
vs NBRM	BIC= 18990.491	dif= 10913.719	NBRM	PRM	Very strong
	AIC= 18918.386	dif= 10919.728	NBRM	PRM	
	LRX2=10921.728	prob= 0.000	NBRM	PRM	p=0.000

Just as in the previous scenario, both Figure 2 and Table 13 indicate that the use of the Negative Binomial Regression Model is preferable, for the same exact reasons indicated in the previous section.

The outputs generated illustrate how the Poisson Regression Model is outperformed by the Negative Binomial Regression Model, regardless how we chose to handle the negative values in our database. As such, the former will be abandoned, leaving us with only the two versions of the Negative Binomial Regression Model to choose from. This decision can also be made by comparing the residuals generated by each estimation, alongside the values given by the three measures of fit (BIC, AIC and LRX2). Thus, we can conclude that using the Negative Binomial Regression Model under the condition that the negative values are ignored will lead to the most robust results achievable for our database.

5. Results

Having selected the model to employ for the task at hand, we now shift our focus to the estimation itself and the results produced by it. As stated above, these results can be interpreted as semi-elasticities, meaning that the coefficients represent the relative change that a one-unit variation in the independent variables has on the dependent variable. Three identical estimations will be computed, each one focusing a different segment of the education system, all using robust standard errors through the `vce(robust)` command. The same independent variables will be utilized in all three cases, with the dichotomous variables representing the Public and University subsystem. This allows us to understand how students from these subsystems relate with dropout *vis a vis* their counterparts (Private and Polytechnic students).

For the first regression, labeled “Full Database”, we consider the complete database, using information regarding all levels of higher education (Bachelor, Master, Integrated Master and Doctoral), all subject matters and both genders. The second estimation, dubbed “Master’s Degrees”, limits our database to only master’s degrees. Lastly, “Master’s in Economics” refers to an even more restrictive database, concerning only master’s degrees in the field of Economics. Afterwards, we will compare individual estimations for each gender, with the goal of finding differences and similarities between male and female dropouts.

Calculating regressions for these three different populations allows us to draw comparisons between them based on the resulting estimates. This will aid in effectively uncovering what distinguishes master’s degrees from the other education levels and how Economics fits in the landscape of 2nd degrees. Table 14 displays the results obtained.

Table 14: Results

	Full Database	Masters Degrees	Masters in Economics
Monthly Wage Disparity	-0.00726 (0.00543)	-0.00793 (0.00858)	-0.201* (0.113)
Average Monthly Wage	0.000157 (0.000102)	-0.000350** (0.000154)	0.00193 (0.00204)
Log of Enrolments 2016	0.637*** (0.0139)	0.843*** (0.0252)	0.878*** (0.119)
Enrolments 2016 – Student Workers	0.837*** (0.107)	0.266** (0.125)	1.576*** (0.506)
Enrolments 2016 – Scholarship	-0.655*** (0.107)	-0.638*** (0.140)	0.949 (0.908)
Enrolments 2016 – Part-Time	-0.523*** (0.176)	-0.103 (0.238)	-0.862 (2.229)
Teacher-Student Ratio	-0.00164*** (0.000498)	-0.000532 (0.000504)	-0.000650 (0.00312)
Percentage of Guest Teachers	0.0633 (0.0847)	0.364*** (0.113)	1.811*** (0.359)
Education Subsystem – Public	0.223*** (0.0411)	0.0892 (0.0623)	0.0924 (0.425)
Type of Institution - University	0.142*** (0.0387)	0.136*** (0.0521)	0.275 (0.361)
Cons	-0.392*** (0.120)	-0.0904 (0.177)	1.886 (1.190)
Number of Observations	3007	1209	31

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.01$

5.1 Comparing Subsystems of Higher Education

Let us begin by analyzing if students from the universities and polytechnics differ in terms of dropout. The results point to a positive relationship towards the dependent variable, with the dropout count being 14,2% higher for universities in general and 13,6% higher when considering only master's degrees. The coefficients is not statistically significant for master's in the field of Economics, but remains positively related with dropout. These results clash with DGEEC's report on attainment in 2017, which might stem from the fact that DGEEC merely calculated the percentage of students that abandon their respective subsystem, without controlling for other variables. As for Master's, the differences between both types

of institution is larger. The direction of the estimate regarding Master's in the field of Economics should be ignored, as there is only 1 polytechnic program, as opposed to 30 in universities.

As for our other binary variable, Education Subsystem, the respective coefficient was calculated using public institutions as baseline. Thus, in comparison with the private system, public education dropout is 22,3% higher when considering the full student population. It is noteworthy however, that the estimates are not significant for either regression on master's degrees. Again, the estimates contradict the conclusions of DGEEC's report on higher education attainment.

Considering the results obtained we can conclude that dropout varies between the different subsystems of Portuguese higher education. However, it is unclear if the type of institution has a direct impact in student's dropout decision or if students that enroll in a particular type of institution are more predisposed towards dropout.

5.2 Measuring the impact of educators

Our estimates indicate that a one-unit increase in the number of teachers per students is only significant regarding the full database, leading to a 0.16% decrease in dropout. Unsurprisingly, the estimate is negatively related to dropout, since student engagement increases when educators have smaller classes to teach. Still, it justifies why an increase in the number of students would lead to more abandonment, *ceteris paribus*.

Still on the subject of teachers, our regressions indicate that if the number of guest teachers increases (in relation to permanent teachers) the dropout count follows suit. Although this coefficient is not significant for the first estimation, it does seem important for the other two populations, at 36,4% for master's degrees and 181,1% for 2nd degrees in Economics. By this logic, variations in this ratio would have a much more substantial impact in the context of Master's in Economics, although the reason for this is unclear. It is possible that institutions with a higher number of guest teachers suffer from unobserved influences, which weaken and make them less appealing. Regardless, the direction is unsurprising, as students as teacher motivation is a cornerstone of student engagement.

Thus, it seems that the number and situation of teachers are associated with dropout count. Still, it would be interesting to delve deeper into this subject, with a higher focus on teaching methods and other measurement of quality. This would determine with certainty if institutions are in fact understaffed, if the problems lie with the general quality of teaching, or elsewhere.

5.3 The fabric of the student population and its relationship with dropout

Let us begin by considering the student population as a whole, through the log of the number of students. The coefficient for enrollments in 2016 is positive and significant for all three estimations, but less than unity. A one percent increase in the number of students is associated with an increase in dropout of either 0,63%, 0,84% or 0,88%, respectively. This is in line with the “friendship-support” and “voluntary withdrawal” concepts, proposed by Spady (1970) and Tinto (1975) respectively. According to these authors, an increase in the number of students enrolled decreases dropout due to the effect of comradery among colleagues and the existence of fewer “social isolates”. Notably this coefficient is substantially higher for master’s degrees than for the full student population, indicating that, when faced with the decision to abandon/persist, the higher number of students plays a more important role for those enrolled in 2nd degrees.

With the analysis of total enrollments out of the way, we begin our deconstruction of the student population, starting by the number of student workers in relation with total enrollments. The coefficient is significant across the board and indicates that the dropout count increases with the percentage of student workers. With student workers having to sacrifice study hours to fulfill their job responsibilities, the relationship between this specific explanatory variable and dropout seems straightforward. But it may also be the product of unobserved influences, such as the courses with a higher weight of student workers coincidentally being more attractive for individuals that are less likely to achieve academic success.

The measure of the effect is much larger for the general system in comparison with master’s degrees, which might indicate that students’ workers who enter second degrees are more serious about their education or more likely to choose courses related to their professional activity. Also noteworthy is the great difference

between the second and third estimations, which might suggest that Economics is a field where obtaining a 2nd degree is more time consuming than most other subjects, with students paying a higher price for the hours spent working.

As for the estimate regarding the impact of scholarships on dropout, the results for the complete student population and master's degrees seem to be in line with the existing literature, with a negative association between dropout and number of students with scholarships. As for scholarships in the context of master's in Economics, the estimate is not statistically different than zero.

Looking at the final characteristic of the student population we chose to study, we can see that the ratio of students enrolled part time in relation to the full student population contributes towards reducing abandonment. We can infer that this is possibly a reflection of the less demanding time requirements that come with these types of registrations. Alternatively, this may also derive from the fact that courses with a higher number of part-time students are able to appeal to individuals prone to academic success. Still, part time enrollments only seem to significantly impact 1st degrees, as our estimates show they are unimportant for both estimations that concern master's degrees.

In summary, it is undeniable that the selected characterizations have a relevant association with dropout for the student population in general and that the magnitude of their impact is large. However, only student workers seem to have a measurable effect in relation to master's degrees in Economics. Further research is required to properly understand these segment's relationship with dropout.

5.4 The effect of prospective income on the decision to drop out

Finally, let us analyze the effect of income on student abandonment, beginning with the monthly wage disparity. This variable negatively impacts abandonment, across the board, indicating that students are more likely to complete their education in regions where there is a greater wage premium on higher levels of education. However, this only seems to be vital/crucial to the decision of students enrolled in master's degrees in Economics. This might be a sign that the market rewards graduates of the master's in Economics with higher wages than most other majors. Alternatively, it could also point to these courses' ability to attract individuals more pre-disposed towards academic success.

As for the average monthly wage, it is insignificant both with the full database and when we focus on master's in the field of Economics. In truth, estimates for both variables related to wages capture all the relevant regional differences correlated with wages. They should thus be interpreted with particular care.

5.5 Gender and dropout

Gender plays an important part on the decisions process in matters concerning education (Contini et al., 2017) with studies showing that female students are more likely to obtain their degrees (Naylor & Smith, 2004). Table 15 contains the results obtained for gender specific estimations concerning the full database. These estimations were calculated in hope of highlighting how Portuguese female and male students differ or agree in regard to the selected determinants of dropout. The focus will not be to explain the reason for value or signal of each coefficient, but rather on comparing the statistically significant results obtained for each gender.

Table 15: Gender Specific Estimations

	Male	Female
Monthly Wage Disparity	-0.0101* (0.00564)	-0.00254 (0.00680)
Average Monthly Wage	0.000247** (0.000105)	0.000125 (0.000124)
Log of Enrolments 2016	0.719*** (0.0120)	0.636*** (0.0162)
Enrolments 2016 – Student Workers	0.550*** (0.101)	0.813*** (0.114)
Enrolments 2016 – Scholarship	-0.605*** (0.111)	-0.539*** (0.113)
Enrolments 2016 – Part-Time	-0.173 (0.160)	-0.385** (0.187)
Teacher-Student Ratio	5.42e-05 (0.000464)	-0.000390 (0.000575)
Percentage of Guest Teachers	-0.0578 (0.0918)	0.212** (0.100)
Education Subsystem – Public	0.168*** (0.0415)	0.202*** (0.0496)
Type of Institution - University	0.0745* (0.0402)	0.183*** (0.0472)
Cons	-0.749*** (0.120)	-0.821*** (0.144)
Observations	2670	2727

Note: *** p<0.01, ** p<0.05, * p<0.01

First and foremost, the number of students from each gender seems to be similar. Also, the effect of the subsystem of higher education selected, as well as of increases in enrollments and scholarship attainment, seem to affect both genders similarly.

Student workers are an interesting population to explore, given that, while their coefficient is significant for both genders, the measure of their impact on dropout is quite larger for female students. The impact of the ratio of female student workers leads to an increase in dropout for the gender higher than the one observed for male student workers. This may indicate that female student workers are less adept in balancing their job and their education, or that only poorer female students decide to work. Alternatively, it can also be that degrees with a higher number of female student workers are more appealing for students less prone to academic achievement.

But there are certainly differences in the way male and female students relate to dropout, as there are multiple variables that are statistically significant for only one gender. For male students, a one unit increase in the monthly wage disparity and average monthly wage is shown to result in a variation of the number of male dropouts, decreasing their numbers for the first and increasing them for the second. Female dropout, on the other hand, seems to respond to one unit increases in percentage of part-time students and guest teachers, with the former having negatively impact and the latter leading to its increase.

6. Conclusion

In an effort to keep our conclusions focused and relevant, we will address the research questions formulated earlier, thus providing a structure to this section.

Research Question 1: What is the impact of wages on dropout behavior?

According to the results obtained for the wage related variables, for most students, prospective income does not seem to have a significant role in the dropout decision. Given the influence labor market returns have on student's choices at enrollment (Hastings et al., 2016), their insignificance in terms of dropout is surprising. Still, Portugal does have a well-known asymmetry between its coastal and inland regions, both in terms of wages and higher education. Perhaps a more complex analysis, comparing different regions for instance, would lead to more interesting results. As it stands, with the tools at our disposal, we can only affirm that the impact of prospective income on dropout seems negligible, with a clear association found only with master's students in Economics.

Research Question 2: Do observed determinants of dropout behavior have a different impact on programs leading to a bachelor's degree or a master's degree?

The answer to this question can be obtained by relating our first and second estimations. Bear in mind that the estimation regarding the full database also include master's degree students, so the conclusions drawn are conservative and the differences between bachelor students and master students may in fact be even greater. That said, there is no doubt that the selected variables affect 1st and 2nd degree dropout differently, despite some coefficients having similar values between the first and second estimation. For the full population, part-time enrollment seems to contribute towards persistence in bachelor's degrees (and possibly at the doctoral level as well). Likewise, the nature of the education subsystem also seems to play a role only for this population of students. The opposite dynamic can be seen when

looking at the percentage of guest teacher, which seem to only play a significant role in master's degree student's decision to abandon.

We cannot specify if these variations are due to differences between the students of each group (such as preferences, commitment, et cetera) or between the courses they are enrolled in (funding, teaching quality, number of enrollments until attainment, to name a few). But the fact of the matter is that the determinants of dropout affect bachelor's degrees and master's degrees differently.

Research Question 2.1: What is the impact of the several determinants of dropout behavior on programs leading to a master's degree?

Focusing solely on master's degrees, quite a few of the selected variables have a significant impact on the dropout count. While diminutive, the positive effect of average monthly wage on master's degree persistence is undeniable. Similarly, scholarship attainment also seems to negatively impact dropout, confirming that the existing literature on this subject holds up in the context of 2nd degrees. Our findings in regard to the percentage student workers in master's degrees display the positive relationship between these and dropout, which literature suggest may result from the study time students sacrifice by maintaining a job (Glocker, 2011). Regarding the type of institution of tertiary learning, dropout seems to be higher for 2nd degrees in universities. Still, the two highest contributors towards raising the dropout count for master's degrees appear to be the percentage of guest teachers and the number of enrollments. The findings regarding the former are particularly curious, requiring further research to shed a light on the reason behind the value of the coefficient and its positive relation with dropout.

Research Question 3: Do observed determinants of dropout behavior have a different impact on courses in different fields of study?

Given the differences between the estimations for master's degrees in general and solely for those in Economics, we can only assume that the impact of the selected determinants of dropout varies between different fields of study. For one, monthly wage disparity only affects dropout in terms of students enrolled in 2nd degrees in

Economics, as previously mentioned. Furthermore, the impact of student workers and guest teachers on the dropout count is significantly higher for master's in Economics (in comparison to the second estimation). This may be explained by the determinants of abandonment affecting it differently between different fields of study, but further research is necessary to confirm that Economics is not an exception in terms of master's degree dropout.

Research Question 4: Do observed determinants of dropout behavior have a different impact on programs depending on the subsystem of the organic unit?

The answer depends on the population we choose to focus on, as the effects of the institution's subsystem and type is different in each estimation. For the full database the answer is yes, as dropout is proven to be higher both for public institutions (in comparison to private institutions) and universities (versus polytechnics). When considering only master's degrees, only the type of institution is proven to be relevant, again with universities displaying more abandonment. Finally, results for master's in Economics are unfit for analysis given that the overwhelming majority of institutions in the population are public universities.

Research Question 5: What is the impact of teaching personnel on dropout behavior?

Our analysis points towards educators having a modest role in the dropout decision process. For the student population in general, the ratio between teachers and students appears to be important, highlighting the role of class sizes in student engagement and persistence (Matta et al., 2015). Master's degree courses, for their part, appear to register an increase in dropout as a consequence of resorting to a higher number of guest teachers, a trend which is substantially higher for 2nd degrees in the field of Economics.

Research Question 6: Do the determinants of dropout behavior have a different impact on each gender?

There are certainly differences in the way male and female students are influenced by the variables we chose to include in the regression. In terms of dropout for male students, both variables relating to prospective income seem to play a significant role, while the same cannot be said for their counterparts. For female students the percentage of part-time students and guest teachers stand out for factoring exclusively in their dropout decision. Further research is required to explain why these variables only effect one gender in specific, but we can affirm with certainty that some determinants of dropout impact dropout for male and female students differently.

Closing remarks

We leave this work confident that we contributed towards a better understanding of dropout in Portuguese higher education. We aimed to shed some light on a few of the factors that contribute towards dropout and we are certain to have done so. Despite its clear importance, this subject is scarcely touched upon by the academic community in the country, leading us to pursue a more general approach in our research. Thus, some of the mechanics behind the influence of these determinates elude our analysis. In fact, most of the variables we chose and their relationship with dropout, are worthy of their own dissertation. Resorting to a database based on the characteristics of individual students, instead of courses, might also lead to interesting and more detailed results. We believe that the inner workings of dropout behavior in Portugal can only be truly understood through studies of this nature, and we hope that our dissertation may contribute towards their creation.

7. Bibliography

- Alon, S. (2011). Who benefits most from financial aid? The heterogeneous effect of need-based grants on students' college persistence. *Social Science Quarterly*, 92(3), 807-829. doi:10.1111/j.1540-6237.2011.00793.x
- Amaral, A. (2012). *Higher Education in Portugal 1974-2009. A Nation, a Generation*.
- Chen, R. (2008). Financial Aid and Student Dropout in Higher Education: A Heterogeneous Research Approach. In J. C. Smart (Ed.), *Higher Education* (pp. 209-239). Dordrecht: Springer Netherlands.
- Chen, R., & St John, E. P. (2011). State financial policies and college student persistence: A national study. *Journal of Higher Education*, 82(5), 629-660. doi:10.1353/jhe.2011.0032
- Conselho Nacional de Educação. (2014). *Estado da Educação 2014*. Retrieved from Conselho Nacional de Educação. (2015) *Estado da Educação 2015*. In.
- Contini, D., Cugnata, F., & Scagni, A. (2017). Social selection in higher education. Enrolment, dropout and timely degree attainment in Italy. *Higher Education*. doi:10.1007/s10734-017-0170-9
- DesJardins, S., & Chen, R. (2008). Rong Chen and Stephen L. DesJardins (2008). *Exploring the Effects of Financial Aid on the Gap in Student Dropout Risks by Income Level. Research in Higher Education*, 49(1): 1-18 (Vol. 49).
- DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (2006). The effects of interrupted enrollment on graduation from college: Racial, income, and ability differences. *Economics of Education Review*, 25(6), 575-590. doi:<https://doi.org/10.1016/j.econedurev.2005.06.002>
- DGEEC. (2011). *Inscritos no ano letivo de 2010/2011*.
- DGEEC. (2016). *Tertiary Education Attainment*. Retrieved from
- DGEEC. (2017). *Inscritos em Estabelecimentos de Ensino Superior - 2016/2017*.
- DGEEC. (2018a). *Inscritos no ano letivo de 2017/2018, dados relativos ao 1.º semestre*.
- DGEEC. (2018b). Número médio de Inscrições até à obtenção do diploma, por nível de formação, curso superior, subsistema de ensino, tipo de ensino e CNAEF - Área de Educação e Formação no ano de 2015/2016. <http://www.dgeec.mec.pt/np4/249/>
- DGEEC, P. E. J. O. B. (2018). *Percursos no ensino superior: situação após quatro anos dos alunos inscritos em licenciaturas de três anos*. Retrieved from <http://www.dgeec.mec.pt/np4/414/>
- DGES. (2017). Pesquisa de Cursos e Instituições. Retrieved from http://www.dges.gov.pt/pt/pesquisa_cursos_instituicoes?plid=372&instituicao=&cursos=&distrito=&tipo_ensino=&tipo_estabelecimento=1&area=&tipo_curso=
- Dowd, A. C., & Coury, T. (2006). The Effect of Loans on the Persistence and Attainment of Community College Students. *Research in Higher Education*, 47(1), 33-62. doi:10.1007/s11162-005-8151-8
- European Commission/EACEA/Eurydice. (2014). *Modernisation of Higher Education in Europe: Access, Retention and Employability 2014*. Retrieved from Luxembourg:
- Figueiredo, H., Portela, M., Sá, C., Cerejeira, J., Almeida, A., & Lourenço, D. (2017). *Benefícios do Ensino Superior*. Fundação Francisco Manuel dos Santos.
- Georg, W. (2009). Individual and institutional factors in the tendency to drop out of higher education: a multilevel analysis using data from the Konstanz

- Student Survey. *Studies in Higher Education*, 34(6), 647-661. doi:10.1080/03075070802592730
- Glocker, D. (2011). The effect of student aid on the duration of study. *Economics of Education Review*, 30(1), 177-190. doi:<https://doi.org/10.1016/j.econedurev.2010.08.005>
- Gonçalves, M. (2018, 05/04/2018). O elevado abandono no ensino superior prova que há um modelo falhado? “Essa conclusão é totalmente errada”. *Expresso*. Retrieved from <http://expresso.sapo.pt/sociedade/2018-04-05-O-elevado-abandono-no-ensino-superior-prova-que-ha-um-modelo-falhado--Essa-conclusao-e-totalmente-errada#gs.bx4X0JE>
- Greene, W. H. (2012). *Econometric analysis*. Boston, Mass.: Pearson.
- Hastings, J. S., Neilson, C. A., Ramirez, A., & Zimmerman, S. D. (2016). (Un)informed college and major choice: Evidence from linked survey and administrative data. *Economics of Education Review*, 51, 136-151. doi:<https://doi.org/10.1016/j.econedurev.2015.06.005>
- Inácio, A. (2018, 04/04/2018). Quase um terço dos estudantes abandona ensino superior. *Jornal de Notícias*. Retrieved from <https://www.jn.pt/nacional/interior/quase-um-terco-dos-estudantes-abandona-ensino-superior-9234774.html>
- Johnes, G., & McNabb, R. (2004). Never Give up on the Good Times: Student Attrition in the UK*. *Oxford Bulletin of Economics and Statistics*, 66(1), 23-47. doi:10.1111/j.1468-0084.2004.00068.x
- Jornal de Notícias. (2018a). As alterações no Ensino Superior aprovadas em Conselho de Ministros. *Jornal de Notícias*. Retrieved from <https://www.jn.pt/nacional/interior/governo-quer-mestrados-de-um-ano-e-formacoes-superiores-curtas-9119918.html>
- Jornal de Notícias. (2018b). Redução de vagas em nove instituições de Lisboa e Porto. *Jornal de Notícias*. Retrieved from <https://www.jn.pt/nacional/interior/reducao-de-vagas-no-superior-avanca-em-nove-instituicoes-de-lisboa-e-porto-9342440.html>
- LUSA. (2018, 25/04/2018). Há mais licenciados e menos abandono escolar em Portugal. *Expresso*. Retrieved from <http://expresso.sapo.pt/sociedade/2018-04-25-Ha-mais-licenciados-e-menos-abandono-escolar-em-Portugal#gs.csc8s9Q>
- M. Ganem, N., & Manasse, M. (2011). *The Relationship between Scholarships and Student Success: An Art and Design Case Study* (Vol. 2011).
- Magalhães, A., Amaral, A., & Tavares, O. (2009). Equity, Access and Institutional Competition. *Tertiary Education and Management*, 15(1), 35-48. doi:10.1080/13583880802700040
- Matta, B. N., Guzman, J. M., Stockly, S. K., & Widner, B. (2015). Class Size Effects on Student Performance in a Hispanic-Serving Institution. *The Review of Black Political Economy*, 42(4), 443-457. doi:10.1007/s12114-015-9214-5
- McKinney, L., & Burrige, A. B. (2015). Helping or Hindering? The Effects of Loans on Community College Student Persistence. *Research in Higher Education*, 56(4), 299-324. doi:10.1007/s11162-014-9349-4
- Melguizo, T., Sanchez, F., & Velasco, T. (2016). Credit for Low-Income Students and Access to and Academic Performance in Higher Education in Colombia: A Regression Discontinuity Approach. *World Development*, 80, 61-77. doi:<https://doi.org/10.1016/j.worlddev.2015.11.018>

- Naylor, R., & Smith, J. (2004). Degree performance of Economics students in UK universities: absolute and relative performance in prior qualifications. *Scottish Journal of Political Economy*, 51(2), 250-265. doi:10.1111/j.0036-9292.2004.00305.x
- Nunes, A. S. (1968). O Sistema Universitário em Portugal: alguns mecanismos, efeitos e perspectivas do seu funcionamento. *Análise Social*, 6(22/24), 386-474.
- OECD. (2016). "Portugal". In *Education at a Glance 2016: OECD Indicators*. Paris: OECD Publishing.
- OECD. (2017). *Education at a Glance 2017*.
- OECD. (2018). *Skills Strategy Implementation Guidance for Portugal*.
- OECD, D. G. P. L. S. R. T. W. (2018). *OECD Review of the Tertiary Education, Research and Innovation System in Portugal*. Retrieved from
- PORDATA. (2018a). Europa 2020. Retrieved from <https://www.pordata.pt/Europa2020>
- PORDATA. (2018b). População, entre os 30 e os 34 anos, com o ensino superior (ISCED 5-8) (%). Retrieved from <https://www.pordata.pt/DB/Europa/Ambiente+de+Consulta/Tabela/5738957>
- PORDATA. (2018c). Taxa de abandono precoce de educação e formação: total e por sexo. Retrieved from <https://www.pordata.pt/DB/Portugal/Ambiente+de+Consulta/Tabela/5738955>
- Sá, C., Amado Tavares, D., Justino, E., & Amaral, A. (2011). Higher education (related) choices in Portugal: joint decisions on institution type and leaving home. *Studies in Higher Education*, 36(6), 689-703. doi:10.1080/03075071003725343
- Silva, S. (2018a). Governo vai autorizar doutoramentos nos politécnicos. *Público*. Retrieved from <https://www.jn.pt/nacional/interior/reducao-de-vagas-no-superior-avanca-em-nove-instituicoes-de-lisboa-e-porto-9342440.html>
- Silva, S. (2018b, 04/04/2018). Quase 30% dos estudantes abandonam o ensino superior. *Público*. Retrieved from <https://www.publico.pt/2018/04/04/sociedade/noticia/quase-30-dos-estudantes-abandonam-o-ensino-superior-1808996>
- Spady, W. G. (1970). Dropouts from higher education: An interdisciplinary review and synthesis. *Interchange*, 1(1), 64-85. doi:10.1007/BF02214313
- Stinebrickner, T., & Stinebrickner, R. (2012). Learning about Academic Ability and the College Dropout Decision. *Journal of Labor Economics*, 30(4), 707-748. doi:10.1086/666525
- Stratton, L. S., O'Toole, D. M., & Wetzel, J. N. (2008). A multinomial logit model of college stopout and dropout behavior. *Economics of Education Review*, 27(3), 319-331. doi:<https://doi.org/10.1016/j.econedurev.2007.04.003>
- Tinto, V. (1975). Dropout from Higher Education: A Theoretical Synthesis of Recent Research. *Review of Educational Research*, 45(1), 89-125. doi:10.2307/1170024
- Winkelmann, R. (2008). *Econometric Analysis of Count Data*: Springer Publishing Company, Incorporated.

8. Attachments

Attachment 1 – OLS estimations

	OLS Original	OLS neg=0	OLS no neg
Monthly Wage Disparity	-0.0764 (0.0711)	-0.0424 (0.0663)	0.00579 (0.0688)
	<i>-1.07</i>	<i>-0.64</i>	<i>0.08</i>
Average Monthly Wage	0.00424*** (0.00141)	0.00395*** (0.00123)	0.00372*** (0.00132)
	<i>3.00</i>	<i>3.20</i>	<i>2.82</i>
Enrolments 2016	0.0705*** (0.00575)	0.0696*** (0.00570)	0.0686*** (0.00574)
	<i>12.27</i>	<i>12.22</i>	<i>11.95</i>
Enrolments 2016 – Student Workers	5.377*** (1.493)	5.255*** (1.366)	5.900*** (1.467)
	<i>3.60</i>	<i>3.85</i>	<i>4.02</i>
Enrolments 2016 – Scholarship	-4.814*** (1.109)	-5.054*** (1.038)	-5.464*** (1.151)
	<i>-4.34</i>	<i>-4.87</i>	<i>-4.75</i>
Enrolments 2016 – Part-Time	-0.493 (1.833)	-1.291 (1.676)	-1.615 (1.777)
	<i>-0.27</i>	<i>-0.77</i>	<i>-0.91</i>
Teacher-Student Ratio	-0.0162*** (0.00323)	-0.0163*** (0.00317)	-0.0186*** (0.00385)
	<i>-5.03</i>	<i>-5.14</i>	<i>-4.84</i>
Percentage of Guest Teachers	-1.604 (1.638)	-1.869 (1.577)	-2.117 (1.699)
	<i>-0.98</i>	<i>-1.19</i>	<i>-1.25</i>
Education Subsystem – Public	2.457*** (0.754)	2.119*** (0.586)	2.183*** (0.628)
	<i>3.26</i>	<i>3.62</i>	<i>3.48</i>
Type of Institution – University	-0.343 (0.637)	-0.149 (0.603)	-0.0593 (0.636)
	<i>-0.54</i>	<i>-0.25</i>	<i>-0.09</i>
Cons	1.164 (1.568)	1.480 (1.477)	1.060 (1.538)
	<i>0.74</i>	<i>1.00</i>	<i>0.69</i>
Number of Observations	3284	3284	3007
F statistic	45.09	44.70	39.41
Prob > F	0.0000	0.0000	0.0000
R-Squared	0.370	0.425	0.422
Root MSE	15303	13451	13828

1 - Standard errors in parentheses; T-statistics in Italic; *** p<0.01, ** p<0.05, * p<0.01