

## Determinants for Dropping out in the First Year of Licentiate Degree Courses at the Federal University of Viçosa

### Determinantes da Evasão no Primeiro Ano dos Cursos de Licenciatura da Universidade Federal de Viçosa

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#### Abstract

Thus, there is not a single factor that leads to drop out, but a set of causes that may be linked to individual, social and institutional issues. As in most Brazilian universities, the Federal University of Viçosa has been suffering from problems related to the permanence of students, mainly in Licentiate degree courses. This study aimed to verify the main determinants for dropping out in the first year of Licentiate degree at the Federal University of Viçosa between 2010 and 2016. Therefore, we used the *Logit* multilevel methodology in three levels, student, Licentiate degree courses (UFV) and time. The variables that most significantly impact the drop out probability are academic performance, student participation in research, quota in modality 3 (candidates who attended high school in Brazil public schools, self-declared blacks, brown or indigenous people, independent of family income), if the student receives help, stock of human capital, teaching experience, teacher qualification and crisis. That is, they are issues related to the proximity between institution and student, indicating that during this period, which is the first year of the course, the university has a significant role in ensuring student permanence, adaptation and also its good performance.

**Keywords:** Drop out. Higher Education. *Logit* Multilevel.

#### Resumo

*Percebe-se que não existe um único fator capaz de produzir evasão, mas um conjunto de causas que podem estar ligadas a questões individuais, sociais e institucionais. Assim como na maioria das universidades brasileiras, uma instituição que vem sofrendo com problemas relacionados à permanência dos alunos, principalmente, nos cursos de licenciatura, é a Universidade Federal de Viçosa. Este trabalho teve por objetivo verificar os principais determinantes da evasão no primeiro ano de estudantes de cursos de Licenciatura da Universidade Federal de Viçosa, entre 2010 e 2016. Para esse fim, foi utilizada a metodologia de Logit multinível, em três níveis, ou seja, aluno, cursos de licenciaturas (UFV) e tempo. Nota-se que, as variáveis que mais impactam significativamente a probabilidade de evasão são os rendimentos acadêmicos, a participação discente em pesquisa, a cota na modalidade 3 (candidatos que cursaram o ensino médio integralmente em escolas públicas brasileiras, autodeclarados pretos, pardos ou indígenas, independente da renda familiar), se o aluno recebe auxílio, estoque de capital humano, experiência docente, qualificação do docente e crise. Ou seja, são questões relacionadas a proximidade entre instituição e aluno, indicando que nesse período que é o primeiro ano de curso, a universidade possui um papel significativo para garantir a permanência do aluno, adaptação e também seu bom desempenho.*

**Palavras-chave:** Evasão. Ensino Superior. *Logit* Multinível.

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## 1 Introduction

Dropping out in higher education can be defined, in a general way, as “the definitive exit of students from their course of origin, without completing it” (BRASIL, 1996), as a frequent phenomenon in most Brazilian universities. Access to education is fundamental and a people’s right to exist with dignity, to exercise their citizenship through knowledge and the development of their potential (BARBOSA, 2013). However, as Zimmer (2013) points out, there is a considerable drop out level, especially in the first schooling years. This phenomenon involves economic, social issues and lack of opportunities. According to the Ministry of Education - MEC (BRASIL, 2016), in an evaluation on the trajectory of

students of higher education, based on the Census of Higher Education<sup>1</sup>, dropping out rates increased in undergraduate courses between 2010 and 2014. In 2010, this rate was 11.4%; in 2014, it went up to 49%.

In this context, public policies stand out, implemented by the federal government during the last decades, mainly starting in 2003, focusing on expansion and internalization (creation of new institutions outside metropolitan areas) the access areas to higher education. Programs such as the Restructuring and Expansion of Federal Universities (Reuni) instituted by the Brazilian Federal Government in 2007, as well as Law No. 12.711/2012 (known as the “Quota law”) are examples of policies aimed at expanding and facilitating the

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1 The Census of Higher Education is provided by the National Institute of Educational Studies and Research Anísio Teixeira (INEP).

access to Brazilian higher education (ZAGO *et al.*, 2016).

According to Lima and Machado (2014), REUNI contributed to the fact that dropout in undergraduate courses became a topic of greater attention. In promoting the expansion and restructuring of federal universities, the overall goal of the program was to increase gradually the average completion rate of face-to-face undergraduate courses. Thus, in return for receiving resources, the institutions committed themselves to fulfill several goals such as the improvement of approval and completion rates, as well as increasing the offer of courses at evening time and Licentiate degree courses. For Rabelo *et al.* (2011), the increase of vacancies in Licentiate degree course in the evening was important in this expansion process, since it related to the increase in teacher training, considered an indispensable factor capable of influencing education quality and change the trajectory of human capital formation in a society.

However, in Brazil, the teaching profession goes through a period of low social and financial recognition, culminating in excess in the demand for teachers, the low demand for Licentiate degree courses and the persistence of high dropping out rates (CASTANHO; CASTANHO, 1996; RABELO *et al.*, 2011; KONARZEWSKI *et al.*, 2001; VELOSO; ALMEIDA, 2002; LIMA; MACHADO, 2014; FÁVERO, 2017).

Considering the importance of teacher training and its close relationship with dropping out in Licentiate degree courses, it is fundamental to question the dropping out determinants, especially during the first year of the course, as pointed out by Mercuri *et al.* (1995), it is the period in which dropping out is more prominent. For Mercuri *et al.* (1995), the initial year is a critical period in the academic life of a student, given the “sudden” change between high school and undergraduation. Complementing, Coulon (2012) states that students who just finished high school should learn to be undergraduation students and those who fail to adapt quickly for a new system tend to fail.

Factors such as academic deficiency accumulated in the pre-university period, family disruption, financial fragility, unfamiliarity with undergraduate courses (added to the increase in the ease of entering university), the characteristic of the curriculum in the initial years of higher education courses and the expectation of financial gains from the investments made in university years are some of the arguments to be evaluated in an attempt to diagnose dropout causes in the first year (SAMPAIO *et al.*, 2011; BARBOSA, 2013; VELOSO; ALMEIDA, 2002; SALES JUNIOR, 2013).

According to Veloso and Almeida (2002) and Gisi (2006), academic performance would be another factor responsible for high dropout rates in the first semesters, because when initial performance are low, students feel unmotivated, leading them to leave. Gilioli (2016) considers the difficulty of professional placement as one of the causes for students to leave in the first year of university. The author also states that identification and

commitment to the chosen course are decisive and positively influence dropout probability.

Thus, there is not a single factor that leads to drop out, but a set of causes that may be linked to individual, social and institutional issues. As in most Brazilian universities, the Federal University of Viçosa has been suffering from problems related to the permanence of students, mainly in Licentiate degree courses. Located in the city of Viçosa, State of Minas Gerais, UFV was one of the institutions that joined REUNI, expanding the number of undergraduate courses. Currently, UFV has Bachelor degree, Licentiate degree and Technology degree modalities, distributed in 3 *campi*; 10 courses in the campus Florestal, 12 courses in the campus Rio Paranaíba and 45 courses in the campus Viçosa. In this composition, 54 are Bachelor degrees and 13 are Licentiate degree s. UFV still has 44 postgraduation programs, of which 25 offer Master’s and Doctorate courses.

The Unified Selection System (Sisu) is main way to join the UFV. This is a computerized system administered by the Ministry of Education (MEC), through which public institutions of higher education offer positions to candidates participating in the National High School Examination (ENEM). Students who register for Sisu have the option to apply for wide competition vacancies or for quota system. Regarding the Licentiate degree courses of UFV, according to data provided by the institution, the average drop out in 2012 was 53.09%, falling in 2016 to 20.74%. Even with this drop in 2016, this number still indicates problems between the number of newcomers and the number of graduates. Given the above, this study aimed to verify the main drop out determinants in the first year of Licentiate degree students of UFV. More specifically, we tried to evaluate how family, social and other variables related to the UFV institution would be influencing the students’ decision to drop out or not.

## 2 Material e Methods

### 2.1 Empirical model

Aiming to analyze the effect of individual, family and course factors over time on the first-year dropout students of UFV’s Licentiate degree courses, we used an econometric model to investigate how and to what magnitude these determinants affect the likelihood of a student to drop out or not. The data used in this research were made available through a request made to the Pro-Rectorates of Teaching and Research of the Federal University of Viçosa, since they are internal data of the institution.

Shirasu and Arraes (2015), Teixeira and Kassouf (2015) point out that the educational system is hierarchical structured, that is, a group of students constitutes a group, the grouping of classes compose the schools and so on. In general, when data are hierarchically structured, which is the case in this study, the units of the same level belonging to a higher level

unit are hardly independent (FÁVERO; BELFIORE,2017; TAMURA, 2007; MERLO, 2003).

One way to consider the hierarchical nature of educational data and the independence violation of error term is the multilevel or hierarchical estimation methodology, since it does not assume the independence between the observations of the units belonging to the same group (TAMURA, 2007).

In this study, the dependent variable is dichotomous, that is, it assumes value 1 to represent a student who dropped out in the first year of the course and value zero in the opposite case. Therefore, to reach the objectives, since the dependent variable is binary, we use the multilevel *Logit* model, since it allows calculating the dropout probability based on an accumulated logistic distribution function, considering the individual and aggregate levels. Three hierarchical levels are considered; the first level shows explanatory variables related to  $i$  students ( $i = 1, \dots, n_{it}$ ) ( $i = 1, \dots, n_{it}$ ), which are nested in  $j$  courses ( $j = 1, \dots, J_t$ ) ( $j = 1, \dots, J_t$ ), which, in turn, are nested in  $t$  years in ( $t = 1, \dots, T$ ) ( $t = 1, \dots, T$ ).

We started the analysis of the hierarchical approach with the model estimation with the absence of explanatory variables (null model or non-conditional multilevel model). Based on this estimation, it is possible to produce an intraclass correlation estimate that makes it possible to evaluate if,

from the econometric point of view, there are justifications for incorporating the second and third levels (HOX, 2002). In order to make the model closer to reality, we estimated a version with the random intercept parameter; however, containing explanatory variables of level 1 (student). Shortly afterwards, we added the level 2 variables to verify the effect of the variables on dropout in the first year. The choice of level 1 and level 2 variables based on the literature. The software used for model estimation is *Stata*.

Equation 4 shows the complete model of random intercept with variables of all levels, in which are considered equations 1, 2 and 3 represent the levels. Equation (1) represents the student level (individual) described as follows:

Level 1:

$$L_{ijt} = \ln \left[ \frac{\phi_{ijt}}{(1-\phi_{ijt})} \right] = \beta_{0jt} + \beta_{pjt} X_{ijt} + \beta_{sjt} F_{ijt} + e_{ijt}$$

$$L_{ijt} = \ln \left[ \frac{\phi_{ijt}}{(1-\phi_{ijt})} \right] = \beta_{0j} + \beta_{pjt} X_{ijt} + \beta_{sjt} F_{ijt} + e_{ijt}$$

in which  $p$  is from 1 to 18, representing the number of parameters for the group of individual variables;  $s$  ranges from 19 to 28, indicating the number of parameters for the family variables group;  $F_{ijt}$  represents a level 1 covariate vector of family characteristics;  $X_{ijt}$  is a vector of level 1 covariates of individual characteristics, described in Table 1. Thus,  $e_{ijt}$  represents the random effect associated with level 1 with normal distribution.

**Table 1** - Description of level 1 variables per group of variables

Individual characteristics ( $X_{ijt} X_{ijt}$ )		
Variables	Data	Description of variables
CRA	Academic performance	Represents the accumulated coefficient.
In the evening	Period	Dummy has joined a course that is offered in the evening.
Grade_test	Stock of human capital	Represents the student's grade (entrance examination or ENEM) standardized
Quota1, Quota2, Quota3 and Quota4	Quota modality	Demonstrates the quota groups ( <i>dummy</i> ): Group 1: Public school, income less or equal than 1.5 minimum wages per person and ethnicity; Group 2: Public school, income less or equal than 1.5 minimum wages per person and other; Group 3: Public school, income more than 1.5 minimum wages per person and ethnicity; Group 4: Public school, income more than 1.5 minimum wages per person and other; Group 5: Wide competition (base).
Male	Gender	<i>Dummy</i> assumes value 1 if it is a male student and 0 if it is female.
Age	Age	Represents the student's age at university entrance.
NWor	Needs to work	<i>Dummy</i> assumes value 1 if students need to work for their own sustain and 0 if it is not the case.
Assistance	Assistance	<i>Dummy</i> assumes value 1 if the student receives some university assistance (food or housing) and 0 if it is not the case.
Resea	Research	<i>Dummy</i> assumes value 1 if the student participates in any project (initiation or extension) and 0 if it is not the case.
Ent 1, Ent 2 or Ent 3	Attempts for entrance	<i>Dummies</i> representing the number of attempts to entrance higher education, based on more than 3 attempts.
Preparatory course	Preparatory course	<i>Dummy</i> assumes value 1 if the student attended a preparatory course and 0 if it is not the case
Children	Children	<i>Dummy</i> equal to 1 if the student had a child up to 5 years-old who lived with the student and 0 if it is not the case.
Family Characteristics ( $F_{ijt} F_{ijt}$ )		
Variables	Data	Description of variables
PaiFund, PaiMed or PaiSupp	Father's Schooling	<i>Dummy</i> father's schooling level; respectively basic, middle and higher/post-, and literate as the basis.
MaeFund, MaeMed or MaeSupp	Mother's Schooling	<i>Dummy</i> mother's schooling level; respectively basic, middle and higher/post-, and literate as the basis.

Source: Research data.

Equations (2) and (3) represent each of the levels, respectively, of the courses and the temporal, described as follows:

$$\beta_{0jt} = \gamma_{00t} + \gamma_{0jt}Z_{jt} + u_{0jt}$$

$$\beta_{0it} = \gamma_{00t} + \gamma_{0jt}Z_{jt} + u_{0jt} \quad (2)$$

in which  $Z_{jt}$  corresponds to the vector of level 2 covariables (courses<sup>2</sup>), described in Table 2. Thus,  $u_{0jt}$  represents level 2 error term with normal distribution.

Level 3:

$$\gamma_{00t} = \pi_{000} + \pi_{00t}C_t + r_{00t}$$

$$\gamma_{00t} = \pi_{000} + \pi_{00t}C_t + r_{00t} \quad (3)$$

in which  $\pi_{000}$  represents the level 3 intercept,  $r_{00t}$  is the random error term with normal distribution with mean zero and variance equal to  $\tau_{r_{00t}}$ ;  $C_t$  corresponds to the level 3 variable that indicates if the student entered before or after 2015 (variable created to represent the effects of the Brazilian economic crisis in relation to the generation of jobs).

**Table 2** - Variable description of Licentiate degree courses (level 2) and year (level 3)

Course Characteristics* ( $Z_{jt}Z_{jt}$ )		
Data	Variables	Description of variables
Percentage of Associate teachers	Teaching Experience	Percentage of Associate teachers. This variable was selected as a proxy for teaching experience, because for reaching the Associate level the teacher must have at least 10 years of teaching.
Percentage of Teachers with Doctorate degree	Teacher Qualification	Percentage of teachers with a doctorate in education
Department with Postgraduation	Postgraduation	Dummy that assumes value 1 if the department to which the Licentiate degree course is linked has a postgraduation degree and 0 if it is not the case
Research Project	Search activity level	Number of research projects in the course
Temporal characteristics ( $C_tC_t$ )		
Crisis	Year	Dummy assumes value 1 if the year is greater than or equal to 2015 and 0 if it is not the case.

Note: \* Departments are used as a course proxy.

Source: Research data.

Therefore, we have to substitute equations (2) and (3) in equation (1) with the following equation:

$$L_{ijt} = \ln \left[ \frac{\phi_{ijt}}{(1-\phi_{ijt})} \right] = \pi_{000} + \gamma_{0jt}Z_{jt} + \pi_{00t}C_t + \beta_{pjt}X_{ijt} + \beta_{sjt}F_{ijt} + r_{00t} + u_{0jt} + e_{ijt}$$

$$L_{ijt} = \ln \left[ \frac{\phi_{ijt}}{(1-\phi_{ijt})} \right] = \pi_{000} + \gamma_{0jt}Z_{jt} + \pi_{00t}C_t + \beta_{pjt}X_{ijt} + \beta_{sjt}F_{ijt} + r_{00t} + u_{0jt} + e_{ijt} \quad (4)$$

In addition to considering the estimation of random intercept parameters, verifying if the slope parameters also vary according to the change of course and time is possible. In this case, it is known as a model with random intercept and slope. Thus, in this study, we performed the LR test to verify the need to use random slope, whose null hypothesis is that the models do not show significant differences, against the alternative hypothesis that they are distinct, that is, that the random slope model provides a better adjustment. The null hypothesis cannot be rejected at 10% so we chose and we used the random intercept model, shown by Equation 4. Variables of levels 2 and 3 were included without slope changing.

In multilevel analysis, verifying the amount of variation that can be determined by the different levels of data structure is necessary (SHIRASU;ARRAES, 2015). Therefore, we used the Coefficient of Variance Participation ( $\rho\rho$ ) or intraclass correlation, which measures the proportion of total variance

due to intergroups difference (GOLDSTEIN, 1999). In the case of the 3-level model, there are two intraclass correlations: the first corresponds to data behavior belonging to the same level 3  $t$  units but coming from different level 2  $j$  units; the second corresponds to data behavior belonging to the same level 2  $j$  units (courses) and same  $t$  units level 3 (years).

This correlation coefficient allows verifying if this is the ideal data model so that when the value is close to 0, there is no hierarchical structure and the classical regression models can be used, whereas for values close to 1, the grouping structure is very strong, being necessary the use of multilevel modeling.

We performed statistical tests in order to ensure that the estimation truly meets the consistent statistical properties. To ensure that the model is adequate to the data, performing the LR test is necessary, whose null hypothesis is that the random effects are zero. This test is necessary because it confirms the need to do the analysis at different levels or at a single level

2 Departments are used as proxy for courses, as many teachers belong to the department rather than a particular course.



(GOLDSTEIN, 1999).

In order to measure the dropout probability for Licentiate degree students on their first year in UFV, we used primary data of the institution between 2010 and 2016, for 2.368 students from the following courses: Biological Sciences, Social Sciences, Dance, Physics, Mathematics, Physical Education, Early Childhood Education, Chemistry, History, Languages, Geography and Pedagogy.

In this study, the Special Commission defined the dropout concept for the Study of Dropout in Brazilian Universities (1996). In it, the student who definitively leaves the course in which they attended in the first year is a dropout student (BRASIL, 1996). Disconnections were not considered, for involving other issues and characteristics, not being a student's decision. Information on deceased students and those who stopped attending the course for health reasons were also excluded.

In order to use the data related to entrance grade, we standardized by year, since the ENEM, as a way of entry into the UFV, through the Unified Selection System (Sisu), came into effect from 2012. However, some courses took longer to start using this system, for example, the Dance course. Therefore, the standardization was created in order to allow the analysis of this entry grade and was performed as follows:

$$Grade_{ent} = \frac{Grade_{iyear} - Mean(Grade_{year})}{sd(Grade_{year})} \quad (5)$$

in which  $Grade_{iyear}$  represents the grade of the student  $i$  in year  $t$ ;  $Mean(Grade_{year})$  is the average grade of year  $t$ ;  $sd(Grade_{year})$  represents the standard deviation of the grades in year  $t$ .

Unfortunately, we could not use the income variables to analyze the dropout probability in the first year in the UFV Licentiate degree courses. The first issue concerns the collection of information on the subject in the institution, that is, in the questionnaire applied to students, the options of income overlapped. In addition, the income variable relates to some variables of the model such as quotas, academic performance and the issue of attending a preparatory course, which could compromise the results.

### 3 Results and Discussion

#### 3.1 Student characteristics and UFV courses

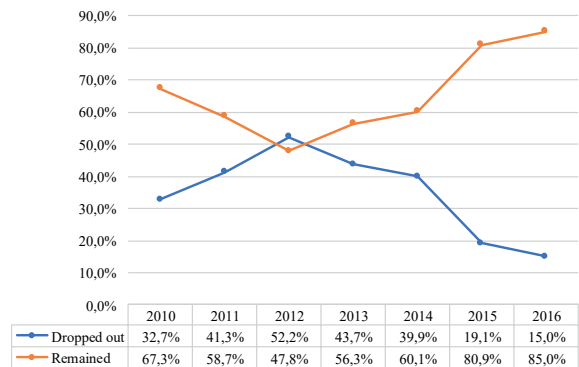
UFV is one of the Brazilian institutions with the highest levels of teacher qualification (SINAES, 2005). In 2010, the offer was 3200 vacancies, distributed among the three campi, of which 2490 vacancies were for Bachelor degree and 790 for Licentiate degree. In 2016, 3190, 2470 and 720 were distributed, respectively.

When evaluating the condition of graduates of UFV

undergraduate courses, there was a relatively small rate of students finishing the courses compared to those entering. Such relationship is observed comparing the data of the entering students with the dropout rates. This fact has a strong relationship with the students who are retained in the university, as well as those who drop out without finishing the course. According to data provided by Pro-Rectorates of Teaching and Research of the Federal University of Viçosa in the Bachelor degree courses, in 2010, the percentage was 57.2% graduates, rising to 68.6% in 2016. In Licentiate degree courses, the figures went from 34.4% in 2010 to 51.8% in 2016.

When analyzing the dropout rate in Licentiate degree courses over the years (Graph 1), a significant increase occurred between 2010 and 2012. However, after 2014, the percentage of dropout in Licentiate degree courses declined substantially, reaching 15% in 2016, still a number high.

**Graph 1** - Percentage of dropout and permanence for Licentiate degree courses between 2010 and 2016



Source: Research data.

This large dropout reduction may be related to the economic scenario, which started in this period. Gross Domestic Product (GDP) reduced by 9% between 2014 and 2016 (BARBOSA FILHO, 2017). Therefore, a sudden change occurred in the evolution of the labor market. According to Pochmann (2015), unemployment again grew rapidly and the average wage of the employed lost purchasing power in the first seven months of 2015.

In this context, the labor market was not so attractive. It was more convenient to continue studying and wait for an improvement in the country's economy and unemployment rates. In addition, the labor market for teachers is dominated in the country by the public sector. Considering that this sector has the right to stability in employment, in times of crisis, the attractiveness in the career of teachers increased. According to Ghez and Becker (1975), this fact would occur because the demand for education behaves countercyclically in relation to economic crises, that is, when unemployment rates are higher, individuals tend to start higher education in response to low supply of labor. This reaction would be a way to improve future income as well as protect against future economic

fluctuations.

Table 3 shows that, between 2010 and 2016, the Licentiate degree course in Physics showed the highest average of dropout rate in the first year, that is, 24%, followed by the Licentiate degree in Mathematics, with 21.53%. These dropout percentages are worrisome for an undergraduate course, since they generate high costs for the government and for society, for being a public institution.

**Table 3** – Average dropout rate in the first year in Undergraduation course between 2010 to 2016

Course	Dropout Rate
Biological Sciences	5.60%
Social Sciences	5.50%
Dance	2.70%
Physical Education	3.50%
Early Childhood Education	6.40%
Physics	24.42%
Geography	5.80%
History	11.58%
Languages	4.90%
Mathematics	21.53%
Chemistry	13.06%
Pedagogy	3.10%

Source: Research data.

UFV has several Student Assistance programs, providing for economic vulnerable students the following types of assistance: Housing, Food Service, Day Care/Preschool and

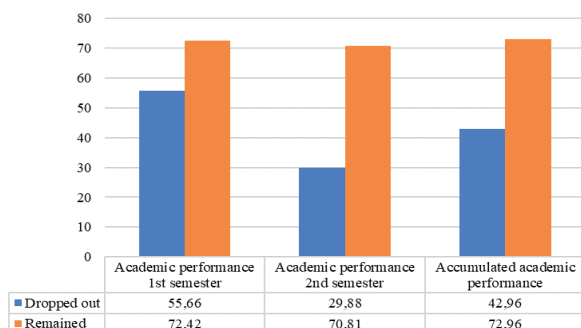
according to the incentive received by the students between 2010 and 2016.

Incentive	Decision	2010	2011	2012	2013	2014	2015	2016
Research	Dropped out	2.10%	4.00%	2.60%	1.90%	1.10%	2.60%	15.00%
	Remained	97.90%	96.00%	97.40%	98.10%	98.90%	97.40%	85.00%
Assistance	Dropped out	4.70%	7.40%	9.90%	6.20%	4.20%	0.50%	2.40%
	Remained	95.30%	92.60%	90.10%	93.80%	95.80%	99.50%	97.60%

Source: Research data.

As for the general academic performance in Licentiate degree courses, Graph 2 shows that students who choose to drop out these courses have lower academic performance in the first and second semesters, as well as in the following semesters.

**Graph 2** - Average of the coefficients in agreement to dropout for the Licentiate degree courses



Source: Research data.

Housing Service. In 2015, for example, the Pro-Rectorate for Community Affairs assisted: 1,533 students in university housing; 827 students with housing assistance; 2,912 with free access to the university restaurant; and 179 with professional initiation scholarship.

UFV develops other programs as a way to encourage students, offering in many cases, financial assistance for scholars. Among them, emphasizing the projects of scientific initiation and extension that allow a parallel learning to the classroom is possible, offering a return to the Brazilian society (extension activities).

In addition, for the Licentiate degree, other programs are offered to improve the training of students and encourage, in a way, the completion of the course. The Programa Institucional de Bolsa de Iniciação à Docência (Pibid) and the Programa de Consolidação das Licenciaturas (Pro-teaching) are some examples. The first one aims at granting of scholarships for students' performance in basic education. The second seeks to contribute to raising the courses quality by promoting institutional projects, recognizing the social relevance of teachers in basic education.

Table 4 shows an example of the importance of such assistance. Note that the dropout rates are much lower when considering only students who receive some type of assistance or have Scientific Initiation in the first year of the course.

**Table 4** - Rate of dropout and permanence in the first year

These statistics point out the importance of academic performance in the students' stay, encouraging them to remain enrolled, in addition to increasing their integration and commitment to the institution, especially when it comes to dropout in the first year.

### 3.2 Analysis of dropout probability in the first year

Initially to confirm the data hierarchical structure, we performed the *Maximum Likelihood Ratio Test*, Table 5, opposite to the standard *Logit* model with the hierarchical *Logit* model for three levels. The test pointed out that at the 1% significance level for both the null model and the random intercept model, from Equation (4), it can be assumed that the multilevel logistic model is more appropriate than a standard logit model. Therefore, the inclusion of levels is necessary to achieve robust results.

**Table 5 – Likelihoodratio test (LR test)**

Estimation	Model	LR test	
		Calculated value	P-value
Dropout in the first year	Null model	272.85	0.0000
	Random intercept model	3.79	0.026

Source: Research data.

Table 6 shows the intraclass correlation results for the null model. The intraclass correlations of level 2 (in Licentiate degree course) and level 3 (year) for the null model are equal to 0.3698 and 0.1274, respectively. This means that around 24% of the variations in dropout probability in the first year are due to the differences between the UFV departments, while about 13% (level 3 - temporal variation) of the variations relate to the differences between the years. Therefore, for the model without explanatory variables, the student’s dropout probability is more affected by the variation between the courses than between the years. This was to be expected, given that the changes are larger, in general, between the Licentiate degree courses over the same year, than over the years.

**Table 6 - Hierarchical null model to determine dropout probability in Licentiate degree courses at UFV.**

Fixed Effect		
	Coef.	Standard Deviation
Intercept ( $\beta_{0jt}$ $\beta_{0jt}$ )	-2.6693*	0.3408
Random Effect		
	Intraclass correlation	Standard Deviation
Variation between courses	0.3698	0.0662
Variation between years	0.1274	0.0735

\* Significant at 1%.

Source: Research data.

Table 7 shows the marginal effects at the sample midpoint. We did this analysis only for the continuous variables to explain dropout probability in the first year. Subsequently, we proceed with the odds ratio analysis for the binary explanatory variables. This procedure based on Shirasu and Arraes (2015).

Table 7 shows that the *academic performance* is a fundamental variable for dropout decision, contributing to reduce the probability of dropping out in the first year. During the analyzed period, an additional performance point would reduce by 0.21 percentage points (p.p.) the probability of dropping out.

The first year is the most critical period in academic formation and in the definition of permanence, as stated in the literature<sup>3</sup>. For that matter, a good student performance in this phase is fundamental for staying in the course. According to Peixoto, Braga e Bogutchi, (2003), the courses with the

highest dropout rate in the first year are generally those with higher failure rates. This result is consistent with Tinto’s model (1975), in which good performance is a motivation for the student to stay in the course and intend to complete it.

**Table 7 - Marginal effects for the model with variables of levels 1 and 2 to dropout estimation in the first year**

Student (Level 1)		
Variables	Marginal effects	Standard Deviation
Performance	-0.0021***	0.0002
Stock of human capital	0.0089***	0.0022
Age	-0.0001 <sup>ns</sup>	0.0005
Licentiate Degree Course (Level 2)		
Teaching Experience	-0.0485**	0.0232
Teacher Qualification	0.0363**	0.0173
Search Activity Level	-0.0002 <sup>ns</sup>	0.0064

\*\*\* Significant at 1%; \*\* Significant at 5%; ns – not significant.

Source: Research data.

Table 8 shows an interesting point, in which the *human capital stock* seems to affect positively the dropout, that is, more prepared students who start the Licentiate degree courses of the UFV tend to drop out more. According to Avena and Verhine (2013), students with higher social status and, consequently, greater human capital stock would tend to choose more prestigious courses in public universities, for providing greater future performance. The authors explain that in higher education there is a great difference in educational and performance costs among incoming students. Thus, these are basically due to the differences in human capital stock that these students gather throughout their school life up to getting to university. In addition, the authors emphasize that student’s learning is not only a result of the conditions and quality of current teaching offered to them, but also of the characteristics of the education offered to them in the past. Therefore, these students with greater human capital stock have greater opportunities of course exchange.

The variable representing the *age* of the student entrance in higher education did not show statistical significance, demonstrating that age does not influence the decision making to leave the course. Santana (2016) also found no significant difference between ages of those who dropped out in relation to the students who remained.

Table 8 also shows continuous Licentiate degree variables, which are *teacher experience*, *teaching qualification* and *research activity level*. The first two showed statistical significance, confirming, once again, the importance of hierarchical structure. Therefore, the more experienced the teacher, the lower the chances of the student leaving in the first year of course. With experience, such professionals can more effectively assist and advise students who still have doubts about their choice. As stated by Barreiro (2009), teachers need to master content, skills, abilities and attitudes to face the daily

3 Santos and Silva (2011); Coulon (2012).

adversities of student learning, therefore, their development as professionals is fundamental.

The *level of research activity* showed no statistical significance, indicating that the research intensity of the department to which the course belongs has no influence to explain the dropout. Such a result could indicate the lack of interest of the departments in initiating the undergraduate students in research activities, that is, the research could be directed towards Postgraduation. The finding in Table 8 that a Postgraduation program in the Department to which the Licentiate degree belongs does not affect the dropout probability is in line with the result showed for the level of research activity.

**Table 8** - Odds ratio for the estimation with levels 1 and 2 variables to estimate dropout in the first year

Variables	Coefficient	Standard Error
Research	0.5251***	0.1505
Assistance	0.4578***	0.1127
Quota 1	1.6577 <sup>ns</sup>	0.6397
Quota 2	0.7644 <sup>ns</sup>	0.4563
Quota 3	1.9998**	0.6734
Quota 4	1.8041 <sup>ns</sup>	0.7701
Gender	0.7824 <sup>ns</sup>	0.1486
In the evening	1.2670 <sup>ns</sup>	0.2893
Preparatory course	0.9835 <sup>ns</sup>	0.1892
Mother - Basic	1.4695 <sup>ns</sup>	0.5011
Mother - Middle	1.0524 <sup>ns</sup>	0.2616
Mother - Higher or Post-	1.0680 <sup>ns</sup>	0.2687
Father - Basic	0.7803 <sup>ns</sup>	0.2628
Father - Middle	1.1102 <sup>ns</sup>	0.2610
Father - Higher or Post-	1.2679 <sup>ns</sup>	0.3350
Children	1.0195 <sup>ns</sup>	0.5227
Needs to work	0.7315 <sup>ns</sup>	0.1620
Admission – Attempt 1	1.4628 <sup>ns</sup>	0.5964
Admission – Attempt 2	0.9506 <sup>ns</sup>	0.4024
Admission – Attempt 3	0.8476 <sup>ns</sup>	0.4265
<b>Level 2</b>		
Postgraduation	1.0542 <sup>ns</sup>	0.3278
<b>Level 3</b>		
Crisis	0.0843**	0.0262

\*\*\* Significant at 1%; \*\* Significant at 5%.

Source: Research data.

Table 8 shows the odds ratios for leaving the Licentiate degree courses in the first year, calculated for the binary explanatory variables. It begins with the analysis of the incentive variables (assistance and research) that were fundamental when it comes to dropout in the first semesters. For that matter, the results below suggest that receiving some assistance (food or housing) from the institution has played an important role, since students with such assistance have their chances of leaving the course in the first year reduced

by 54.22% compared to those who do not receive the aid. Likewise, participation in some type of research reduces the dropout probability in the first two semesters by 47.49%, in relation to the chances of those who do not participate.

As stated by Sales Junior (2013), student assistance is a way of establishing the student's relationship with the institution, in order to complete the course. In addition, participation in research is a way for the student to maintain a good performance during the course, raising the coefficient.

Regarding the quota modalities, only modality 3 of quota was statistically significant. The requirements for the individual to participate in this modality are candidates who attended high school in full in Brazilian public schools, self-declared black, brown or indigenous people, regardless of family income. Thus, the level 3 incoming student has a 99.98% chance of leaving the university in the first year in relation to the student entering via other quota modalities and general competition.

This fact is consistent, since in this case the family income will not necessarily be a barrier to the entry of this individual, making the subject to compete in other institutions of higher education (with or without quota). Sampaio et al., (2011) explains that students with higher family income have the advantage that parents can afford a possible indecision and choose to start another course. In addition, in the modalities of quotas 3 and 4 the cutline grade, in general, is higher than in the previous quotas. Thus, the student who starts a Licentiate degree by one of these modalities tends to have a greater chance to abandon the course and try another course using the quota again.

The results indicate that the individual characteristics (gender and if the student has a child) did not show statistical significance. Measures to support university parents, such as day care centers, are likely to facilitate, in part, the continuation of studies. As for the relationship between gender and dropout, Santana (2016) argues that, according to the literature, there is no consensus on the subject. The author points out that the studies, which generally have different effects, do not support themselves, given that there is a contextual particularity of the gender, causing this variable not to determine the decision by dropout in some cases.

In relation to *parents' schooling*, none of the used *dummies* showed statistical significance. Dropping out in the first year would involve the student adaptation and perception of the course, rather than parental influence. The advice given by the parents is a fundamental factor and, generally, parents with higher education levels would tend to have a greater influence on the permanence in higher education. However, other factors (e.g. performance and human capital stock) would be more important during the first year of the course.

The *period* of the course did not affect the probability of students to drop out. The student who starts a course in the evening has this information before entering university. In general, students who study in the evening work or wish



to engage in paid activity during undergraduation, to support the expenses or to help the family. Consequently, this tends to affect academic performance; however, it was not as a significant factor for dropping out in the first year.

As for the *crisis variable*, it negatively affects the dropout probability. Given the other characteristics, the chances of dropping out are 91.57% lower, considering the average of all courses after 2015. Ghez and Becker (1975) indicate a negative relation between economic activity and the demand for education. In periods of economic expansion, the cost for the opportunity to study rises by inducing people to opt for the labor market, which would be paying great wages. The opposite effect occurs in recessions. In these cases, individuals seek a way to increase the human capital stock (such as higher education) in order to mitigate the effects of future crises (GHEZ; BECKER, 1975). With the increase in the unemployment rate, which took place in Brazil during and after 2015, economic agents would tend to obtain qualification to return to the labor market, that is, in the recession there would be an increase in demand for education.

The other analyzed variables did not show statistical significance to explain the dropout probability in the first year of Licentiate degree courses at UFV, between 2010 and 2016. Thus, the variables that most affected dropout were academic performance, human capital stock, student access to research, assistance, quota modality 3, economic crisis, experience, and teaching qualification. This is a critical period for students, so it is necessary to increase efforts to increase integration between student and institution.

#### 4 Conclusion

Given the changes in the education system in recent years and the few studies in the area, investigating some existing gaps in the process of decision making regarding dropout in the first year is important. In this study, we opted for the Licentiate degree courses at the Federal University of Viçosa, which still does not have a study with this focus of analysis. Therefore, we used a probability analysis taking into account the hierarchical data nature in order to evaluate the determinants of dropout probability in the first year of the Licentiate degree at the UFV, from 2010 to 2016.

Academic performance was the variable with the greatest impact on dropout probability in the first year. This was expected, for being one of the most important variables for the initial period of undergraduation. It encourages the student to persist, being a determinant of their commitment to finish the course and to the institution. This fact indicates that a higher performance in the Licentiate degree course at the UFV tends to increase the chance of permanence, which has a strong relation with the academic and social integration of the student at the beginning of the course.

In addition, the assistance and crisis variables were significant and could reduce dropout probability. The results corroborate with the literature, in which forms of incentive

and financial assistance help the student to remain in the institution. Thus, a relationship with the student's academic and social interaction is observed again; to the extent that they increase, students have more access to research opportunities that encourage them to stay in the course. The second represents the drop in dropout rates and had the expected signal, as students ponder further dropout at a time when the economy is not thriving.

As for the course variables, only two of them were significant: teacher experience and teaching qualification. Experience reduces dropout probability in the first year, which may relate to the fact that more experienced teachers generally know how to advise better students. Teaching qualification positively affects dropout in the first year, showing that higher qualification does not imply greater experience to deal with students.

The institution has taken some measures with the aim of reducing these rates, for example the First Year Program. In addition, UFV is a reference in terms of student assistance, which is fundamental, since some students give up because they are not able to continue without help. The analysis shows that Licentiate degree courses at the UFV have issues, as well as other courses with high dropout. Some steps must be taken to work around this issue.

The participation in research is quite important. Therefore, students should be more encouraged in these activities. In the case of Licentiate degrees, it can even influence the way students see themselves in the future as a professional. The institution should explore the reduction of barriers between institution and student, making possible greater integration between student and university, according to the literature, which would result in a fall in dropout rates.

The results are of extreme academic and social importance and serve as a way of helping the institution's actions. Clearly, such studies should be carried out more frequently for periodic monitoring. In addition, it would be interesting to carry out an analysis of each course individually or per year, through this or other methodologies. Therefore, UFV could increasingly reduce these indices and improve the application of questionnaires with students aiming at such studies.

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