



## When the road to academic success goes through the library: A case study at the University of Seville

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### ABSTRACT

University libraries are adapting to the new study, learning, and research needs of the university communities that they serve. In an environment of economic tweaking, a trend toward the performance of investments, the progressive digitization of resources and services, and easy access to information in digital format, universities are compelled to show that they are still cost-efficient for the institutions that they serve; in this case, the University. This paper will use a robust methodology based on multiple indicators and a broad database that takes into consideration other control variables of a socio-demographic, economic, and academic nature to analyze the impact that the library circulation service can have on student academic performance. Our results show that there is a clear positive relationship between the number of library loans that a student takes out and the various academic performance indicators used. Furthermore, the more intense the use that students make of the system, both in terms of time and renewals, the greater the academic success that they attain. Lastly, measures are proposed to exploit this positive synergy and realize university excellence.

### Introduction

University libraries have traditionally been places where documents of different types are kept, consulted and loaned out, and also where students have been able to study on their own. Their functions have multiplied over time, with the creation and design of more flexible spaces for individual or group work, Maker Spaces, and Learning Commons as part of the current debate on Active Learning Classrooms. At the same time, university libraries have become involved in training both students and teaching staff in information management competencies—"Information literacy" or "Digital Competencies"—not only in relation to searching for and evaluating information but also regarding copyrights, bibliographical citations, anti-plagiarism systems, the visibility of scientific publications, and filling out applications for promotion within the teaching staff structure.

Academic libraries, in general, and Spanish libraries, in particular, do not only have to deal with this new roster of functions but also other major future challenges (Aslam, 2018; Kumbhar, 2014). First, they have to adapt to the internet age, which has forced them to digitize a large part of their book collections and to purchase digital media to make them accessible online (Dempsey & Malpas, 2018), with the

corresponding effort in material and human resources. Closely connected to this is the emergence of borderless competition with mass online information sources and resources to which students have easy access (Mwaniki, 2018). Third, there is a growing trend for students to dispense with the study of textbooks and the recommended reading found in academic libraries and to study their own notes taken in class and those posted on a variety of online platforms created ad hoc. This change in students' study habits and easy access to information has led to a fall in library loan rates. As with US academic libraries (Barclay, 2017), the number of printed book loans in Spanish university libraries fell by 37% between 2014 and 2018 (REBIUN, 2019). Lastly, in the wake of the great recession, Spanish universities and, therefore, also their libraries, are facing major budget restrictions that limit not only their ability to expand and bring their catalogs up to date but also to adapt to the new technologies and bibliographic innovations. By way of example, in the ten years that have passed since the economic crisis began in 2007, the total expenditure on bibliographic material at the University of Seville library has remained virtually unchanged (BUS, 2012; REBIUN, 2019).

In this environment, academic libraries have to provide proof of the contribution that they make to universities. As a result, they are

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devoting major resources to demonstrating their impact on students' academic success using various assessment measurements (Scoulas & De Groote, 2019), given the multidimensional range of functions that they have today (which, following Alharbi and Middleton (2012) can be summarized as training, collection, information technology, facilities and equipment, and library physical environment.)

Given this pressing need, the academic literature has studied the influence that libraries have on student retention (Haddow, 2013; Haddow & Joseph, 2010; Hubbard & Loos, 2013; Mezick, 2015; Soria, Fransen, & Nackerud, 2013); student engagement (Griffith & Kealty, 2018; Schlak, 2018) and perception (Alharbi & Middleton, 2012; Kim, 2017); the use of scholarly resources and citations in their coursework (Hurst & Leonard, 2007); and libraries' contribution to faculty productivity in terms of research, grant, and publishing activities (Tenopir, King, Mays, Baer, & Wu, 2010). More specifically, studies have also been developed that analyze the use that students make of libraries and how this influences their grades. For example, De Jager (1997) found a positive relationship between academic success and the use of open shelf library books, while Wong and Webb (2011) empirically demonstrated that library usage contributes positively to students' grade point averages (GPAs). Goodall and Pattern (2011) also concluded that students who borrow books and access electronic resources in the library obtain better grades in some subjects. Cox and Jantti (2012) used the total number of items borrowed as one of their indicators and found a strong relationship between the average marks for each level of resource usage and student marks. Jantti and Cox (2013) went on to stress that students who borrow library resources outperform students who do not, which could influence students' decisions as to whether to drop out or continue to study at university. In the same line, Soria et al. (2014) suggested that students who utilize academic libraries within their first-year have higher cumulative grade point averages and retention, and highlighted four library functions that are positively related to students' GPAs: database logins, book loans, electronic journal logins, and library workstation logins. Stemmer and Mahan (2015) identified some specific library services that have a positive influence on students' cumulative GPAs, depending on the point in time in the undergraduate experience; i.e., for first-year students, the library's influence can be seen as a place to study alone and where specialized equipment is available, whereas, for seniors, cumulative GPA is influenced by checking out books. Allison (2015) analyzed the influence of checkouts and off-campus access to databases on students' GPAs and showed a correlation between greater use of the library and retention and increases in GPA. Lastly, Soria, Fransen, and Nackerud (2017) analyzed various aspects related to library usage and highlighted a significant positive relationship between students' use of books (collection loans, e-books, and interlibrary loans) and web-based services (database, journal, and library website logins) and academic outcomes; meanwhile, Krieb (2018) highlighted the fact that while there is no statistically significant impact for library instruction on course grades (as did Hurst & Leonard, 2007), a strong statistically significant positive impact of visiting the reference desk was observed.

Our aim in this debate on the role of academic libraries is to use a robust multiple indicator-based methodology to analyze the impact that their function as lenders of resources might have on students' academic performance. Despite libraries having a multipurpose structure, as has already been mentioned, our study seeks to highlight their traditional mission of loaning out both textbooks and audiovisual platforms and IT materials. This function is even more important in a context in which the rising cost of textbooks is one of the factors that most affect higher education today (Todorinova & Wilkinson, 2019). In the case of Spain, which has gone through a serious economic crisis, student access to educational resources has become a great expense for families and, in some cases, one that it has been difficult for them to bear, which reinforces the role that libraries play in students' academic performance. However, in this context of tight budget restrictions, there is also an increasing need for analyses that evaluate the return on the public

expenditure invested in libraries by public universities.

To achieve this objective, this paper is structured as follows. After this introduction, *Data and methodology* section presents the case that is the object of our study and the data and methodology used. This is followed by the results and their discussion in *Results and discussion* section. Finally, the main conclusions are set out.

## Data and methodology

Our study was conducted at the University of Seville's Faculty of Economics and Business Sciences. To put university education in Spain into context, it should be noted that it is structured into first (undergraduate) degrees (normally four years long), followed by a master's degree (normally 1 year) and lastly, a doctorate. The University of Seville is one of the 50 public universities in the Spanish university system, with 52,490 first degree students, of which 3874 are in the Faculty of Economics and Business Sciences. Three degree courses are taught at the faculty (Management, Economics, and Marketing) and two joint degree courses (Management & Law and Economics & Law). In terms of users, the Faculty of Economics and Business Sciences library is eighth on the list of 17 University of Seville libraries.

Our target population is students who are studying on degree courses at the University of Seville Faculty of Economics and Business Sciences or who have recently completed their degrees but still have open files, as they have not finished processing their academic qualifications. In this sense, one of this paper's main strengths is its broad database, which is larger than those used in similar studies such as Massengale, Piotrowski, and Savage (2016) and Stemmer and Mahan (2015). Specifically, the database contains references to 3670 enrolled students and 2874 library loan records. Students enrolled on more than one individual degree course are excluded. The two spreadsheets have been linked, giving a total of 2873 records. Of these, only 2533 contain all the data for the used set of both endogenous (5 different performance indicators are considered, see Table 2) and explanatory variables. The latter are used to estimate the net effects of the library on the endogenous variables.

In short, our model tries to explain how a wide set of explanatory variables (also called independent variables), some of which measure student library use, affect a set of five endogenous variables that measure student academic performance.

All the data were taken from statistical datasets collected from the library's management information systems in January 2019 (this method was used in other studies such as Massengale et al., 2016; Matthews, 2012; Soria et al., 2013; Thorpe, Lukes, Bever, & He, 2016), thanks to collaboration with the University of Seville's IT services and University library staff. Unlike other studies (Scoulas & De Groote, 2019; Stemmer & Mahan, 2015), no survey data were used to prevent any bias issues and any false answers being given by students, especially concerning questions on their performance, socio-economic situation, the real number of library loans taken out, and access marks, as they would be likely to affect the results of the model and distort the conclusions. In other respects, in line with Jantti and Cox (2013) and Krieb (2018), the data used do not allow the identification of individual students, so their privacy has not been compromised in this research.

Concerning the variables used in the model, three related to library use have been included. The first of these, *Library Loans*, is the most used variable in the academic literature (Emmons & Wilkinson, 2011; Teske, Cahoy, & DiCarlo, 2013; and Stemmer & Mahan, 2015, inter alia). However, another strength of this study is that two new variables have been included to better capture some specific particularities related to the library loan function. These are, specifically, the variable *Loans x Time*, which takes into account the time that students have been studying at the university, irrespective of the year that they are in. Although the academic literature has not included this variable previously, its inclusion is important in the case of Spanish public universities. Despite the age group of students being 18–21 years, the

average age is 24.4 years (SIU, 2018) and the average time taken to complete a 4-year degree course is 4.8 years (MCIU, 2019). Lastly, the variable *Renew Coef* is used to account for more intensive use of loans. The separate renewal of loans observed in previous studies (Haddow, 2013; Soria et al., 2013, 2014; Soria, Nackerud, & Peterson, 2015) is not considered.

We have included some control variables along with the explanatory variables that are our study object. The purpose of these other variables is to isolate the impact of library loans on student academic performance from multiple other factors and circumstances that might have an effect, as is stated in the academic literature.

First, variables linked to students' academic backgrounds are included, such as their university admission marks—*Admission mark*—(Soria et al., 2013, 2014; Soria et al., 2015; Soria, Fransen, & Nackerud, 2014; Stemmer & Mahan, 2015); age on university admission—*Admission age*—(this variable is included in slightly different forms in some other studies such as Alade, Iyoro, & Amusa, 2014; Haddow, 2013; Soria et al., 2015; Thorpe et al., 2016 and Whitmire, 2003); and the time that they have been studying at the university—*Time at University*—(although this variable has not been used in any of the previous academic literature, it will enable the link to the previous variable *Loans x Time*).

Second, some socio-demographic variables are considered such as *Gender* (Alade et al., 2014; Emmons & Wilkinson, 2011; Stemmer & Mahan, 2015; Thorpe et al., 2016; Whitmire, 2003); the location of the *Family Home* (Haddow, 2013; Haddow & Joseph, 2010); and *Nationality* (Haddow & Joseph, 2010; Soria et al., 2013, 2014; Soria et al., 2015). Economic variables include the award of a *Grant* since, to receive a grant, family income and assets cannot exceed a specific threshold (MEFP, 2019). This variable has also been used in some studies such as Soria et al. (2013, 2014), Soria et al. (2015) and Stemmer and Mahan (2015), who take the Pell grant recipient as an indicator.

Lastly, it is important to differentiate students by their college environmental variable, which can be summarized as the name of the degree course that they are on. This was also done in other studies such as Alade et al. (2014), Goodall and Pattern (2011), Soria et al. (2014), Thorpe et al. (2016) and Wong and Webb (2011), for example. One of the reasons for differentiating by degree course, apart from the differences in the subject matter taught, is the need to differentiate joint or dual degree courses from single degree courses, as the university admission mark required for the former is markedly higher than for the latter (see Table 1). Besides, they are 5 academic years in length compared to the 4 for all other first degree courses taught at the Faculty.

A further strength of this study over the prior literature is that five different indicators have been simultaneously used for academic performance (see Table 2, Endogenous variables section) to test the robustness of the results. Specifically, we have used the average grade on students' academic records; the percentage of subjects that they passed on the first sitting; the highest academic year in which they are enrolled compared to the time that they have been studying at the university (as a proxy of the speed with which they complete their university studies) and, finally, the total number of subjects that students have passed, both as an absolute value and according to the time that they have

spent at the university, i.e., passes in the shortest possible time.

The variables used in this analysis and their main descriptive statistics are given below in Table 2. The third column in Table 2, i.e., Number of Observations, tells us the number of observations in the category with a value of 1 for the dummy variables, which only take a value of 0 or 1. For example, for the variable Gender, 1425 of the 2873 students in the database are observed to be male, which means that 1448 are female. The mean, i.e., column 4, is the average value of each variable (also called the expected value). Finally, the standard deviation in the final column measures the amount of variability, or dispersion, for a subject set of data from the mean of the set. Low standard deviation indicates that the values tend to be close to the mean and vice versa.

## Results and discussion

Table 3 presents the results of the econometric model estimations. The models are differentiated by the endogenous and explanatory variables used. Variables are always chosen in such a way as to prevent any autocorrelation issues. The results are robust to heteroscedasticity, which increases the reliability of the estimated coefficients.

Both the Wald joint significance tests and the  $R^2$  confirm that the explanatory variables included in the models are useful for clearly and meaningfully explaining the 5 different student academic performance indicators used as endogenous variables. The higher the values that the Wald Tests and the  $R^2$  are, the greater the model's explanatory power. Some especially high  $R^2$ , above 0.5, should be highlighted, specifically in the last four models, despite the great difficulty a priori of trying to explain such a complex concept as students' academic performance over their entire time at university. Finally, the Variance Inflation Factor (VIF) values are very low, all below 2, i.e., well below the generally accepted threshold of 10 in econometrics. These VIFs indicate that there are no multicollinearity problems among the variables used. In general terms, any multicollinearity would make interpretation of the estimated coefficients difficult, as these can change erratically in response to small changes in the model or the data.

Given the large number of models estimated, to make it easier to interpret Table 3, the number of decimal digits has been limited to three and only results of coefficients significant at a minimum of 10% are given. In other words, when a cell is empty, this means that the explanatory variable indicated at the beginning of the cell's row has a statistically zero effect on the endogenous variable indicated at the top of the cell's column. However, the symbol “-” in a cell means that the explanatory variable indicated at the beginning of the row has not been taken into account when estimating the model of the endogenous variable indicated at the top of the cell's column.

The results are fairly robust whichever performance indicator is chosen. It can be concluded that there is a clear positive relationship between library services usage, measured by the number of loans requested by the student (variable *Library Loans*), and better student performance. This is in line with previous studies (Allison (2015), Massengale et al. (2016), Thorpe et al. (2016), and Wong and Webb (2011)). This continues to be the case irrespective of which of the five performance indicators are chosen. This positive relationship between library service usage and the academic performance indicators is always statistically significant at the highest standard, i.e., at 1%, except for the percentage of subjects that are passed on the first sitting, which is on the borderline between 1% and 5%.

However, the results offer many more details beyond the incontrovertible evidence that library loan service usage plays a relevant role for students who make use of the library at the Faculty of Economic and Business Sciences in Seville.

First, more intensive usage of library services over time (variable *Loans x Time*) usually offers better academic performance results (see the values of the respective coefficients) than total usage of these services (variable *Library Loans*), i.e., students that take out 10 resources

**Table 1**  
Admission marks required at the University of Seville (maximum 14 points).  
Source: Junta de Andalucía (2019a).

Management	6.620
Management & Law	9.350
Marketing	9.530
Economics	7.112
Economics & Law	11.657

Note: Admission marks required as of October 2019.

**Table 2**  
Variables and descriptive statistics.

Variable	Description	No. observations (only dummies = 1)	Mean	Std. dev.
<b>Endogenous variables</b>				
Grade	Average grade of student's academic record at the University	–	6.111	0.596
% Subjects (1st sitting)	Percentage of subjects passed on first sitting over total no. of subjects enrolled in at the University.	–	0.787	0.213
Year x Time	Highest academic year of the degree course in which students are enrolled divided by no. of days from the date that they were first enrolled at the University.	–	0.002	0.001
Subjects x Time	No. of subjects that students have passed divided by the no. of days from the date that they were first enrolled at the University.	–	0.012	0.007
Total no. subjects	Total no. of subjects that students have passed assuming that an annual subject equates to two four-monthly periods.	–	20.030	12.594
<b>Explanatory variables</b>				
<b>University library attributes</b>				
Library loans	Total no. of loans taken out by students measured in hundreds.	–	0.326	0.485
Loans x Time	Total no. of loans divided by the no. of days from the date that students were first enrolled at the University.	–	0.023	0.031
Renew coef	Percentage of loans renewed.	–	0.161	0.205
<b>Academic background</b>				
Admission mark	University admission mark. Weighted average of high school pass mark (60%) and university access exam mark (40%), maximum 10 points. A maximum of 4 points can be added to this for examinations specific to the degree course. (Junta de Andalucía, 2019b)	–	9.458	1.757
Admission age	Age of students on the date that they first enrolled, measured in hundreds of days.	–	70.057	10.346
Time at university	Time that students have been enrolled at the University, measured in hundreds of days.	–	13.712	7.864
<b>Socio-demographic and economic</b>				
Gender	1 if the student is male, 0 otherwise.	1425	0.496	0.500
Family home	Location of family home: 1 if in the same city as the Faculty; 2 if in the same province; 3 in the same region; 4 otherwise.	–	0.706	0.456
Nationality	1 if the student is not Spanish, 0 if the student is Spanish.	66	0.023	0.150
Grant	1 if the student has received a grant, 0 otherwise.	290	0.101	0.301
<b>Degree courses</b>				
Economics	1 if the student is on an Economics degree course, 0 otherwise.	541	0.188	0.391
Marketing	1 if the student is on a Marketing degree course, 0 otherwise.	435	0.151	0.359
Management & Law	1 if the student is on a joint degree course in Business Management & Administration and Law, 0 otherwise.	164	0.057	0.232
Economics & Law	1 if the student is on a joint degree course in Economics and Law, 0 otherwise.	50	0.017	0.131

on loan every 100 days on average over the entire period of their time at university will obtain noticeably better academic results than those who borrow only 10 resources over the entire period of their time at the faculty. This result implies that there is no apparent fall in performance over the time that a student uses the library resources, which indicates that an incentive exists for students to develop a stable and unwavering relationship with the library.

Second, students with more intensive usage of loans with renewals (variable *Renew Coef*) obtain better results both in the average overall mark and, to a less significant extent at only 10%, in the percentage of subjects that they pass on the first sitting.

Third, the remaining control variables offer a set of interesting conclusions as to the factors that shape a student's performance. First, the lack of significance of some socio-demographic variables such as nationality (unlike in other studies such as Bone & Reid, 2013 and Soria et al., 2013, 2014) and gender in the majority of the models, is striking. This latter result differs from the findings obtained in Kara, Bagheri, and Tolin (2009) and Soria et al. (2013, 2014), although the influence of gender on performance is a topic that is still under discussion, as can be seen in Arnold and Rowaan (2014) and the Johnson, Robson, and Taengnoi (2014) meta-analysis. Nevertheless, as was to be expected and as was found in some previous studies (Kara et al., 2009; Mallik & Lodewijks, 2010; Soria et al., 2014), the variable that best defines student performance, however it is measured, is the synthetic mark with which the student was admitted to the faculty (variable *Admission mark*). Being the beneficiary of a grant (variable *Grant*) is also always very significant, although the impact of financial aid on student performance is far from well established in the prior literature (see Arendt, 2013), and in some cases such as Soria et al. (2013, 2014), the effect is negative. In our case, and even though this variable has been used as a

proxy of the student's socioeconomic level (as previously commented, socioeconomic factors tend to be the primary conditions for grants to be awarded), student performance can also be linked to this as, for a grant to be renewed, students are required to have passed 100% of the credits in which they were enrolled in the previous academic year, or 90% with a mark of 6½ points out of 10. There seems to be no doubt that these requirements, which are necessary for the grant to be renewed, are a definite economic incentive that compensates for however disadvantaged that a student with a grant is by coming from a family environment with fewer economic resources.

Finally, the dummy variables that are included to represent the differences in difficulty that exist between the different degree courses taught at the Faculty of Economic and Business Sciences work very well. In this context, it is worth mentioning the case of the joint degrees, measured by the variables *Economics & Law* and *Management & Law*, due to the indirect educational implications that it might have. The coefficients of the two dummies that represent the two joint degrees offer significantly higher values in all the student academic performance variables on average, even though the students on these courses have to contend with a higher number of subjects (approx. 14 four-month subjects in joint degrees compared to 10 in single degrees). A priori, this can be attributed to students on joint degrees possessing greater ability, on average, as the mark required to be admitted to joint degree courses is noticeably higher than for single degrees (see Table 1). However, as this effect, if it exists, would be captured by the variable *Admissions mark*, what is being captured here might be the fact that this is an academic environment composed of excellent students who generate agglomeration economies that force up the average academic performance of all those involved. These agglomeration economies could in part be the result of a more competitive student environment that

**Table 3**  
Estimates of the endogenous variables.

	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII	Model IX	Model X	
Endogenous variable											
	Grade	Grade	% Subj. (1st)	% Subj. (1st)	Year x Time	Year x Time	Subj. x Time	Subj. x Time	Total subj.	Total subj.	
<b>University library attributes</b>											
Library loans	0.176 (0.030)***	–	0.020 (0.008)**	–	0.0002 (0.000)***	–	0.001 (0.000)***	–	2.699 (0.624)***	–	
Loans x Time	–	2.779 (0.513)***	–	0.277 (0.107)***	–	0.004 (0.001)***	–	0.0218 (0.0038)***	–	37.296 (6.083)***	
Renew coef	0.118 (0.051)**	0.108 (0.050)**	0.027 (0.015)*	0.026 (0.015)*							
<b>Academic background</b>											
Admission mark	0.148 (0.013)***	0.148 (0.013)***	0.030 (0.003)***	0.030 (0.003)***	0.0002 (0.000)***	0.0002 (0.000)***	0.002 (0.000)***	0.002 (0.000)***	1.977 (0.127)***	1.973 (0.127)***	
Admission age	0.008 (0.002)***	0.008 (0.002)***			0.000 (0.000)***	0.000 (0.000)**	0.000 (0.000)**	0.000 (0.000)**	–0.102 (0.024)***	–0.101 (0.024)***	
Time at university	0.009 (0.002)***	0.013 (0.002)***	–0.013 (0.001)***	–0.012 (0.000)***	0.000 (0.000)***	0.0000 (0.000)***	–0.0001 (0.000)***	–0.0001 (0.000)***	1.310 (0.027)***	1.370 (0.024)***	
<b>Socio-demographic and economic</b>											
Gender									0.8218 (0.3081)***	0.805 (0.307)***	
Family home	0.046 (0.023)**	0.041 (0.023)*									
Nationality											
Grant	0.456 (0.040)***	0.451 (0.040)***	0.070 (0.007)***	0.070 (0.007)***	0.001 (0.000)***	0.001 (0.000)***	0.006 (0.000)***	0.006 (0.000)***	3.568 (0.449)***	3.512 (0.452)***	
<b>Degree courses</b>											
Economics							–0.0001 (0.000)*	–0.001 (0.000)*	–0.001 (0.000)*	–1.572 (0.392)***	–1.532 (0.391)***
Marketing	0.131 (0.031)***	0.130 (0.031)***	0.057 (0.008)***	0.058 (0.008)***	–0.0001 (0.000)***	–0.0001 (0.000)***	0.002 (0.000)***	0.002 (0.000)***	1.304 (0.412)***	1.313 (0.412)***	
Management & Law	0.161 (0.062)***	0.167 (0.061)***	0.050 (0.009)***	0.050 (0.009)***	–0.001 (0.000)***	–0.001 (0.000)***	0.011 (0.001)***	0.011 (0.001)***	7.888 (1.142)***	8.011 (1.141)***	
Economics & Law	0.171 (0.099)*	0.173 (0.098)*	0.030 (0.013)**	0.030 (0.013)**	–0.001 (0.000)***	–0.001 (0.000)***	0.010 (0.001)***	0.010 (0.001)***	8.292 (2.043)***	8.372 (2.056)***	
Intercept	3.846 (0.228)***	3.8037 (0.2254)***	0.6629 (0.0527)***	0.6566 (0.0524)***					–11.1551 (2.4997)***	–11.9697 (2.4652)***	
R <sup>2</sup>	0.298	0.301	0.465	0.464	0.430	0.437	0.574	0.574	0.641	0.640	
Wald joint significance test	53.38***	53.18***	281.59***	282.04***	187.21***	185.73***	339.31***	335.53***	284.23***	283.98***	
Max VIFs (mean VIFs)	1.86 (1.21)	1.86 (1.19)	1.86 (1.21)	1.86 (1.19)	1.86 (1.21)	1.86 (1.19)	1.86 (1.21)	1.86 (1.19)	1.86 (1.19)	1.86 (1.19)	
Number of observations	2533	2533	2533	2533	2533	2533	2533	2533	2533	2533	

Note 1: Standard errors robust to heteroscedasticity in brackets. Statistical significance at 1%(\*\*\*) , 5%(\*\*) , 10%(\*), i.e., the null hypothesis is rejected at 99%, 95%, and 90% respectively (when the value of the estimated coefficient is 0).

makes them give of their best. When the also positive (and significant) result of the variable *Grant* is added to this, the two together justify the hypothesis that the university system access policy should consider both overcoming economic barriers and students' academic commitment, as measured by their grades.

**Conclusions**

At a time like the present, when budget restrictions on universities are tight, the role of all the agents that comprise the university community should be evaluated to corroborate whether they meet the objectives that they pursue and contribute to academic excellence. In the same way that procedures exist to certify teaching staff, libraries should also undergo an evaluation of the work that they do that enables resources to be directed toward the tasks that best benefit student training and performance. The presence of libraries on university campuses is a given, but it is right and proper to rigorously quantify whether the resources and services offered to students have a significant impact on their university outcome. That is why this paper presents ten robust econometric models that link students' performance, measured with five different performance indicators, with the material resources offered by the library at the faculty in which the students are studying. To

isolate this effect from other socio-economic, academic, and environmental factors that might influence a student's mark, a range of control variables have been included that have previously been used in the academic literature.

All the results of the models show that the library's role as a lender of materials has a clear and significant positive effect on student learning and success. And, what is more, it is not only access to the library that contributes to this result, but the continuity of usage of these resources, which enables better performance indicators to be achieved. For this reason, and given the fact that this benefit, measured as better grades, not only affects students but the university community in its entirety, universities need to make the best use of their libraries, publicize their wide range of functions and eliminate the barriers to entry that might deter students from accessing library resources. In this sense, at the Faculty of Economics and Business Sciences at the University of Seville, where the study has been done, all first-year students attend sessions with library staff who inform them about the work that they do and instruct them in the use of library bibliographic resources and digital competencies. This strategy of promotion and visualization could be broadened to include other student-targets, such as students who, according to university records, do not make use of library resources or only do so sporadically.

Other results in this study demonstrate that a student's prior learning and ability, as measured by their university admission marks, are factors that have the greatest bearing on their success at university. Also, if they receive grants whose renewal depends on academic performance, this is another factor that benefits the student's academic achievements. It can be concluded from both these effects that there is a need for aid programs to have twin objectives and to consider not only recipients' economic circumstances but also their academic records to guarantee that the best possible use is made of grants.

Finally, there are some limitations to the research that should be mentioned. The obtained results should, therefore, be interpreted with due caution. First, as the control variables in the analysis have been obtained from the library's information management systems and not from student surveys, some other variables that might influence the results have been excluded, such as family income, the parents' level of education and the type of pre-university studies (Arts, Sciences, Humanities, Social Sciences). Notwithstanding, some of these have been replaced by proxies such as "receiving grants" and "family home". Second, our results are obtained with a sample of students studying at a Faculty where degree courses in the Social Sciences are taught, so it would be appropriate to replicate the study at other libraries catering to other disciplines for the results to be compared, as pedagogic reasons may exist that explain the greater or lesser use of the resources held at libraries (Goodall & Pattern, 2011). Also, it has to be borne in mind that there is restricted access to half the book collection at the University of Seville Faculty of Business Sciences library (a request has to be made to the librarians for access to these books). There is also no automatic self-service machine at the library, which might also impact the number of loans taken out. Third, we are well aware that, on its own, the library resource loan function cannot present a full picture of either the usage and consultation of resources by students or the library's multipurpose mission in the current university model. Lastly, it should be noted that there are no mentorship programs at the University of Seville to guide students toward textbooks or other resources required for their training. The library is, therefore, the main place for students to obtain advice on such matters.

#### CRedit author statement

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