A web-based application tool for university career choosing factors analysis

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Keywords

Analytic analysis; Higher education management; University career choosing;

Abstract

The first results of a structural mathematical model that analyses the access to the Spanish Public Universities System (SUPE) were presented at congress "Mathematical modelling in engineering 2013 and 2014". A combination of associations between supply and demand with the admittance procedure and student decision making were set. This group identifies the factors that can influence in the decision making and thus, allows isolating the variables of the mathematical model.

Subsequently a multivariable and partial model was obtained that can assess the weight of the different variables and identified factors related with career and university decision making made by the students or by their family environment.

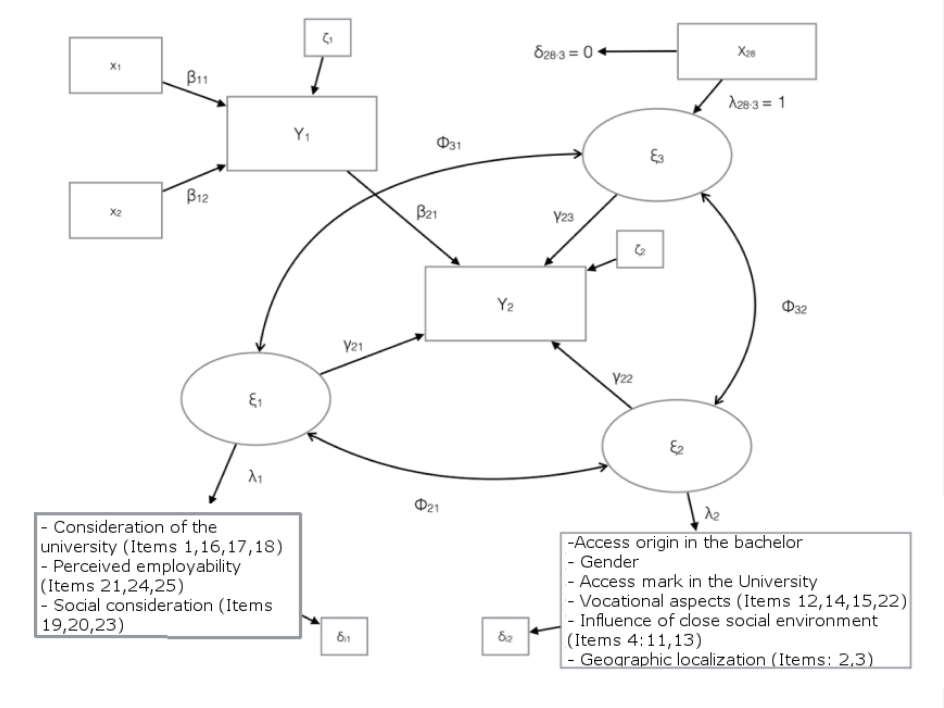


Figure 1 model schematic

As can be observed in the Fig.1, a schematic of the mathematical model is depicted. The following structural equations can be extracted from the previous figure:

$$Y_1 = \beta_{11}X_1 + \beta_{12}X_2 + \zeta_1 \quad (1)$$
$$Y_2 = \beta_{21}Y_1 + \gamma_{21}\xi_1 + \gamma_{22}\xi_2 + \gamma_{23}\xi_3 + \zeta_2.$$

With the following constraints:

$$E(X_i) = E(Y_i) = E(\xi_i) = 0 \quad (2)$$
$$Var(X_i) = Var(Y_i) = Var(\xi_i) = 1$$

Quantitative variables were transformed by reduction and normalizations obtaining:

$$E(\varepsilon_i\varepsilon_j) = E(\delta_i\delta_j) = E(\xi\delta) = E(\eta\varepsilon) = E(\zeta_i\zeta_j) = 0 \quad (3)$$

This model has been validated with a questionnaire of more than 5800 participants of the university system. The questionnaire results assurances a correlation between the model and the data at acceptable minimum for all the fields of study and, moreover, this correlation is excellent in global level [1], [2].

Based on the developed general model and the available data, more specific models have been developed for universities and fields of study. These models allow discriminating student performance between universities and fields of study.

Researching more deeply, it has been found that some factors give similar results for the same degrees in different universities of a specific field of study. However, there are also significant differences among other factors.

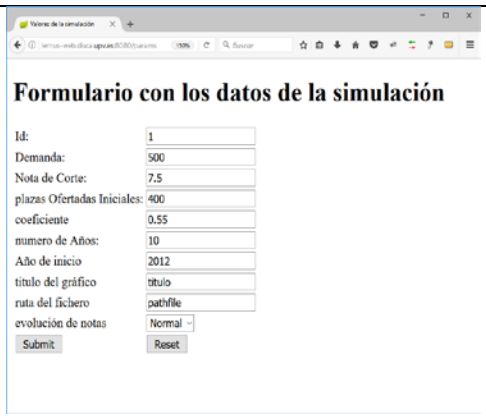
Taking into account the obtained results, a proposed objective is exploring the possibility to use these models to analyse how a degree demand fluctuate in function of perturbations in the parameters. In other words, how external causes can directly affect degrees. And furthermore, explore if these models could explain crisis such as the bursting of the technological bubble with technical degrees, or the bursting of the housing market bubble with construction degrees.

In this work, a simulator has been developed that can configure the model data and predict the demand variations in followings years. This simulator is a web-based application currently hosted in a server in the university “Universitat Politècnica de València” (UPV) in Spain.

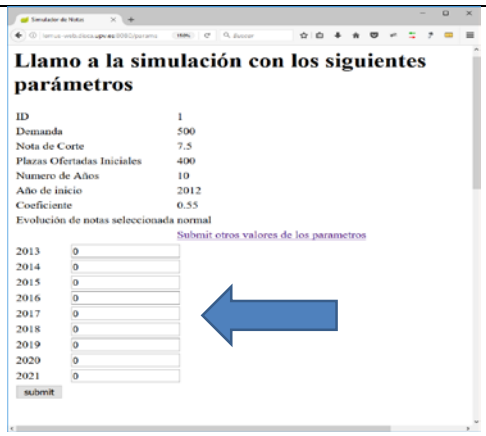
The application has been developed using the software architectural pattern “Model View Controller” (MVC). The software technology used for having a stand-alone application with an easy deployment is spring-boot.

Two simulations have been done for the same degree in the same context situations but changing the number of offered places. These simulations allowed studying the impact of changing different parameters and variables in the model.

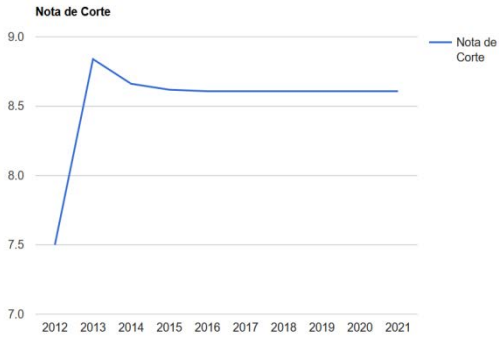
In the first case (figure 2), it is desired to know the evolution of the cut-off grade and the demand of places for the department of engines. In this case the number of offered places is maintained fixed to 400.



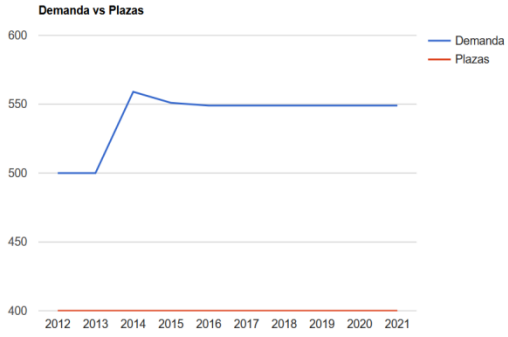
2.1 Parameters of the simulation



2.2 The number of places offered do not change



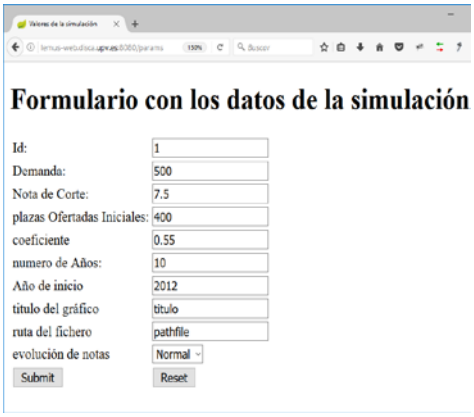
2.3 Evolution of the cutoff grade



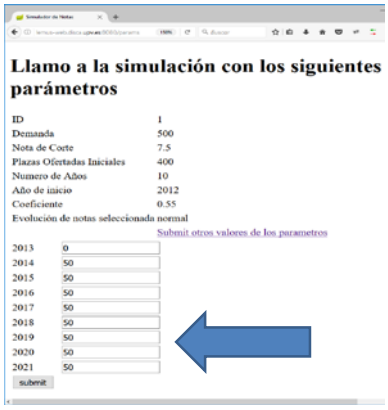
2.4 Evolution of offered places and the demand

Figure 2 First study case using the developed app

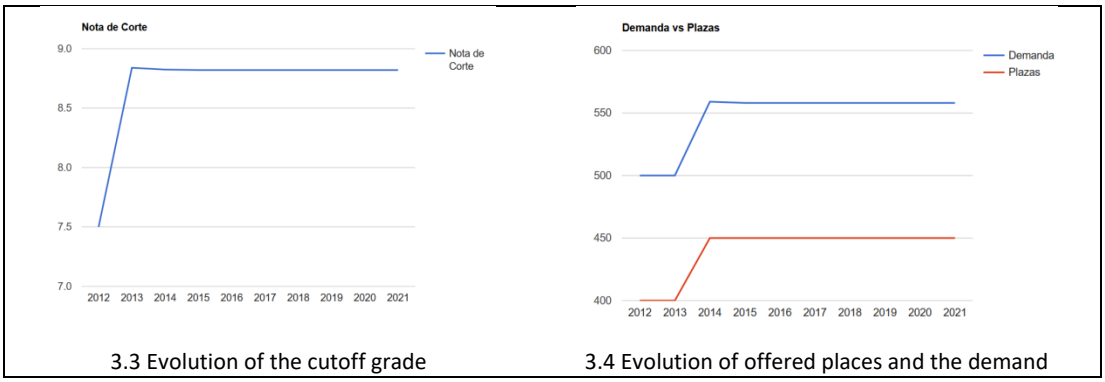
It can be seen from figure 2.2 and 2.3 that maintaining the number of places to 400 the cut-off grade and the demand increases the first year. However, the second year these index decreases remaining stable in posterior years. In the second case it is also studied the department of engines in the same context situations. Though, in this simulation the number of places offered is increased from the second year to the last in 50 places.



3.1 Parameters of the simulation



3.2 The number of places offered do not change



3.3 Evolution of the cutoff grade

3.4 Evolution of offered places and the demand

Figure 3: Second study case using the developed app

It can be seen that the cut-off grade and the demand increases the first year, being both stables in the following years. Comparing with the first case, it is remarkable how increase the number of offered places in the right time can lead to not only to a stable situation but even a better context with higher demand and cut-off grade.

Conclusions:

The developed web-based simulator can be used to effortlessly study the evolution of the cut-off grade and the demand of a degree based on a structural mathematical model. This study can be smartly employed for planning the university strategy and to validate the model with real data.

References

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