

Article

Efficiency Analysis of Graduate Alumni Insertion into the Labor Market as a Sustainable Development Goal

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Abstract: The assumption that greater education levels of a given population leads to better employability levels thanks to higher education institutions (HEI) is widely known. However, most of the research related to HEI is focused on the determination of efficiency levels from an eminently academic perspective. The objective of this research is to carry out a comparative analysis of the efficiency degree of Latin American universities in terms of labor insertion for their graduate alumni, in order to evaluate the Sustainable Development Goal 8 related to decent work and economic growth. The data enveloping analysis (DEA) methodology was implemented. Main results showed different levels of labor efficiency among the studied institutions that were classified into eight groups of universities. Likewise, it was noted that Latin American university students showed employment levels above those of workers with lower levels of education and training.

Keywords: human resources development; social inequality; labor market; graduate alumni; employment



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1. Introduction

According to data from the annual report of the International Labour Organization (ILO), in 2019 the total unemployment rate reached 8.1% in Latin America and the Caribbean. According to their forecasts, during 2020, this result may increase as a consequence of the economic and health crises derived from the COVID-19 pandemic, reaching 8.4% of the active population. This means that more than 25 million people are willing to work but cannot find a job. By sex, 7.3% corresponded to men and 10.2% to women, showing the unbalance in the job market and a greater loss for women [1].

If these unemployment data are analyzed according to educational levels (Figure 1), it is noticed that, since 2006, the unemployment rates of those with basic or intermediate educational levels has been practically double of those who have obtained higher education. Although from 2012 to 2014 these differences decreased, as of 2017 they have increased, highlighting the discriminatory effect of unemployment in relation to the level of training achieved.

The relation between the employability degree of people and their educational levels has been abundantly addressed by researchers, both from an eminently theoretical perspective [2–8] and as a practice approach [9–11]. In these latest investigations, the relation between the development of current economies and the degree of educational level attained by their population has been revealed.

This relation of economic development/educational levels is one of the causes of the increasing economic effort made by the countries of Latin America and the Caribbean aimed at improving the training of their working population. Thus, if in 2007 the percentage of the gross domestic product (GDP) devoted to total education was 3.7, a decade later that percentage had increased by 30% to stand at 5.32 (Figure 2).

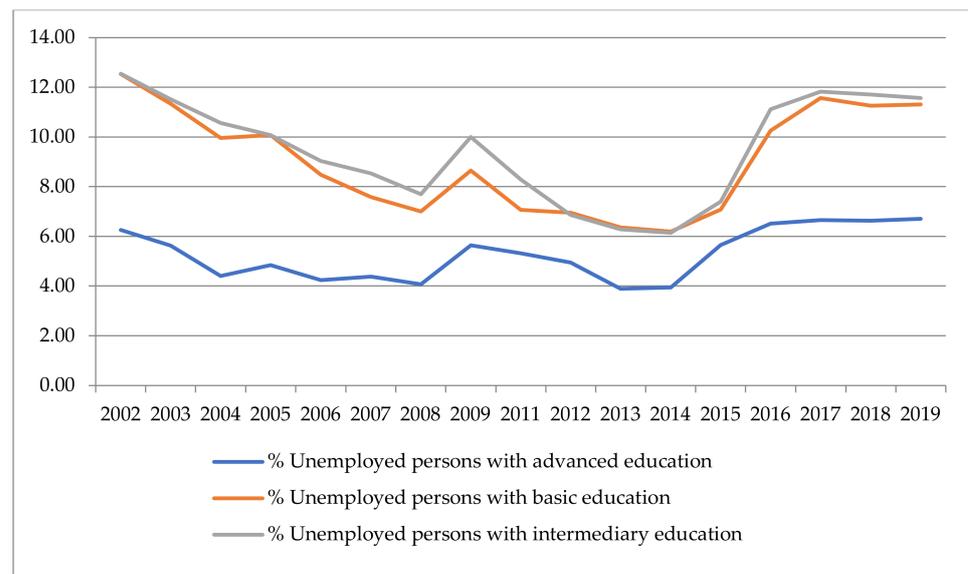


Figure 1. Percentage of unemployment out of the total according to educational levels in Latin America and the Caribbean. Source: Own elaboration based on World Bank data.

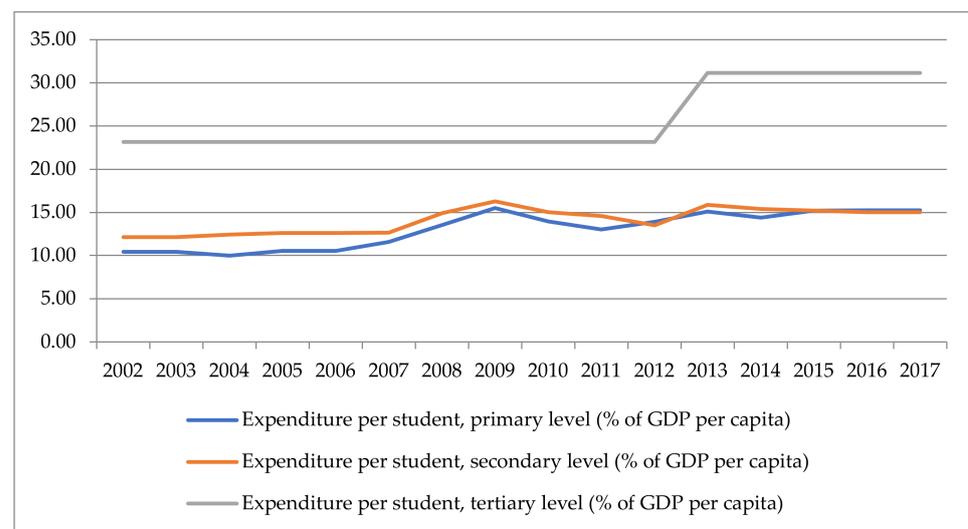


Figure 2. Public spending on education by educational level. Latin America and Caribbean. Source: Own elaboration based on World Bank data.

Figure 2 shows the breakdown of public spending on education by educational level in Latin America and Caribbean. It shows how the different regional governments dedicated almost 10% more to their investments per student at the tertiary level than those corresponding to the primary and secondary levels. However, the percentage of GDP dedicated to training has remained constant from 2013 up to 2017, the last year in which official data is available.

Despite the important relation that exists between educational levels and employment, and which is reflected in Figures 1 and 2, most of the existing research carried out in the field of higher education is focusing on the university research facet, leaving secondary the relevant role that these organizations have in improving the employability of their alumni. Frequently, series of international rankings are published. These rankings show the relative position that each institution occupies, and it is determined based on the results obtained through the use of different methodologies. Thus, the definition of a global indicator is considered by weighting, constructed from a series of variables fundamentally related to research activity.

At the international level, several rankings are available. Among them, there are the Academic Ranking of World Universities (Shanghai Ranking Consultancy), the World University Rankings (Times Higher Education, Performance Ranking of Scientific Papers for World Universities, Higher Education Evaluation and Accreditation Council of Taiwan), Ranking Web of World Universities (Cybermetrics Lab (CCHS), a unit of the Spanish National Research Council (CSIC)), UTD Top 100 Business School Research Rankings (The UT Dallas' School of Management), and QS World University Rankings (Quacquarelli Symonds).

At the national level, there are rankings such as those prepared by the National Council for Evaluation and Accreditation of the Universities of Argentina; the ENADE, annual standardized examination ranking university programs on a five-grade scale from 1 to 5 (Anísio Teixeira National Institute for Educational Studies and Research) of Brazil; and the publications of the National Accreditation Council of Chile.

Of all of them, the QS World University Rankings (Quacquarelli Symonds) is the only indicator that includes an analysis of the degree of employability of university graduates—the QS Graduate Employability Rankings. This ranking is constructed from the following variables: reputation of the employer, results of the students, relations between universities and companies, relations between students and employers, and the employment rate of alumni.

From the analysis of the existing literature, it is not observed that this topic has been sufficiently covered by researchers. Despite that authors have studied the relation between education levels and employment, the strong correlation is observed between training and employment. Additionally, based on the prominent role that universities play in the productive development of the countries, as well as in the improvement of the employability degree of alumni, this article has as a goal to study the efficiency degree of Latin American universities in order to insert their alumni into the labor market. In most of the analyzed literature, when the authors incorporated the concept of efficiency to the university world, they have done so to analyze the purely academic aspect. For this reason, it is quite usual to find published research where the human and material resources available to universities are related to the publications made by them. Therefore, the main novelty of this research is to analyze the university efficiency from a perspective eminently related to the labor market and the level of insertion of university graduates.

The following steps have been followed for accomplishing this research. First, an exhaustive search of the literature related to efficiency analysis and research was conducted. The determination of a methodology widely accepted in the field was chosen to perform comparative analysis of efficiencies between various organizational units. Third, the data were retrieved and analyzed by application of the model and the results were analyzed. This research is related to the Sustainable Development Goals number 8 “Decent work and economic growth”, and more specifically aligned with the goal target “By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization”. There are little studies about employment as a Sustainable Development Goal [12–14], so our aim is to contribute to this gap in the literature.

The contributions of this research are numerous. Firstly, the results obtained can be used to identify those universities that present a higher level of work efficiency than their graduates. Secondly, this analysis could be expanded by focusing the research on determining the actions carried out by educational centers in terms of job placement for their students and creating a public base of good practices that could be developed in other centers. For this, it has become necessary to define a methodology that is usually used by researchers in efficiency analyzes. Thirdly, this research used a nonparametric methodology called data envelopment analysis (DEA), proposed by Charnes, Cooper, and Rhodes [15]. Although at the beginning these efficiency analyses were mainly focused on the business environment, in the past several decades, this methodology has become

frequently used by authors in their studies both in the private sphere and in efficiency analyses in the management of public policies [16].

The structure of this manuscript is as follows. After this introduction, a literature review is proposed that includes the main contributions made in the evaluation of Latin American universities and determination of the efficiency degree applied to the higher education sector. Next, the proposed methodology is presented. In the third section, this methodology is applied and, based on the results obtained, the conclusions and discussion proposals are presented.

2. Materials and Methods

2.1. University Efficiency Analysis

The analysis of university efficiency is a topic frequently addressed by researchers [17–19]. The concept generally used in efficiency research is the one that relates a set of output and input variables [20–23].

Regarding the efficiency models used, there are basically two types: parametric and nonparametric. From the analysis of the bibliography carried out, it is observed that, in most of the investigations, the authors adopted the nonparametric models. Particularly, the so-called DEA is extensively used [24–27]. This type of methodology was already applied in certain geographical areas, such as Portugal [28], Romania [29], and Austria [30].

In the geographical area of Latin America and the Caribbean, relevant investigations have been found related to Chile [31], Argentina [32], Colombia [33], and Latin America as a whole [34,35].

King-Domínguez [31] measured the efficiency of the 16 Chilean State universities, using a nonparametric model of DEA, using data from the Ministry of Education for the period 2015–2016. The results indicated that the average efficiency in the country is 81.71% in students' retention and graduation, where universities in the northern region are the most efficient, followed by those in the southern region. Meanwhile, those from the center region presented greater variability and inefficiency with respect to the national average.

The study of Quiroga et al. [32] analyzed the efficiency of the Argentinian public universities and their determinants over a 10-year period (2004–2013), using a nonparametric DEA and parametric models. The results revealed the existence of a positive and significant effect on the efficiency levels of those variables related to highly ranked professors and full-time positions, while those variables associated with the budget allocation do not significantly affect efficiency.

Visbal-Cadavid [33] studied the efficiency of Colombian public universities in 2012, using the DEA methodology and the CCR, BCC, and SBM models under results orientation. The main objective was to determine the technical scale and mixing efficiencies using data acquired from the Ministry of National Education. Universities were also classified using a Pareto efficient cross-efficiency model and the author focused the changes on general productivity between 2011 and 2012. The results showed that Tolima, Caldas, and UNAD were the universities with the best performances, with the Universidad del Pacific showing the worse efficiency. The Malmquist index was applied to analyze the change in productivity from 2011 to 2012.

Torres-Samuel et al. [34] analyzed the factors that contribute to the technical efficiency of universities' visibility included in the Top 100 of the Web Ranking of Latin American Universities—published by the Webometrics in January 2017. The DEA was used to calculate the contributions of input variables to efficiency. As data sources for the inputs, the study considers the academic data published on the website of each university, the contents and profiles shown in Google Scholar (GS), the data by university published in the scientific network Research Gate, and the data of social networks, such as Twitter and Facebook accounts.

Another study available is of Torres-Samuel et al. [35]. The authors analyzed fifteen Latin American countries considering six factors that reflect their advances in research and development (R&D), science and technology, education, and innovation. These factors

were studied as inputs and outputs in a technical efficiency analysis of Latin American economies using DEA methodology. As inputs, the percentage of GDP contributed to education and R&D expenditures, in addition to the number of universities in each country, while the results are information and communication technology (ICT) services and high-tech exportations, as well as the Global Innovation Index. The data were collected from the World Bank, the Economic Commission for Latin America and the Caribbean (ECLAC), the World Intellectual Property Organization (WIPO), and the Webometrics Ranking of Universities. The results demonstrated that Latin American countries present different performances considering the contribution of GDP to R&D expenses—considered main input that contributes to high technology exportations in the studied Latin American countries.

These aforementioned investigations were not focusing on the efficiency analysis in labor matters. Despite the importance of these institutions as an engine for the economic development of the territories, these studies have focused on the functions of knowledge generation and dissemination. Thus, there is a lack in the literature body concerning the efficiency analyses from a labor perspective, even though the few studies published do not sufficiently cover these topics [20–23].

According to Gette et al. [20], monitoring the graduate alumni should be considered a strategic action when defining educational policies of a university. Ibañez et al. [21] evaluated the efficiency in higher education institutions (HEI) using the stochastic borders methodology and data from the National University of the South (Argentina). Among the findings, the authors identified that efficiency of the production units (university careers) was strongly determined by the profile of the students these HEI serve.

Barquero et al. [22] identified the main factors that determine the success of university students in Spain regarding their labor insertion. Through the Graduate Labor Insertion Survey University (EILU), data from graduate alumni was selected for the period of 2009–2010. Their results showed that success in job placement is positively related to (a) working full time in parallel to the study period, (b) with the persistence of gender differences, and (c) with the absence of incidence of mobility programs carried out by students.

López and Bastidas [23] proposed some instruments to analyze the circumstances that affect labor insertion of alumni. The authors addressed these instruments as a priority proposal in the generation of strategies and policies for the actors involved in this issue: the productive sector, HEI, and the State. Among the main findings are that the university system must consider the diversified variables and factors that affect the issues associated with the labor insertion of early alumni, and that HEI need to establish strategic alliances with the productive sector supported by public policies and government initiatives.

2.2. Methodology

The main goal of this research is to analyze the level of labor efficiency achieved by Ibero-American universities from a perspective of improving the degree of labor insertion of their university graduates. For this reason, it has firstly become necessary to specify the concept of efficiency. The efficiency is a concept that relates outputs and inputs at the business or organizational level. Three types of decisions must be taken correctly for efficiency assessment [36]:

- Scale efficiency: the choice of the output that maximizes profit at all possible levels of production.
- Allocative efficiency: the choice of an optimal combination of inputs that minimizes production costs.
- Technical efficiency: the production of a certain level of output in which the minimum number of inputs is used.

To determine the efficiency degree, it is necessary to define a production, benefit, or cost function for each of the organizations under study. This determination can be taken by using parametric or nonparametric techniques. Likewise, a production frontier is defined representing the maximum product that can be achieved from a certain combination of inputs. The results obtained would indicate the relative position that each organization

occupies in relation to the optimal value defined by the production frontier [37]. In this way, the real situation that an organization occupies with respect to the optimal level, that has been defined, can be determined. If its position is below the defined production function, then the organization is inefficient.

In this research, the efficiency frontier has been determined using a nonparametric methodology. The use of this model allows the determination of the relative efficiency of an organization regarding to others by considering a representative and homogeneous group [38].

The nonparametric methodology adopted in this research is the so-called DEA proposed by Charnes, Cooper, and Rhodes [15]. Since then, DEA has become a tool frequently used by researchers in the development of their scientific activity [16].

In this research, the research model is composed of the efficiency of the decision unit (DMU), obtained as:

$$Ef = \frac{Y}{X} = \frac{\text{OUTPUT}}{\text{INPUT}}$$

When more inputs are used, the equation would be presented as follows:

$$Ef = \frac{a_i Y_i}{b_i X_i}$$

The applied model aims to achieve the maximum amount of output given a certain level of inputs, under a restriction of ignorance of the technological level assumed by each DMU. For this reason, the variable returns to scale model (VRS) proposed by Banker, Charles, and Cooper [39] is used, oriented towards the output (BBC-output model). Thus, the problem to solve would be the maximization of the following expression:

$$\text{Max } y_j + \varepsilon \left(\sum_{k=1}^s h_k^+ + \sum_{i=1}^m h_i^- \right)$$

Subject to:

$$\begin{aligned} \sum_{j=1}^n \lambda_j * x_{ij} &= x_{ij} - h_i^-, \quad i = 1, \dots, m \\ \sum_{j=1}^n \lambda_j * y_{kj} &= y_{kj} * \gamma_j + h_k^+, \quad k = 1, \dots, m \\ \sum_{j=1}^n \lambda_j &= 1 \quad \lambda_j, h_i^-, h_k^+ \geq 0, \quad \forall i, j, k \quad \gamma_j \text{ free} \end{aligned}$$

where γ_j is the radial enlargement that occurs in all its outputs. It can be identified with the efficiency of j if j is compared with a point belonging to the efficient frontier. h_i^- is the rectangular reduction of input i . h_k^+ is the rectangular magnification of the output k . λ_j represents the coefficients of the linear combination of inputs and outputs to which the DMU projection point is referring, on the efficient frontier. It can be interpreted as the proximity of the DMU projection point, with respect to the efficient frontier.

In this way, the efficiency frontier would be made up of all those efficient decision units. Once the border has been determined by these entities, it compares each of the entities under study with the border, under the assumption that the detected deviations indicate inefficient behavior. In this way, the relative efficiency of a set of DMUs that produce a type of output from a common set of inputs can be measured.

In this research, the analysis of university labor efficiency is developed through a production function where the inputs would be made up of the number of students and professors and the output is made up of an indicator of the job placement of graduate alumni.

A DEA has been applied to this function, in which the DMUs are each of the analyzed Latin American universities. Given that the objective of this function is to achieve the greatest increase in the labor insertion indicator, an orientation towards output is assumed. For its part and because there is no certainty about the type of return exhibited by the production function, a model of VRS, also known as BCC-output, is proposed [39]. The VRS yields a measure of pure technical efficiency that ignores the impact of scale size comparing only one DMU to a similar scale unit.

The choice of inputs is supported by numerous studies that have applied the DEA methodology to studying the university environment. Table 1 shows some of the main contributions and the variables used in previous studies.

Table 1. Studies that applied the DEA methodology in the university environment. Source: Own elaboration.

Authors	Inputs	Outputs
Kuah and Wong [26]	Number of staff Number of taught course students Average students' qualifications University expenditures (USD million)	Number of graduates from taught courses Average graduates' results Graduation rate Graduates' employment rate
Li [40]	Floor area Library collection size full-time teachers scientific research expenditure discipline level	Students' scale six months after students graduate, the average monthly income students from when the school acquired the ability to work
Blanco, Bares and Hrynevich [41]	Number of national and international students enrolled in bachelor studies Number of national and international students enrolled in graduate studies National and international teaching staff related to bachelor and graduate studies Participants in employment programs	Overall score calculated for the indicator QS Graduate Employability
Jeong and Lee [42]	A language teacher Family economic volunteer Job target	Worker
Zhang and Kim [43]	Number of professors Number of students University student-professor ratio Campus scale Library area per student Annual science and technology funding	Employment rate Graduate employment competitiveness index Local advanced study rate Overseas advanced study rate

The output used is the overall score calculated for the QS Graduate Employability indicator, for which the results are of the weighting of the following variables: reputation of the employer, students' results, employer partnerships by college, employer/student connections, and graduate employment rate. Table 2 lists the weights applied to each of the variables and their definition.

The choice of output has conditioned the number of universities used in the study, as there is no calculation for all Latin American universities. Table 3 lists the selected universities and their country of origin.

As a summary, Table 4 shows the production function in the degree of university labor efficiency on which the DEA has been applied.

The reliability degree of the built model depends on the relations that exist between the number of input and output variables, which is defined in the production function and the considered DMUs. If there was not an adequate relation between them, results could show that all the DMUs were efficient. This would distort the results, and decisions taken would be biased by an unrealistic maximum efficiency scenario. To avoid this situation, the Cooper's Rule [44] will be followed in this research, which establishes the relation between DMUs and input and output variables. In particular, the rule indicates that:

$$DMUs \geq \alpha (\text{input} + \text{outputs})$$

This means that the number of DMUs to be considered in the model must be greater than, or at least equal to, α times the sum of the inputs and outputs. The rule states that the minimum value to be assumed is $\alpha = 1.5$, although many authors, in order to guarantee the

most robust results, usually assume values of 2 or 3 [45,46]. For the analysis developed in this research, it is considered that $\alpha > 3$, above the minimum indicated in the Cooper's Rule.

Table 2. Methodology for calculating the QS indicator Graduate Employability. Source: QS Graduate Employability.

Variable	Weighting Factor (%)	Definition
University reputation in labor matters	30%	Value that employers assign to the universities that offer the most competent, innovative and effective graduates.
Graduate students	25%	Number of students who have obtained the consideration of innovative, creative, wealthy, entrepreneurial, and/or philanthropic persons in the world.
Relations between universities and companies	25%	This indicator has two parts. First, using Elsevier's Scopus database to establish which universities are successfully collaborating with international companies. Second, it considers associations related to job placement that are reported by institutions and validated by the QS research team.
Participation of employers in university activities for employment	10%	This indicator involves adding the number of entrepreneurs who have actively participated in a university campus in the last twelve months, allowing students the opportunity to network and obtain information on how to work in their companies. This "active presence" can take the form of participating in career fairs, organizing company presentations, or any other self-promotional activity.
University employment rate	10%	Measures the proportion of graduates (excluding those who choose to continue studying or are not available for work) in full or part-time employment within 12 months of graduation.

Table 3. Selected universities analyzed by this research. Source: Own elaboration based on the information QS Graduate Employability.

Number	University	Country of Origin	Foundation Year
1	Pontifical Catholic University of Chile	Chile	1888
2	University of Sao Paulo	Brazil	1934
3	Monterrey Institute of Technology and Higher Studies	Mexico	1943
4	National Autonomous University of Mexico	Mexico	1910
5	University of the Andes	Colombia	1948
6	National University of Colombia	Colombia	1867
7	Adolfo Ibanez University	Chile	1953
8	University of Chile	Chile	1842
9	State University of Campinas	Brazil	1962
10	Pontifical Catholic University of Argentina	Argentina	1958
11	Pontifical Catholic University of Peru	Peru	1917
12	Anahuac University	Mexico	1964
13	Federal University of Rio de Janeiro	Brazil	1920
14	National Polytechnic Institute	Mexico	1936
15	Autonomous Technological Institute of Mexico	Mexico	1946
16	Technological Institute of Buenos Aires	Argentina	1959
17	Pontifical Javeriana University	Colombia	1623
18	Pontifical Catholic University of Sao Paulo	Brazil	1946

Table 3. *Cont.*

Number	University	Country of Origin	Foundation Year
19	Austral University	Argentina	1991
20	Autonomous University of Nuevo Leon	Mexico	1933
21	University of Antioquia	Colombia	1803
22	University of the Americas Puebla	Mexico	1940
23	University of Palermo	Argentina	1986
24	Rosario University	Colombia	1653
25	Diego Portales University	Chile	1982
26	Iberoamerican University	Mexico	1943
27	Federico Santa Maria Technical University	Chile	1931
28	Torcuato Di Tella University	Argentina	1991
29	University of Brasilia	Brazil	1962
30	Federal University of Minas Gerais	Brazil	1927
31	Federal University of São Paulo	Brazil	1933

Table 4. Production function. Source: Own elaboration.

Type	Variable	Description
Product (Output)	(QS) Overall score	Overall score calculated for the QS Graduate Employability indicator
	(I.1) Undergraduate students	(I.1.1) National undergraduate students (I.1.2) International undergraduate students Number of students enrolled in national and foreign undergraduate studies
Supplies (Inputs)	(I.2) Graduate students	(I.2.1) National Graduate students (I.2.2) International graduate students Number of students enrolled in graduate studies, both national and foreign
	(I.3) Teaching staff	(I.3.1) National teaching staff (I.3.2) Foreign professors Professors who give lectures at national or foreign undergraduate and graduate programs

3. Results

The model used in this research assumed the existence of VRS—BBC—in estimating the efficiency degree. Likewise, an orientation towards output is contemplated (BBC-output model), based on the hypothesis of maximizing the QS indicator without having prior knowledge of the returns to scale that may be generated by comparing the number of inputs applied to the said maximizing purpose. Table 5 summarizes the statistics of the input and output variables defined in the constructed production function.

Table 6 presents the results obtained from the application of the research model. The column “score” shows the relative position of each university with respect to an optimal point that has been assigned the value “100”. This has allowed establishing a numerical order related to the said value that can be assigned to each DMU. Likewise, a column (increment higher education—IHE increase, represented by the “goal” column in Table 6) has been added, indicating the percentage of increase that the analyzed DMUs should make so that their score is at the maximum efficiency level.

Table 5. Statistical summary of inputs/outputs variables for the production function. Source: Own elaboration.

Measures	QS	(I.1.1)	(I.1.2)	(I.2.1)	(I.2.2)	(I.3.1)	(I.3.2)
Variance	228.163928	734,212,950	216826.087	53,116,497.4	194147.661	7,387,006.84	41,942.7742
Standard deviation	15.354784	27,544.2683	473.34303	7408.57931	448.154447	2762.83195	208.184694
Quasi variance	235.769392	758,686,715	224 053.624	54,887,047.3	200,842.408	7,633,240.41	43,340.8667
Median	20.8	13,831.95	114.3	2833.05	198.28	1459	90
Kurtosis coefficient	1.85879361	3.7972693	2.51801821	5.17050646	14.183411	11.7251631	10.2494093
Asymmetry coefficient	1.6635453	2.01239477	1.68815632	2.23745989	3.43421411	3.13510568	3.18941097
Maximum	73.6	113,551.2	1731.38	30,222.46	2351.24	14124	949
Minimum	20.8	1448.18	0	459.2	0	146	0
Ranking	52.8	112,103.02	1731.38	29,763.26	2351.24	13,978	949

Table 6. BBC-output model efficiency. Source: Own elaboration.

Group Number	University	Score	Goal
1	Iberoamerican University	100	0
	Torcuato Di Tella University	100	0
	Adolfo Ibanez University	100	0
	Pontifical Catholic University of Argentina	100	0
	Monterrey Institute of Technology and Higher Studies	100	0
	Pontifical Catholic University of Chile	100	0
2	University of the Andes	98.41	1.59
	Technological Institute of Buenos Aires	92.5	7.5
	University of Sao Paulo	90.08	9.92
3	Austral University	86.38	13.62
	University of the Americas Puebla	86.21	13.79
	Autonomous Technological Institute of Mexico	83.81	16.19
	Federico Santa María Technical University	81.66	18.34
	Pontifical Catholic University of Sao Paulo	80.17	19.83
4	Rosario University	76.62	23.38
	Pontifical Catholic University of Peru	76.43	23.57
	Anahuac University	70.45	29.55
5	National Autonomous University of Mexico	69.29	30.71
	State University of Campinas	68.45	31.55
	National university of Colombia	64.98	35.02
	University of Chile	60.62	39.38
6	Federal University of Sao Paulo	56.29	43.71
	University of Palermo	53.55	46.45
	University of Antioquia	49.35	50.65
7	Federal University of Rio de Janeiro	47.37	52.63
	Diego Portales University	45.11	54.89
	Pontifical Javeriana University	44.27	55.73
	Autonomous University of Nuevo Leon	41.83	58.17
8	National Polytechnic Institute	34.22	65.78
	Federal University of Minas Gerais	33.26	66.74
	University of Brasilia	29.41	70.59

4. Discussion and Conclusions

This research has as a goal to carry out a comparative analysis of the degree of efficiency in terms of labor insertion of graduate alumni among various Latin American universities. From the analysis of the previous literature, it was noticed that most of the publications on university performance were focusing on the research activities of these HEI, leaving in the background the relevant work they carry out in the process of improving

the employability degree of their alumni, as well as their contribution to the economic development of societies.

The analysis carried out incorporated an eminent business concept to the university management context. For this, a production function was defined to calculate the degree of university labor efficiency through three input variables: (a) undergraduate students, (b) graduate students, and (c) teaching staff (both national and foreigners). The output variable was the QS overall score. The applied DEA analysis to this function made it possible to determine the relative position of each university with respect to a theoretical efficiency frontier. The valuation of each DMU was conditioned by the spatial position that each HEI occupies relative to the said border.

As it was not possible to directly specify the way in which the conversion of inputs into outputs occurs, we are aware of the existence of an element of subjectivity in this analysis. Thus, the choice of other input or output variables in the DEA application would probably yield different values. For this reason, an exhaustive analysis of the prolific existing bibliography on this subject was carried out in advance.

With these exceptions, this research revealed notable differences between the analyzed DMUs. Thus, results showed the existence of eight groups of HEI. The best-ranked HEIs that presented scores of 100 were Iberoamerican University, Torcuato Di Tella University, Adolfo Ibanez University, Pontifical Catholic University of Argentina, Monterrey Institute of Technology and Higher Studies, and Pontifical Catholic University of Chile. All these universities form the group number 1, in which the HEIs with higher scores were grouped by the research model. Likewise, an analysis of the goals was included in which the effort that the DMUs must make by groups is indicated.

The HEIs related to group 2 (Technological Institute of Buenos Aires, University of Sao Paulo, and Austral University) have to increase their score by 6%. Those in group 3 (Autonomous Technological Institute of Mexico, Federico Santa María Technical University, Pontifical Catholic University of Sao Paulo and Rosario University), 16%; those in group 4 (Pontifical Catholic University of Peru, Anahuac University and National Autonomous University of Mexico), 25%; those in group 5 (State University of Campinas, National University of Colombia, University of Chile and Federal University of Sao Paulo), 34%; those in group 6 (University of Palermo and University of Antioquia), 45%; those in group 7 (Federal University of Rio de Janeiro, Diego Portales University, Pontifical Javeriana University, Autonomous University of Nuevo Leon and National Polytechnic Institute), 54%; and those in group 8 (Federal University of Minas Gerais and University of Brasilia), 67%. This increase in the levels of effort is made more necessary by the greater potential that university students have to find jobs over those who have a lower education level.

These results coincide with those obtained and published by consulted authors. From a strictly labor perspective, there are significant differences in the degree of employability of universities' alumni. Thus, three aspects related to this situation were fundamentally identified: (a) the profile of the students, (b) the environmental conditions, and (c) the management style of the HEI.

However, in order to precisely determine the specific university policies aimed at improving the students' employability who have obtained better results, it is necessary to carry out studies aiming to offer information about the labor efficiency degree achieved. Above all, these degrees can promote effective feedback to the curriculum and identify practices to be developed to achieve a higher level of success related to alumni employability. Thus, a supportive change is needed in order to better narrow the decisions of HEI management according to the job market needs.

For this reason, an expanded analysis by a comparative study of the specific labor insertion policies developed by the DMUs analyzed is needed. From a political point of view, education authorities could create a bank of best practices where the employment policies that are presenting better results would be reported. Likewise, additional analyses could be included, such as the existence and operation of specific employment guidance services, ex-

tracurricular internship programs, job placement programs, specific courses of transversal competences associated with each degree, or even analysis of territorial dynamics.

Additionally, some suggestions are addressed in order to increase the studies that aim to explore the relations between higher education and employment. Databases could be formed relating the labor insertion of university alumni to determine the evolution experienced in the efficiency indices of Latin American universities.

Finally, this field of research is sensitive to HEI economic results and should be treated more abundantly by the researcher. Researchers could consider aspects in future research, such as the definition of a standardized model of labor efficiency university, the inclusion of a cost analysis, the incidence of staff selections models, or the impact of students' and professors' mobility schemes.

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