LinkedIn as a data source to rank universities according to graduate's employability in top companies

LinkedIn como fonte de dados para classificar as universidades de acordo com a empregabilidade dos licenciados em empresas de topo

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Abstract

The purpose of this study is to determine the feasibility of ranking universities considering the number of its graduates employed in top companies (selective employability), as mapped through LinkedIn. To achieve this, we analyzed the presence of 3,716,720 graduates from eighty Spanish universities hired by the Iberian Index companies, considering the percentages of graduates from each university working in those companies. The index obtained presents a short statistical range to correctly discriminate all universities. Moreover, the selective employability indicator is influenced by the distance between universities and companies (*i.e.*, companies attract graduates from universities near their headquarters). This issue jeopardizes the use of this metric as a standalone ranking indicator. Finally, LinkedIn shows several limitations as a data source (mainly representativeness, reliability, and accuracy).

Keywords: Employability. IBEX35. Social media. Spain. Higher Education Institutions. University rankings.

Resumo

O objetivo deste estudo é determinar a viabilidade de classificar as universidades segundo o número de egressos empregados em empresas de topo (empregabilidade seletiva) através do LinkedIn. Para isso, será analisada a presença de 3.716.720 egressos de 80 universidades espanholas, contratados por empresas listadas no índice da bolsa espanhola Iberian Index, através da porcentagem de egressos de cada uma das universidades contratados por essas empresas. O índice obtido apresenta um curto intervalo estatístico para discriminar corretamente todas as universidades. Além disso, o indicador seletivo de empregabilidade é influenciado pela distância entre universidades e empresas (ou seja, as empresas atraem licenciados de universidades localizadas perto da sua sede). Essa questão compromete a utilização da métrica como indicador autônomo de classificação. Finalmente, o LinkedIn apresenta várias limitações como fonte de dados (principalmente representatividade, fiabilidade e exatidão).

Palavras-chave: *Empregabilidade. IBEX35. Redes sociais. Espanha. Instituições de ensino superior. Classificação das universidades.*

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Introduction

Universities have undergone a series of changes that culminate in a new model in which higher education institutions move away from their eminently theoretical and academic natures and toward a more practical two-way approach. Within that approach, universities offer both professional training at the service of real business demands, on the one hand, and scientific research, on the other (Orduña-Malea, 2012). Within this new approach, a market-driven university has emerged (Prokou, 2008) with a commitment to enable its graduates to enter the job market and to position themselves in closer proximity to society, willing to meet the demands that society addresses to the university (Beraza; Rodríguez, 2007). As a result, companies play an important role in the higher education system.

This relationship between the university and the industry can be referred to as an attempt to adapt the former to the challenges of a contemporary society of knowledge so that its product – graduates – adapts as much as possible to the demands of the job market. As a consequence, if graduates do not adjust to the needs of the productive system, the investment in their training would represent a social and economic loss, since the expenditure would show no returns (Galcerán, 2010). This fact has generated political criticism and controversy, since the industry might overdetermine the educational and training activities that take place in universities (Levidow, 2002), leading to their marketization (Bendixen; Jacobsen, 2017).

The relevance of graduate employability in the current university context is thus evidenced. Unquestionably, the quality of education can provide graduates with more chances of being hired by companies, though this indicator is not the sole variable in defining employability. Still, employability-related data has long been used as potential indicators of the quality of the education received. Furthermore, employability might constitute an indicator for elitist hiring in certain top companies (*i.e.*, selective employment rate), assuming that recruitment processes in those companies are more stringent. Following this logic, universities with a higher number of graduates preferred by top companies in recruiting processes would be seen as top-quality institutions by society at large.

One can find university rankings that include employability rates. These rankings reflect – or else, stimulate – the increasing competition among universities to offer better job placements or internships in leading companies. In particular, it is worth mentioning that we can find global rankings based exclusively on data related to employability, such as the Global University Employability Survey & Ranking and the QS Graduate Employability Rankings.

However, these rankings' coverage is low and insufficient to analyze entire national university systems. This is mainly due to the complexity of measuring universities by employability rates, given the absence of systematic and/or standardized protocols for obtaining data from graduates (Pavlin; Svetlik, 2014). Some universities have not implemented procedures to obtain this kind of data in a manageable way. Other institutions are inconsistent in their approach, which might vary from year to year, or from one department or institute within the university to the other.

While data may be available via external official bodies (governmental agencies and university associations), it also depends on the information provided by the universities. Moreover, general reports covering more than one institution tend to aggregate data, preventing comparative studies or fine-grained analyses at the institutional level. Information may also be obtained directly from the companies, which may use employees' resumés to create personnel databases. Nonetheless, only a few firms would maintain comprehensive databases, provide access to this information, or follow standardized procedures.

The launch of LinkedIn opened a new door for monitoring employment data. For companies, the platform allows users to create different pages by typology (educational institution; freelance; government agency; non-profit; single owner; private; association). As to universities, the profile can only be created by the LinkedIn team on request, and it is generally used as a marketing tool (Paniagua; Gómez, 2012).

LinkedIn allows graduates to build and maintain a professional network, as well as to find and connect with former colleagues. It also helps them identify and obtain information about companies, find professionals in a particular sector, share ideas and information of interest with their network, and find new career opportunities.

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LinkedIn constitutes a valuable repository of information to be used in the development of new services and information-based products (Case *et al*., 2012). Mijic (2012) suggested a systematic approach to the collection of data regarding alumni, given the importance of such information for universities and other institutions. Gonçalves *et al*. (2014) designed a tool to extract targeted information about LinkedIn users while avoiding the need to consult the social media platform. Meanwhile, Li *et al*. (2016) analyzed and compared graduates' professional careers by creating database systems.

LinkedIn allows users to include the university from which they graduated as well as their professional experience and current job when creating their profiles (Orduña-Malea *et al*., 2017; Komljenovic, 2019). Consequently, LinkedIn can potentially provide massive data on universities' levels of employability. However, the suitability of LinkedIn as a legitimate data source of graduates' employability still needs to be validated.

The overall objective of this study is to determine the feasibility of ranking universities considering the number of graduates employed in top companies by using LinkedIn as a data source. In order to address this objective, we formulated the following research questions: (RQ1) According to LinkedIn, Which universities have a higher number of graduates working in top companies? (RQ2) Are the university's longevity, legal status, teaching mode or University-to-Company distance related to the number of graduates working in top companies? (RQ3) According to LinkedIn, which top companies hire a larger number of graduates?

Methodological Procedures

To achieve the article's objective, a set of universities (the whole Spanish university system, composed by 83 institutions) and top companies (those listed in the IBEX35 stock market index) were considered as the object of a case study. The IBEX35 index comprises the 35 companies in Spain with the highest volume of trades in euros during the previous six months. This way, the number of graduates from Spanish universities working in these 35 companies constitutes a case study of a selective employability indicator.

With regards to the universities, data about their longevity (years since the foundation), teaching methodology (face-to-face or distance), legal status (public or private), and geographic location (*Nomenclature des Unités Territoriales Statistiques*-2 level) were obtained directly from the official university websites and the Spanish Official Registry of Universities, Centers and Titles. The total number of graduates (undergraduates and holders of Master's Degrees) from each of the 83 Spanish universities from 1985 to 2018 was obtained from the official statistics provided by the Spanish Ministry of Education and Vocational Training. Since the data is incomplete (it excludes doctorate degrees and all graduates before 1985), it can be used only as a rough approximation. The number of graduates from Spanish universities working for each of the 35 companies included in the IBEX35 index (2018 edition) was retrieved directly from the universities' official profile on LinkedIn (alumni section).

With regards to the companies, the number of full-time employees and headquarters' location (*Nomenclature des Unités Territoriales Statistiques*-2 level) was retrieved from Yahoo Finance. The site of the company's headquarters has been taken as its location. Likewise, the cities where the headquarters of the company and the university were located were used to establish distances between universities and companies. The number of employees according to LinkedIn was taken directly from the companies' official profiles.

No LinkedIn profiles were found for one company (*Actividades de Construcción y Servicios*) and three institutions: *Universidad Europea de Valencia* (this organization has the same LinkedIn profile as the *Universidad Europea de Madrid*), *Universidad Eclesiástica San Dámaso* (it has a LinkedIn profile as a company but not as a university, and therefore graduate information cannot be accessed), and *Universidad Fernando Pessoa-Canarias* (with no LinkedIn profile). All of them were excluded from the study. All the data was obtained between April and June 2018.

The IBEX35 rate (percentage of graduates from one university working in IBEX35 companies) was obtained for each university and then used as a selective employability indicator to rank Spanish institutions. A relative measure was used to make this indicator size-independent.

In addition, a discriminant analysis was carried out to establish whether the teaching methodology and legal status were related to the number of graduates employed by the companies under study. Correlations were also conducted to determine whether the university's longevity and the university-to-company distance were related to the number of graduates employed by IBEX35 companies. The software XLStat was used for data processing and statistical analysis.

Results

RQ1: Graduates from Universities

LinkedIn records 3,716,720 graduate profiles, of which 97,748 correspond to graduates working in IBEX35 companies. The ranking of Spanish universities according to the IBEX rate is shown in Table 1. The IBEX rate is low (mean=2.35; median=1.99) and quite homogeneous throughout all universities (standard deviation=1.29), with a maximum value of 7.13 (*Internacional Menénez Pelayo*) and a minimum value of 0.36 (Isabel I).

Table 1. Ranking of universities according to the IBEX35 rate (May 2018).

Rank	QS Rank	University	Status	Graduates	Alumni LinkedIn	Alumni IBEX35	IBEX35 Rate (%)
1		Internacional Menéndez Pelayo	Public	4,736	2,103	150	7.13
2		Pontificia Comillas	Private	49,862	49,200	2,926	5.95
3	5	Politécnica de Madrid	Public	140,061	154,073	8,410	5.46
4		Pública de Navarra	Public	36,203	16,667	852	5.11
5	7	Carlos III de Madrid	Public	57,529	74,011	3,675	4.97
6	10	Alcalá	Public	85,871	63,207	2,862	4.53
7	8	Autónoma de Madrid	Public	152,386	119,224	4,864	4.08
8		Cantabria	Public	52,467	26,938	1,057	3.92
9		Pontificia de Salamanca	Private	42,069	22,037	821	3.73
10		CEU San Pablo	Private	35,621	50,412	1,871	3.71
11		Deusto	Private	71,531	50,322	1,827	3.63
12		Politécnica de Cartagena	Public	13,337	11,051	397	3.59
13		Francisco de Vitoria	Private	13,110	19,054	666	3.50
14		La Coruña	Public	78,375	32,311	1,123	3.48
15	11	Rey Juan Carlos	Public	62,332	75,785	2,614	3.45
16	15	Pompeu Fabra	Public	49,741	69,863	2,315	3.31
17		Oviedo	Public	134,831	56,037	1,856	3.31
18		Alfonso X El Sabio	Private	36,605	20,519	672	3.28
19	2	Complutense de Madrid	Public	484,018	317,139	10,043	3.17
20		Oberta de Catalunya	Public	49,695	77,343	2,381	3.08
21		Castilla-La Mancha	Public	115,157	41,003	1,251	3.05
22		Nacional de Educación a Distancia	Public	139,338	108,196	3,255	3.01
23		Valladolid	Public	146,758	59,576	1,787	3.00
24		Illes Balears	Public	48,953	22,095	612	2.77
25		León	Public	69,229	30,816	837	2.72
26		Distancia de Madrid	Private	7,777	8,689	232	2.67
27		Católica de Ávila	Private	5,235	4,901	130	2.65
28		Europea de Madrid	Private	33,769	43,590	1,108	2.54
29		Abad Oliva CEU	Private	2,899	7,101	178	2.51

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Rank	QS Rank	University	Status	Graduates	Alumni LinkedIn	Alumni IBEX35	IBEX35 Rate (%)
30		Antonio de Nebrija	Private	14,732	22,096	548	2.48
31		Extremadura	Public	109,754	32,829	813	2.48
32	4	Politècnica de Catalunya	Public	130,935	112,681	2,701	2.40
33		Loyola Andalucía	Private	870	3,185	73	2.29
34	13	Zaragoza	Public	169,610	68,491	1,518	2.22
35		País Vasco	Public	243,678	71,912	1,570	2.18
36		Burgos	Public	34,262	15,701	342	2.18
37		Vigo	Public	83,750	41,336	893	2.16
38	1	Navarra	Private	65,374	44,164	917	2.08
39		Rovira i Virgili	Public	50,437	26,648	550	2.06
40	3	Barcelona	Public	289,915	223,043	4,505	2.02
41		San Jorge	Private	2,642	5,301	104	1.96
42		La Rioja	Public	23,228	10,456	198	1.89
43		Santiago de Compostela	Public	145,895	61,054	1,151	1.89
44		Camilo José Cela	Private	38,698	29,092	546	1.88
45		Europea Miguel de Cervantes	Private	2,167	8,820	164	1.86
46		Alicante	Public	101,565	57,585	1,060	1.84
47	6	Autònoma de Barcelona	Public	184,697	146,992	2,691	1.83
48		Las Palmas de Gran Canaria	Public	63,041	32,816	594	1.81
49		Málaga	Public	130,675	67,829	1,218	1.80
50		Lleida	Public	37,712	17,164	306	1.78
51		Sevilla	Public	251,460	132,072	2,314	1.75
52		Jaén	Public	56,239	23,295	404	1.73
53	12	Salamanca	Public	146,830	84,287	1,459	1.73
54		Internacional de La Rioja	Private	30,030	20,642	355	1.72
55		Cádiz	Public	87,378	33,244	556	1.67
56		Europea de Canarias	Private	467	484	8	1.65
57	9	Politècnica de València	Public	114,985	96,117	1,534	1.60
58		Murcia	Public	130,078	48,070	755	1.57
59		Ramon Llull	Private	59,590	32,636	512	1.57
60		Huelva	Public	41,262	17,067	262	1.54
61		Girona	Public	52,323	28,332	430	1.52
62		Vic	Private	18,799	11,923	178	1.49
63	14	València	Public	255,533	109,597	1,631	1.49
64		Miguel Hernández de Elche	Public	31,201	21,728	296	1.36
65		Granada	Public	254,339	115,513	1,543	1.34
66		La Laguna	Public	86,420	34,121	448	1.31
67		Córdoba	Public	78,713	30,062	379	1.26
68		Jaume I	Public	36,367	15,933	197	1.24
69		Pablo de Olavide	Public	21,011	25,850	308	1.19
70		Católica San Antonio	Private	27,927	14,215	167	1.17
71		Internacional de Valencia	Private	9,533	4,760	54	1.13
72		Almería	Public	41,869	19,166	211	1.10
73		Mondragon Unibertsitatea	Private	16,944	9,994	101	1.01

Table 1. Ranking of universities according to the IBEX35 rate (May 2018).

Rank	QS Rank	University	Status	Graduates	Alumni LinkedIn	Alumni IBEX35	IBEX35 Rate (%)
74		CEU Cardenal Herrera	Private	17,485	15,483	157	1.01
75		Internacional de Catalunya	Private	11,562	10,620	107	1.01
76		Company Institute	Private	8,887	1,429	13	0.91
77		Católica de Valencia	Private	25,795	11,753	71	0.60
78		Internacional de Andalucía	Private	1,392	4,301	20	0.47
79		Europea del Atlántico	Private	736	3,758	16	0.43
80		Isabel I	Private	8,329	7,810	28	0.34

Note: QS: Ranking positions from QS Graduate Employability Ranking (2018 Edition), available at: https://www.topuniversities.com/university-rankings/employability-rankings/2018.

Graduates: Number of graduates from Spanish universities (Graduate and Master degrees, from 1985-1986 to 2017-2018).

RQ2: The university's dimensions and the IBEX35 rate

The university's longevity shows a strong and significant correlation (Spearman, a=0.1) with the university's size. This way, the total number of graduates (R=0.86; p-value=0.000), the number of graduates with a LinkedIn profile (R=0.74; p-value=0.000), and the number of graduates employed in IBEX35 companies (R=0.74; p-value=0.000) are sensitive to long-lasting institutions. However, the university's longevity and the IBEX35 rate are weakly correlated (R=0.34; p-value=0.002).

The strong correlation between the total number of graduates and the number of graduates with a LinkedIn profile (R=0.91; p-value<0.0001) created evidences that LinkedIn can represent the size of the university.

As to the type of the university (Figure 1), we observe a higher average number of graduates from public universities than from private universities (1,631.3 and 501.7 graduates, respectively). The IBEX35 rate is higher in public universities (2.50) than in private universities (2.08). However, the Discriminant Analysis (Kullback's test) did not find statistical differences between private and public universities (p-value=0.941; a=0.01).
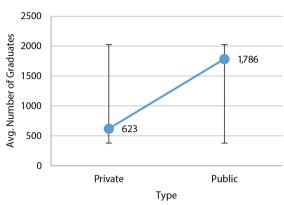
Regarding the university's teaching method (Figure 2), the average number of graduates is slightly higher in distance universities than in face-to-face ones (1,195 and 1,096, respectively), despite the low number of private institutions in the sample (6). However, when it comes to measuring the IBEX35 rate, it is slightly higher in face-to-face universities (2.38) than in distance universities (2.00). The discriminant Analysis (Kullback's test) did not find statistical differences between presence and face-to-face universities (p-value=0.730; a=0.01).

The regions of Madrid (44,442 graduates), Catalonia (16,854), and Andalusia (7,288) are the three main areas in numbers. An influence of the location of the companies' headquarters is observed. The region of Madrid concentrates a great percentage of IBEX35 companies (22). Catalonia experienced an exodus of companies due to the 1-O (October 1) political conflict (6 companies moved from Catalonia to other regions). However, Andalusia stands out as this region does not host any IBEX35 company.
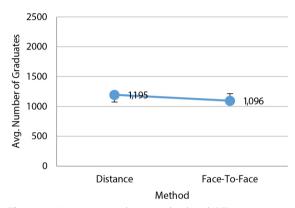
RQ3: Graduates in IBEX35 Companies

According to LinkedIn, a total of 651,128 employees are currently working in IBEX35 companies. Out of these, 15.0% (97,748) are graduates from Spanish universities.

Despite some outliers, the correlation (Spearman; a>0.1) between the size of the company (full-time employees) and the number of its employees on LinkedIn is strong and significant (R=0.8; p-value<0.000). Also, the number of graduates from Spanish universities working in IBEX35 companies shows a significant correlation (Spearman; a>0.1) both with the number of full-time employees (R=0.60; p-value=0.000) and with the number of employees with a LinkedIn profile (R=0.80; p-value<0.0001).

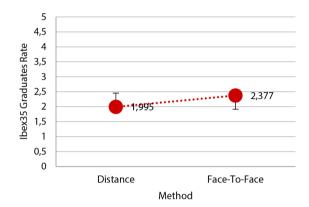**Figure 1**. University type and IBEX35 rate.

Figure 2. University teaching method and IBEX35 rate.

Telefónica (10,705), *Banco Bilbao Vizcaya Argentaria* (10,119), and *Indra* (10,090) are the companies employing more graduates from Spanish universities (Table 2). If the size of the company is considered, Mediaset (84.4%) and *Red Eléctrica* (83.5%) are the companies with the highest percentage of graduates employed.

The number of universities from which such graduates come varies widely from one company to the other (average=63.6; standard deviation=17.9). For example, *Colonial* and Acerinox employ graduates from few universities (15 and 24, respectively), while Telefónica, BBVA, and Mapfre employ graduates from a wide range of Spanish universities (79 universities each).

Table 2. Distribution of graduates employed by IBEX35 companies.

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Company	Sector	Location	Full-Time Employees	LinkedIn Employees	Number of Graduates	%	Number of Universities
Telefónica	Communication services –Telecom Services	Madrid	118,022	90,857	10,705	11.8	79
BBVA	Financial Services – Banks – Diversified	Basque Country	126,332	79,169	10,119	12.8	79
Indra	Technology – Information Technology Services	Madrid	49,082	29,930	10,090	33.7	76
Banco Santander	Financial Services – Banks – Diversified	Cantabria	201,017	102,206	8,429	8.2	77
Caixabank	Financial Services – Banks – Regional	Valencia	35,669	9,742	6,812	69.9	76
Banco Sabadell	Financial Services – Banks – Regional	Valencia	24,997	8,366	4,415	52.8	77

Table 2. Distribution of graduates employed by IBEX35 companies.

Company	Sector	Location	Full-Time Employees	LinkedIn Employees	Number of Graduates	%	Number of Universities
Mapfre	Financial Services – Insurance – Specialty	Madrid	34,507	20,602	3,971	19.3	79
Repsol	Energy – Oil & Gas Integrated	Madrid	25,705	17,195	3,887	22.6	74
Inditex	Consumer Cyclical – Apparel Retail	Galicia	167,897	40993	3,784	9.2	76
Acciona	Industrials – Engineering & Construction	Madrid	38,980	9,636	3,621	37.6	78
Bankia	Financial Services – Banks – Regional	Valencia	16,051	6,085	3,603	59.2	74
Bankinter	Financial Services – Banks – Regional	Madrid	8,512	5,006	3,127	62.5	77
Ferrovial	Industrials – Infrastructure Operations	Madrid	78,316	22,710	2,991	13.2	74
Técnicas Reunidas	Basic Materials – Industry and Construction	Madrid	8,971	6,581	2,908	44.2	72
Endesa	Utilities – Utilities – Regulated Electricity/Power	Madrid	9,923	6,531	2,609	39.9	73
Gas natural	Utilities – Utilities – Regulated Gas	Madrid	11,880	8,027	2,309	28.8	77
Iberdrola	Utilities – Utilities – Diversified	Basque country	34,584	10,773	2,120	19.7	71
Melia Hotels	Consumer Cyclical – Lodging	Balearic Islands	21,263	6,911	1,939	28.1	77
Siemens Gamesa	Industrials – Specialty Industrial Machinery	Basque country	24,453	10,570	1,574	14.9	73
Aena	Industrials – Airports & Air Services	Madrid	7,629	3,410	1,458	42.8	72
Grifols	Healthcare – Drug Manufacturers – General	Catalonia	22,000	7,332	1,403	19.1	63
Amadeus	Technology – Information Technology Services	Madrid	15,967	12,555	967	7.7	62
Red Eléctrica	Utilities – Utilities – Regulated Electricity/Power	Madrid	1,816	977	816	83.5	60
Dia	Consumer Defensive – Discount Stores	Madrid	43,692	6,633	810	12.2	65
Arcelormittal	Basic Materials – Steel	Luxembourg	208,583	30,206	762	2.5	55
Enagas	Utilities – Utilities – Regulated Gas	Madrid	1,452	915	700	76.5	59
Mediaset	Communication services – Broadcasting	Madrid	1,247	776	655	84.4	59
Cellnex	Communication services – Telecom Services	Madrid	1,437	870	508	58.4	57
Viscofan	Consumer Cyclical – Packaging & Containers	Navarra	4,639	392	173	44.1	31
Abertis	Industrials – Engineering & Construction	Madrid	15,046	342	166	48.5	32
IAG	Industrials – Airlines	Madrid	65,808	626	101	16.1	37
Acerinox	Basic Materials – Steel	Madrid	6,809	189	90	47.6	24
Merlin	Real Estate – REIT – Diversified	Madrid	176	104	78	75.0	31
Colonial Socimi	Real Estate – REIT – Office	Madrid	200	477	48	10.1	15

Source: Elaborated by the authors (2020).

Note: IAG: International Airlines Group.

The IBEX35 rate does not correlate with the university's size (number of graduates). We find small institutions with an elevated IBEX35 rate and big universities with less relevant scores. While this result is not necessarily negative, we find that those universities with the highest IBEX35 rates do not correspond to those appearing in the top positions in both Spanish (U-ranking, *Conocimiento y Desarrollo*) and global rankings (Times Higher Education World University Rankings, Quacquarelli Symonds World University Rankings, Academic Ranking of World Universities, Scimago Institutions Ranking, or Leiden Ranking), though these lists do not measure employability, but mainly the production of scientific research. The Quacquarelli Symonds Graduate Employability Ranking also offers a different order of Spanish universities. Therefore, the selective employability indicator used in this study offers distinct and supplementary information about the universities.

The university's longevity correlates with the total number of graduates working in IBEX35 companies, though this correlation disappears when the university's size is considered. This result aligns with previous research that highlights the relevance of longevity in the university's reputation (Drennan; Beck, 2001; Volkwein; Sweitzer, 2006; Repiso; Chaparro-Domínguez, 2018).

Evidence about the relationship between the university-to-company distance and the number of graduates employed by these companies was also obtained. This shows that companies that have their headquarters in the same area as the university tend to hire a larger number of its graduates, confirming similar earlier conclusions (Orduña-Malea *et al.*, 2017).

The use of the IBEX35 as a test-bed of a selective employability indicator raises its own difficulties: First, it constitutes a very restrictive indicator. According to the data from LinkedIn, 0.026% of graduates from Spanish universities is currently employed in IBEX35 companies. As a consequence, the indicator holds low sensitivity. The statistical range of the IBEX35 rate is 6.77, a low value to discriminate 80 universities. Moreover, other relevant sectors of the Spanish economy, such as public employment, education, and health are omitted. In this sense, the inclusion of other national (continuous market) and international (Eurostock, National Association of Securities Dealers Automated Quotations, etc.) stock market indexes is advisable.

Second, changes in the headquarters' location affect the accuracy of the indicator. One example is *Banco Santander*, which has its central office in Cantabria and its corporate headquarters in the region of Madrid. Future research must deal with the methodological challenges of determining whether the change of headquarters' locations led to a change in the employees' universities of origin.

Third, the companies in IBEX35 change over time. Twice a year, a new company may enter or leave this select club. In addition, the market area is highly volatile. Companies might merge, be absorbed by other companies, etc. Fourth, the sectors covered by IBEX35 companies are limited. Therefore, employability in these firms would depend on the Faculties and Centers where students graduate. This issue would discriminate universities not offering related degrees. Fifth, the occupations and positions of the graduates in IBEX35 firms should be considered. Sixth, top students might opt to work abroad, to create a start-up, or to become entrepreneurs.

How representative, reliable, accurate, and relevant the collected data from LinkedIn is constitutes another discussion in point. First, LinkedIn data must be representative of the size of universities, in terms of the number of graduates. In this sense, we find a strong correlation between the total number of graduates according to the official statistics and the number of graduates provided by LinkedIn ($R=0.92$). This way, LinkedIn reflects the size of the universities. However, there is no way to check whether the number of graduates provided by LinkedIn (3,716,720) is the real total value. This number represents approximately 61.3% of all graduates from Spanish universities if we consider the official statistics of the Spanish Ministry of Education and Vocational Training, excluding doctoral students.

Second, LinkedIn data must be representative of the size of companies, in terms of their numbers of employees. The data shows a strong correlation between the number of full-time employees in a company and the number of employees with a LinkedIn profile ($R=0.8$). This way, LinkedIn reflects the size of the companies. However, some

firms (*e.g.*, Inditex) have a low presence in LinkedIn, which makes this platform unreliable for measuring alumni employment metrics for all companies.

Third, LinkedIn data must be reliable. Despite the strong correlations obtained, important inconsistencies were also found (17 out of the 80 universities show a higher number of graduates with a LinkedIn profile than total number of graduates since 1995). Moreover, not all LinkedIn users link their place of work or study correctly, and the data provided by social network users is not verifiable. All this entails potential biases.

Fourth, LinkedIn data must be as accurate as possible. However, LinkedIn does not include the International Standard Classification of Occupations codes and hence it is not possible to evaluate whether the graduates are not overqualified for the positions they occupy. Fifth, the companies and universities with programs for their employees and/or graduates to create professional profiles may be over-represented. Sixth, different economic sectors might have different uses for and presences on LinkedIn (*e.g.*, communication or marketing labor markets have a much bigger presence than other industries).

Conclusion

In response to the RQ1, the *Universidad Complutense de Madrid* (10,043) and the *Universidad Politécnica de Madrid* (8,410) are the universities that provide the largest number of graduates to IBEX35 companies. When the university's size is considered (IBEX35 rate), two small institutions (*Menéndez Pelayo* and *Pontificia Comillas*) obtain the highest scores. With a few exceptions, the large traditional universities (*e.g.*, *Complutense de Madrid, Barcelona, Granada, Sevilla* or *Valencia*) obtained lower scores.

In response to the RQ2, the number of graduates working in IBEX35 companies correlates both with the longevity and the size of the universities. On average, more graduates from distance universities are found in IBEX35 firms than from face-to-face universities, due to the existence of a long tail of presence-based institutions with few graduates employed by IBEX35 companies. As to the geographical variable, results show a high concentration of graduates employed by IBEX35 companies in the same areas where these companies are located. These results demonstrate that companies tend to hire graduates who have studied in universities placed in the regions where the companies have their headquarters. This can be explained by the local specialization of the universities and by the existence of fluent relations between companies and universities.

In response to the RQ3, *Telefónica*, *Banco Bilbao Vizcaya Argentaria*, and Indra are the companies that employ more graduates from Spanish universities. In terms of diversity, *Telefónica*, Aena, Indra, Dia, Cellnex, and Colonial are the ones that recruit graduates from a greater number of different universities.

In response to the general objectives proposed: First, the selective employability indicator used (number of graduates from Spanish universities working in IBEX35 companies) is not currently accurate enough to rank universities. However, the future inclusion of other companies listed in other share indexes might improve its value. Second, LinkedIn currently exhibits several inconsistencies that jeopardize its use as a data source for graduates' employability. Nonetheless, LinkedIn currently provides data about university-company connections through graduates, which is not available anywhere else, and its use in university rankings is promising if the issues raised in this study are overcome.

Despite all the limitations, the ranking obtained is a new tool that contains information of interest to classify the institutions, thus constituting a valuable resource when choosing universities for enrollment. Moreover, it would be an invaluable tool for any university brand when it comes to directing training policies, employability, insertion in the job market, and corporate reputation. In this sense, further research is deemed necessary to better comprehend and manage the employability data extracted from LinkedIn.

Contributors

A. MORENO-DELGADO and E. ORDUÑA-MALEA contributed to the data analysis and interpretation. R. REPISO contributed to the study conception and design.

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