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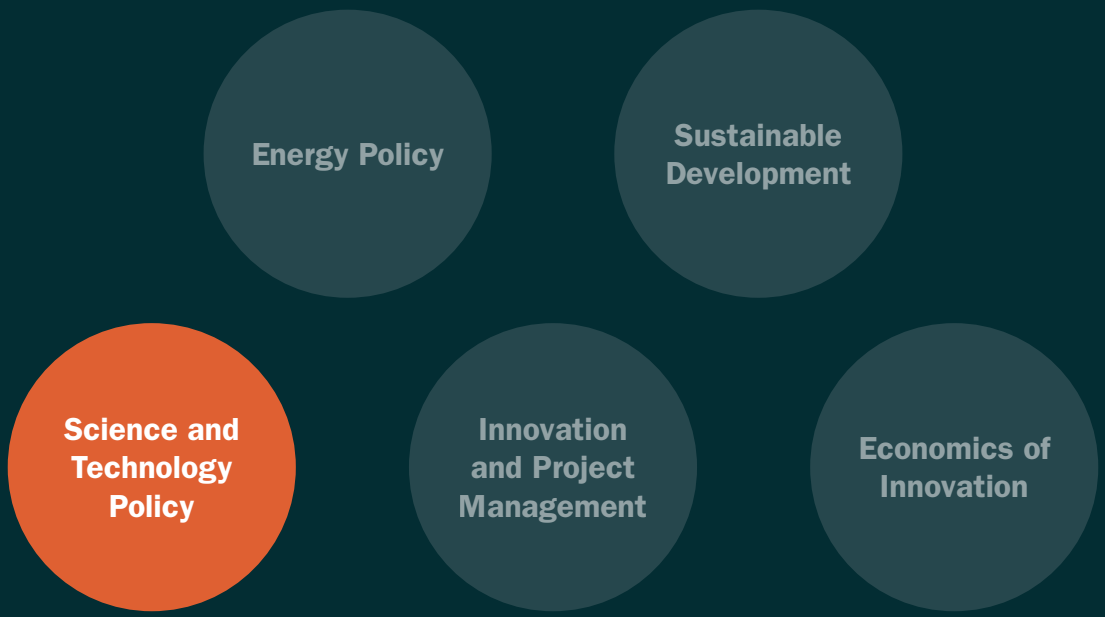

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To what extent is inclusion in the Web of Science an indicator of journal 'quality'?

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Abstract

The assessment of research based on the journal in which it is published is a widely adopted practice. Some research assessments use the Web of Science (WoS) to identify "high quality" journals, which are assumed to publish excellent research. The authority of WoS on journal quality stems from its selection of journals based on editorial standards and scientific impact criteria. These can be considered as universalistic criteria, meaning that they can be applied to any journal regardless of its place of publication, language, or discipline. In this article we examine the coverage by WoS of journals produced in Latin America, Spain, and Portugal. We use a logistic regression to examine the probability of a journal to be covered by WoS given universalistic criteria (editorial standards and scientific impact of the journal) and particularistic criteria (country, language, and discipline of the journal). We find that it is not possible to predict the inclusion of journals in WoS only through the universalistic criteria because particularistic variables such as country of the journal, its discipline and language are also related to inclusion in WoS. We conclude that using WoS as a universalistic tool for research assessment can disadvantage science published in journals with adequate editorial standards and scientific merit. We discuss the implications of these findings within the research evaluation literature, specifically for countries and disciplines not extensively covered by WoS.

1. Introduction

In the last three decades there has been a proliferation of national research assessments under increasing pressure for accountability (Whitley and Gläser 2007; Hicks 2012). Many of these assessments are strongly informed by the classification of journals into 'quality' ranks. The underlying assumption in research assessment by journal rankings is that the reputation or scientific impact of a journal is a good proxy of the 'quality' of papers and researchers. Most of the research evaluation literature warns against this practice (Hicks et al. 2015) given that journals publish different types of articles with highly diverse outcomes in terms of citation impact (Seglen 1997). This conventional practice lead to uniform research criteria, regardless of the context in which research is produced. Although this simplifies activities related to the management of research, such as

funding and indicators production, it has been argued that it does not adequately represent the process and outputs of research. For example, the San Francisco Declaration on Research Assessment (DORA), subscribed to by a variety of universities, journal editors, and publishers, called for a radical change in the way current research evaluation is performed, away from the use of journal indicators.

Despite this concern, research assessment based on journals is a common practice as can be seen in the assessment exercises of Slovak Republic and Hungary (Lillis and Curry, 2010), Poland, Russia, and Slovenia[1], Spain and Colombia (Rafols et al. 2016), Brazil (Frigeri & Monteiro 2015), and South Africa (Woodiwiss 2012), among others. The reasons for the adoption of these methods are not always clear, but a plausible reason could be that the main function of research evaluation in certain countries is to audit researchers and distribute funds. Having an internationally accepted measure thereby accords objectivity to managerial decisions that otherwise could be questioned (Rafols et al. 2016).

In journal-based methods of evaluation, a challenge is to find reliable data sources to select the best journals. In many quantitative research assessments, the Web of Science (WoS) is the main data source used to obtain bibliographic indicators such as the number of papers, citations, or impact factors (Rafols et al. 2016). WoS is commonly regarded as an objective data source that selects its journals based on their fulfilment of editorial standards and high scientific impact (Garfield 1997; Braun, Glänzel, & Schubert 2000; Testa 2014). Based on its perceived objectivity, WoS has achieved a status of authority on the identification of high quality journals globally (Guédon 2001; Lillis and Curry 2010).

However, the extent to which WoS should be used as a global research assessment tool has been contested based on linguistic, geographical, and disciplinary biases in its journal coverage. According to this argument, research evaluations based on WoS may reproduce those biases (Bonaccorsi 2015, p. 22; Rafols, Ciarli, & Chavarro 2015, p. 598) thereby affecting countries, disciplines, and languages that are under-represented (Gibbs 1995; Tijssen, et al. 2006). This is particularly relevant in countries in which research evaluations tend to favour

[1] These cases were kindly provided by an anonymous reviewer.

papers published in high impact factor journals to promote and reward excellence in research (Velho 1985; Sancho 1992; Vessuri, Guédon, & Cetto 2014).

Objectives

This paper aims to contribute to extant literature on the use of data sources for identifying and appraising research excellence. We do this by focusing on a much neglected aspect -- the inclusion criteria used by WoS for analysing journals produced in Latin America[2], Portugal, and Spain. To do this, we look at the detailed characteristics of individual journals (as suggested by Tijssen et al. 2006, p. 173) in relationship to stated criteria for inclusion in WoS. Latin America, Spain, and Portugal are relevant because they are important producers of academic journals that are not included in WoS (Cetto & Alonso-Gamboa 2011).

In order to study the coverage of WoS, we analysed the extent to which two perspectives found in the literature help to elucidate the inclusion of journals in this database. The first perspective regards WoS as universalistic, meaning that its coverage depends on meritocratic criteria (Merton 1973, p. 271), specifically on editorial standards and scientific impact of the journals. The second is that WoS is particularistic, meaning that its coverage depends on ascribed characteristics (Merton, 1973, p. 273) such as country, discipline, and language of the journals.

The novel contribution of this paper is to interrogate, using a regression model, these two competing perspectives on journal selection by WoS. In particular, we show that particularistic variables such as *country* and *discipline* and universalistic variables such as *editorial standards* and *scientific impact* help to predict the probability of inclusion of a journal by WoS. This finding challenges the view that WoS' coverage is based only on universalistic criteria (the dominant view in research evaluation), but also bring a more nuanced view to the claims of biases advanced by the most critical perspectives. Based on this finding, we suggest a more balanced assessment of data sources such as WoS while recognising both their strengths and weaknesses for the assessment of research.

[2] The definition of Latin America is ambiguous because it comprises a variety of countries that are economically and culturally diverse. We use the term here to indicate a geographical region that comprises Central America (including Mexico), South America, and the Caribbean.

2. Universalistic and particularistic views of WoS

This study focuses on Latin America, Spain, and Portugal as locations in which there is a considerable production of nationally edited journals that are not covered by WoS (Testa, 2011). To remedy this 'invisibility' in WoS, the dominant research policies in these regions have attempted to improve the editorial standards of their journals so that they are included in this database (Cetto & Hillerud 1995). These policies resemble recommendations by the founder of WoS, Eugene Garfield. For Garfield, by publishing in journals covered by WoS, which are mainly produced outside of Latin America, Latin American scientists could achieve international recognition for their work (Garfield 1976; 1995). Therefore, 'recognizing and providing for this elite would seem a logical way to efficiently and systematically improve a nation's science base' (Garfield 1995, p. 95).

In order to explore the understanding of WoS as an indicator of journal quality we use the concepts of universalism and particularism (Merton, 1973). Universalism refers to the appraisal of research based on merit regardless of ascribed characteristics of who produces the knowledge. Particularism means the influence of ascribed characteristics, such as nationality or language, in the appraisal of research. In the case of journal coverage, universalism means the selection of journals based on their intrinsic quality, i.e. their editorial standards and intellectual merit. Particularism means that the selection of journals is influenced by ascribed characteristics of the journals such as their language, geographical location or discipline.

Garfield's recommendation responds to a universalistic conception of the journal coverage of WoS. Operationally, Garfield explained the inclusion of journals in WoS through the use of citation indicators and fulfilment of editorial standards (Garfield 1980; 1985). The citation indicators are proxies for the scientific impact of a journal, and the editorial standards control for rigour in the review process of and publication in the journal. From this perspective, WoS 'generally represents the best science performed in any nation' (Garfield 1995, p. 88). The implication of this statement is that journals excluded from WoS are perceived as failing to meet the objective quality requirements, which renders them unsuitable for publication of excellent research.

However, different authors have criticised the selection of journals by WoS, arguing that its coverage is biased. The main criticism has been that WoS is under-representing some types of scientific research because it focuses mainly:

- on English language journals (Seglen 1997; van Leeuwen et al. 2001; Lillis & Curry 2010)
- on natural and engineering sciences (Yaalon, 1962, as cited by McDonald 1994, p.58; Velho & Krige 1984; Arvanitis & Chatelin 1988; Hicks 1999; Archambault et al. 2006; Larivière & Macaluso 2011).
- on journals produced in the UK, the Netherlands, and the US (Sanz, Aragón & Méndez 1995; Larivière, Haustein, & Mongeon 2015; Chavarro 2017, chapter 5).

The researchers here make the point that the indicators obtained from WoS give a partial view of scientific publications. However by expanding the coverage of WoS or using more databases, it becomes possible to obtain a more accurate representation of scientific production (Sivertsen & Larsen 2012).

From the argument above it can be conjectured that the coverage of WoS is particularistic. This means that it is potentially influenced by characteristics of the journals such as their place of publication, discipline, and language. In Latin America, perceptions of particularism in WoS have motivated the development of alternative journal databases such as Scielo and RedALyC (Chavarro, 2017, Chapter 3), which aim at giving visibility to research that is not usually covered by WoS. Similarly, many Latin American researchers have argued for more recognition of the knowledge produced in these journals (Packer & Meneghini 2007; Aguado-López et al. 2014; Alperín 2014; Vessuri, Guédon, & Cetto 2014; Bianco, Gras, & Sutz 2016).

Merton and other sociologists of science considered the possibility that in practice ‘both universalistic and particularistic standards might be *concretely* involved in the actual [as opposed to ideal] process of evaluation’ (Zuckerman & Merton 1971, p. 86; see also Cole & Cole 1973, p. 37). However, the above universalistic and particularistic perspectives on WoS reveal a tension between the two (Vessuri, Guédon, & Cetto 2014; Rafols et. al 2016). It is between the recognition of WoS as an appropriate tool to identify and reward excellent research

regardless of its context of production (the universalistic perspective), and WoS as an inadequate or incomplete tool that underestimates the value of journals not covered by it (the particularistic perspective). As the universalistic and particularistic views on WoS imply different policies to support excellence in research both arguments need to be confronted. We do so by examining to what extent these views are related to the coverage of WoS in the case of journals produced in Latin America, Spain, and Portugal.

3. Methodology

Previous studies of coverage analyses have focused on descriptive statistics of the number of journals in a database (mainly WoS and Scopus) in order to reach conclusions about their linguistic, geographical, and disciplinary balance (see, for instance, Braun, Glänzel & Schubert 2000; Archambault et al. 2006; Moya-Anegón et al. 2007; Wagner and Wong 2012; Aguado-López et al. 2014). However, these studies do not take into account the coverage criteria used by the databases as part of their analyses. This way of analysing coverage has been seen Garfield (1997) as a weakness in these studies because uneven representations of countries, disciplines, and languages in databases do not necessarily reflect biases. Concentration in a few journals can also be the result of a rigorous selection, because good editorial standards and 'research quality' could be missing in many journals published in Iberian and Latin American countries. For this reason, Garfield (1997) has called for more elaborate statistical analyses of coverage.

In order to address this gap, we performed a detailed analysis of individual journal characteristics through a logistic regression. The independent variables are characteristics of the journals (classified as universalistic and particularistic). The dependent variable is inclusion in WoS. The universalistic characteristics are *editorial standards*, *scientific impact*, and *journal age*. These characteristics are found in WoS as the criteria on which journals are included (Testa, 2014). Particularistic variables are *country*, *language*, *discipline, and GDP per capita of the country* of the journals.

3.1 Population and sample

The population studied is formed of journals active in the period 2000 - 2012 in the Latindex Catalogue covered by WoS, Scopus, Scielo, or RedALyC (n=1,954). Latindex[3] is the biggest catalogue of journals produced in Latin America, Spain, and Portugal. It provides basic cataloguing information and editorial standards of the journals and specifies the date on which the checking was done. This is performed by national research councils, libraries, and international networks such as the European Network for Information and Documentation on Latin America (REDIAL) by directly inspecting issues of the journals (Alonso-Gamboa & Russell 2012). Scopus is a competitor to WoS. Scielo and RedALyC are open access databases that include many journals produced in Latin America, Spain, and Portugal not covered by WoS (Aguado et al. 2014; Vélez-Cuartas, Lucio-Arias, & Leydesdorff 2015).

The sample for the study was formed of journals indexed by WoS in the period 2005 - 2012 and journals produced in Latin America, Spain, and Portugal which are indexed by Scopus, Scielo, and RedALyC that were active in the same period 2005 - 2012. The reason for including only indexed journals was to help ensure that the journals in the sample had been assessed for inclusion by at least one other journal database in addition to Latindex. The year 2005 was chosen because it marked the beginning of a six-year expansion in the coverage of WoS. During this period 2,906 journals were added to an initial base of 8,833 journals (Testa, 2011, p. 3). This expansion raised a discussion about the transparency of the criteria used by WoS for inclusion, suggesting that WoS was biased towards the inclusion of journals from specific countries (Gavel & Iselid 2008; Kosanović & Šipka 2013; Collazo-Reyes 2014; Utrobičić et al. 2014). In addition, only languages with more than ten journals were included. After these filters, there were 1,360 journals in the dataset, 270 of which were covered by WoS (20% of the population of journals identified).

3.2 Procedure

The initial and most recent date of coverage and the number of documents covered by each database were checked for each journal. Two groups were

[3] http://www.latindex.org/

classified: (1) journals indexed by WoS and (2) journals not indexed by WoS. Coverage was checked through the ISSNs of journals and also at the title level. Only journals with 100% match in their titles were included. Also, journals with 95% or more similarity in their titles[4] were checked manually against their web pages and WoS. After this check, journals that matched WoS' journal titles were classified as covered and other journals as excluded. Details on the start dates of the journals were collected from Latindex and all four databases (WoS, Scopus, Scielo, and RedALyC), as well as from the web pages of the journals. It is important to note that journals can have more than one version, such as paper and online versions. Only the versions of the journal that were covered by WoS, Scopus, Scielo, and RedALyC were included.

In addition to collecting data on coverage, Google Scholar was used as a third-party source to identify citation impact (a proxy for scientific impact) for all the journals gathered (Harzing & van der Wal 2009). It was chosen because it covers a wider range of journals than RedALyC, Scielo, WoS, and Scopus, thereby increasing the chances of finding citation information for the journals (more below). In order to gather information on as many journals as possible, we also used the software Publish or Perish (Harzing 2007). 937 journals were directly obtained from Google Scholar Metrics, and 423 through Publish or Perish.

3.3 Universalistic variables

Editorial standards. We selected the characteristics provided by Latindex that are closer to the editorial standards stated by WoS in their web page (Testa 2014). These are: timeliness (i.e. regular periodicity), peer review, internationality of authors and editors, and whether titles and abstracts are available in English. Table 1 shows these variables.

[4] For this procedure, the Levenshtein distance function was used. It calculates similarity as the minimum number of characters that have to be inserted, deleted, or replaced in order to transform one word into another word. The implementation was done in PhP language. The routine compared all titles and takes into account country, start year of the journal, and publisher, where available. The list was then manually checked.

Table 1 Selected variables based on editorial criteria of WoS

Label	Criterion	Description
PeerRes	Peer review of original research content	A stated requirement of originality and at least 40% of the documents published are research papers or original contributions that are externally peer reviewed according to the process mentioned in the instructions for authors.
ExAu	External authors	At least 50% of the works published must be from authors external to the organisation or publisher of the journal. In the case of journals published by associations this includes affiliations of the staff members and persons on the board of directors of the association.
EdOp	Openness of the editorial board	At least two thirds of the editorial board must be external to the organisation or publisher of the journal, confirmed by the institutional affiliations of the members.
Regul	Regularity	The periodicity is stated and there is timely publication of the journal in accordance with this statement.
AbsKeyLang	Abstract and keywords in two languages	The abstract and keywords are provided in at least two languages, mainly the original language and English.

Source: Latindex

h-Index. The h-Index is expressed as the *x* number of papers with at least *x* number of citations (Hirsch 2005). For instance, an h-Index of 15 for a journal means that it has published 15 papers with at least 15 citations. One problematic issue of this indicator is its size-dependency. This means that the calculation of the h-Index partially captures the citation impact of the journal and its size in terms of number of articles published. Many bibliometric analysts, e.g. Waltman and van Eck (2012), consider that size should not influence comparisons of journal scientific impact and recommend, instead, a size-independent indicator (Waltman & van Eck 2012, p. 409).

However, to use a size-independent indicator requires reconstructing the impact factor or number of citations for journals that are not covered by WoS. This would have required the very difficult effort of joining citations from WoS and Scopus, and Scielo (which are citation databases). Moreover it would have omitted

RedALyC, which is not a citation database. A possible solution is to use the 'cited reference search' available in WoS and Scopus but it is very inaccurate, restricts the citations to their journals, and requires manual identification. For these reasons this solution was not convenient.

Although not ideal because of its size-dependence, the h-Index indicator provided by Google Scholar is empirically correlated with WoS' impact factor (Bornmann & Daniel 2009; Harzing & van der Wal 2009; Franceschet 2010; Hodge & Lacasse 2011; Romero-Torres, Acosta-Moreno & Tejada-Gómez 2013). Based on its availability and correlation with the impact factor, the h-Index of journals (Braun, Glänzel & Schubert 2006) was chosen to indicate scientific impact in terms of influence (Martin and Irvine 1983).

High editorial standards (HighQ). This variable was used to group journals into those that fulfil all the criteria in table 1 and those that do not fulfil the criteria. It was used to test variation in the sample according to the number of editorial criteria met.

Journal age. This variable shows the time in years from the start of the journal until its indexing in WoS for journals covered by it, or until 2012 for journals not covered by it. It can be expected that established journals are likely to be included in WoS in comparison to new journals (Testa 2014). The age of the journals in the sample is based on their start date as it appears in Latindex.

3.4 Particularistic variables

Country of publication is the nation state where the publisher is located, as reported in Latindex. This variable has been seen as a source of bias in the coverage of WoS (Gibbs 1995; van Leeuwen et al. 2001). Even though some countries do not have journals indexed by WoS, they are kept in the dataset as they constitute part of the scientific production of academic community in Latin America, Spain, and Portugal.

Language. Language is also seen as a source for biased coverage in WoS (van Leeuwen et al. 2001; Lillis & Curry 2010). In this study it refers to the main language of the publication as found in Latindex. Only languages with more than

ten journals listed, after the use of the filters, were included in the analyses. These are Spanish, Portuguese, English, and Catalan.

Discipline. The third variable that has been seen as being prone to bias is the discipline of the journal, mainly in the social sciences (Larivière & Macaluso 2011; Sivertsen & Larsen 2012, p. 572). We use the main Frascati Field of Science (FoS) classification (OECD 2006): natural sciences, social sciences, engineering and technology, medical and health sciences, agricultural sciences, humanities, and multidisciplinary, as found in Latindex.

Gross Domestic Product per Capita (GDPPC2005). GDP represents the monetary value of all goods and services produced in a country and it is a measure of economic performance. We used the 2005 GDP in US thousand dollars per capita. This variable tests whether journals in wealthier economies, which constitute an important market for WoS, are more likely to be covered. The economic information for the countries in the dataset was gathered from the World Bank data series[5]. The normalisation per capita was used in order to make the GDP more comparable between countries. It has to be noted that this variable violated the linearity of the logit assumption. For this reason, we present the results using GDP per capita tertiles, with T1 identifying the lowest tertile.

3.5 Additional variables

During the course of this research additional variables were identified as potential determinants of indexing by WoS. These are: *type of organisation* and *type of publication*. They could have an impact on coverage by WoS given its focus on commercial publishers and journals published by learned societies. For this reason, they have been included in the analysis, despite not being usually addressed by the literature on coverage.

Type of organisation. This refers to the organisation that publishes the journal. Importantly, most of the journals in WoS are published by commercial companies (Larivière, Haustein & Mongeon 2015), whereas most of the journals in the sample are published by universities. Therefore, one could expect some positive relationship between commercial publishing houses and coverage by WoS. The

[5] http://data.worldbank.org/indicator

types of organisation found in Latindex are: governmental, international and educational organisations, learned societies, private companies[6] and research institutes.

Type of publication. Most of the publication venues in WoS are academic journals. In the sample, however, there are also academic magazines and trade journals. This variable was used to control for these types of publications.

3.6 Models

We tested three models for inclusion in WoS using logistic regression implemented in R language[7]. Logistic regression is suitable when the dependent variable is dichotomous, as is the case in this study (1= included, 0 = not included), and it is widely used in the bibliometrics literature (Thelwall & Wilson 2014, p. 964). Other statistical techniques require strict conditions to be met with multivariate normality and equal distribution of variance and covariance matrices. This is the case of discriminant analysis. In contrast, logistic regression is robust when the data does not meet such conditions (Hair, Tatham & Black 2005, p. 276).

The initial explanatory variables were: *editorial standards*, *scientific impact* (*h-Index*) of the journal, and *journal age* (universalistic criteria); *country*, *language*, and *discipline* (particularistic criteria); and *type of publishing organisation* and *type of journal (additional variables)* – model 1 in table 2. We also performed a second regression to differentiate journals fulfilling all editorial criteria (*HighQ*) from the others (model 2 in table 2), and a third regression in which we replaced the variable *Country* with 2005 GDP per capita tertiles (model 3).

Table 2 Models tested through logistic regression

Model #	Model

[6] A global trend is the acquisition of information services such as SSRN, publishers such as Woodhead Publishing, journal portfolios such as IP Publishing's, and other publication media by international publishing houses.

[7] https://cran.r-project.org/

1	WoS ~ Editorial standards + h-Index + Journal age + Language + Discipline + Country + Type of publishing organisation + Type of journal
2	WoS ~ HighQ + h-Index + Journal age + Language + Discipline + Country + Type of publishing organisation + Type of journal
3	WoS ~ Editorial standards + h-Index + Journal age + Language + Discipline + GDPPC2005 + Type of publishing organisation + Type of journal

3.7 Statistical analysis

A reduction of -2 times log-likelihood (-2LL) achieved by the models, and higher values of pseudo-R^2 (Hosmer & Lemeshow's R^2 and Nagelkerke's R^2) were used to assess the models (Field, Miles & Field 2012, 315–316; 765). Also, classification accuracy by chance (Bayaga 2010, p. 293) was used as a benchmark to measure the effectiveness of the models for the specific sample of journals. This measure is calculated as the sum of the squared proportion of records covered by WoS and the squared proportion of records not covered by it ($0.2^2+0.8^2 = 68\%$).

To examine the issue of journal coverage in WoS through the universalistic and particularistic variables, we applied some recommendations from the approach known as estimation thinking (Cumming, 2014; Schneider, 2015). Estimation thinking is a way of formulating research questions and analysing data that allows for quantitative measures rather than dichotomous indicators of significance, which is the practice in null hypothesis testing. In short, hypothesis testing asks whether a phenomenon happens, or whether there is a significant relationship (the "truth" value of a premise), while estimation thinking asks about the extent to which a phenomenon happens or the magnitude of relationships.

In line with estimation thinking, in this study we do not make use of *p-values*. The reasons for this (Cumming 2014) are, firstly, that our study is not based on a random sample; therefore p-values are inappropriate as indicators to generalise

to the entire population of journals. Secondly, *p-values* do not show the extent of uncertainty in the findings, which must be acknowledged and reported especially in exploratory studies such as ours (Cohen, 1995, p. 1002; Ioannidis 2005). Thirdly, *p-values* exhibit high variation according to the sample size and selection ranging from significant to non-significant (Cumming 2014). For these reasons, instead of the common practice of reporting *p-values* we provide confidence intervals. This allows subsequent studies to measure the reduction of uncertainty and thus build on these exploratory results.

In order to have a qualitative indication of the effect size of the different variables, we used odd ratios and the likeliness that they are positively or negatively related to the dependent variable (Batterham and Hopkins 2006). One way to do this is to assess the odd ratio observed in regards to the overlap between positive and negative values of its confidence interval. If there is substantial overlap, the information provided is ambiguous and it is harder to understand its effect. Otherwise, when there is no substantial overlap it is clearer that the effect size observed is positive or negative. In this paper we used the categories *positive*, *trivial*, and *negative* to describe each relationship within a 90% confidence interval. To these categories we assigned a probability based on the following thresholds: 0= most unlikely; 0.5% = very unlikely; 5% = unlikely; 25% = possibly; 75% = likely; 95% = very likely; 99.5% = most likely (Hopkins, 2007). For these calculations we used a spreadsheet developed by Hopkins (2007) [8] which assumes that if a log-normally distributed study is repeated many times it approximates a normal distribution (for an application of a similar approach see Petersen, Wilson, & Hopkins 2004). However, as our study is not based on a random sample, we used these numbers only as indicators and not as inferences about the journal population. The chances that an effect is positive, trivial, or negative depend on an estimation of the smallest worthwhile value. In this work we use 1.1 odd ratio as the smallest worthwhile value, as suggested by Hopkins (2007).

[8] Available at http://www.sportsci.org/resource/stats/xcl.xls

4. Results

In this section we present the regression results, followed by an analysis of the goodness of fit of the models, and an exploration of predicted probabilities. According to the data, journals are concentrated on Spain, Brazil, Colombia, Mexico, Chile, and Argentina. These countries produce 85% of the journals in the sample. In terms of disciplines, the social sciences and medical and health sciences are the most prominent (62% of the journals). Spanish prevails as the main language for all journals produced (81%). It has to be noted that there are no journals in Catalan covered by WoS in the sample.

Regarding editorial standards, the ones with the highest variability are *editorial openness* (*EdOp*) and *peer review* (*PeerRes*). They are met by 66% and 73% of the journals, respectively. These two variables are related to the control of quality of the works published and the diversity in editorial policies. The other editorial variables exhibit a less obvious contrast and are met by at least 80% of the journals. Compliance with all standards, however, is shown by less than half of the journals. Table 3 shows the distribution of all the categorical variables. Table 4 shows the descriptive statistics for the numerical variables. The sample has diverse observations in terms of *h-Index* and *journal age*. Important differences are seen between the maximum and minimum values for these variables.

Table 3 Categorical variables

Country	**WoS-Indexed journals**	**Total journals**
Dominican Republic	0	2
Ecuador	0	3
Uruguay	0	3
Puerto Rico	1	6
Peru	0	14
Costa Rica	0	19
Portugal	3	36
Cuba	0	43
Venezuela	7	84
Chile	31	99
Argentina	8	102
Mexico	25	161
Colombia	7	164
Brazil	80	272
Spain	108	352
Discipline	**Indexed**	**Total**
Engineering and technology	14	60
Agricultural sciences	21	74
Arts and humanities	30	85
Natural Sciences	41	142
Multidisciplinary	19	153
Medical and Health sciences	59	311
Social sciences	86	535
Language	**Indexed**	**Total**
Catalan	0	**11**
Portuguese	19	**115**
English	53	**134**
Spanish	198	**1,100**
Editorial Standards		
Peer review	**Indexed**	**Total**
No	71	364
Yes	199	996
External authorship	**Indexed**	**Total**
No	3	67
Yes	267	1,293
Editorial openness	**Indexed**	**Total**
No	69	457
Yes	201	903
Abstract keywords in two languages	**Indexed**	**Total**
No	32	202
Yes	238	1,158
Regularity	**Indexed**	**Total**
No	38	232
Yes	232	1,128
Type of publication	**Indexed**	**Total**
Magazine	14	**80**
Trade journal	38	**201**
Scholarly journal	218	**1,079**
Type of organisation	**Indexed**	**Total**
Government/int org.	10	62
Private company	23	83
Research Institute	31	134
Scientific society	83	351
Educational Organisation	123	730
high quality standards (HighQ)	**Indexed**	**Total**
Yes	126	589
No	144	771
GDP tertile	**Indexed**	**Total**
T1	7	243
T2	126	562
T3	137	555
Total	**270**	**1,360**

Source: Own elaboration based on Latindex, WoS, Scopus, Scielo, and RedALyC

Table 4 Numerical variables

	Max	Min	Average	Std. Dev
h-Index	**39**	**0**	**5.8**	**5.1**
Not indexed	34	0	4.9	4.2
Indexed	39	0	9.4	6.6
JournalAge	**160**	**2**	**24.0**	**17.9**
Not indexed	160	2	23.5	17.5
Indexed	149	3	26.2	19.2

Source: Own elaboration based on Latindex, WoS, Scopus, Scielo, and RedALyC, and Google Scholar

4.1 Regression results

Table 5 shows the logistic regression results using exponential coefficients and confidence intervals (in brackets). To repeat,three models were calculated. The first model included all disaggregated variables. The second model substituted the individual editorial standards for a variable aggregating the journals which meet all five editorial standards. Finally, the third model aggregated countries according to GDP per capita tertile.

The three models show the extent to which universalistic and particularistic variables are related to being covered by WoS. Starting with the universalistic variables, the biggest positive effect is given by *external authorship*[9]. The odds for journals meeting this standard is 2.7 (CI 0.9 to 7.7) times that of journals without it. Another positive effect is shown by the variable *editorial openness*. The odds for journals fulfilling this standard are 1.4 (CI 0.9 to 2) times higher than for journals not complying with it. *H-Index* and journal age also had positive relationships with WoS coverage. For each unit increase in *h-Index* a journal increases its odds of being covered by 1.18 (CI 1.15 to 1.24) times. Although its effect might seem small, given that in theory the h-index of a journal can increase substantially, this variable could have a large effect on indexing. Conversely, journal age is likely to have a trivial effect on indexing as its change in odds for every year is 1.01 (CI 1 to 1.02). For other universalistic variables it was harder to establish a positive or negative effect. For instance, when considered alone,

[9] When describing results for variables that were used in different models, we averaged the mean effect sizes and reported the minimum and maximum confidence interval values among the models as an estimation of the widest margin of error. Meta-analysis techniques, which allow which mitigate uncertainty introduced by measurement error, were not used because the observations are not independent (Cumming, 2012, chapter 7).

peer review, regularity, and Abstract/keywords in two languages could have negative or positive effects. However, when journals meet all editorial standards (*HighQ*), their odds are 1.7 (CI 1.3 to 2.2) times higher than journals failing to meet all standards.

In regards to particularistic variables, the biggest positive effects are seen for GDP: The odds of being included by WoS for journals in the middle and top tertiles are respectively 8 (CI 4 to 16) and 12 (CI 6 to 24) times higher than for journals in the lowest tertile. These results are further confirmed by the lower odd ratios found for journals from Argentina, Colombia, Brazil, Mexico, Venezuela, and Portugal in comparison to journals from Spain: the negative effect size of these journals range from 0.6 (CI 0.4 to 0.9) for Brazilian to 0.08 (CI 0.04 to 0.17) for Colombian journals. This means that they are between 2 and 12.5 times less likely to being covered than Spanish journals.

In terms of *discipline*, the clearest effect sizes are seen for the social sciences, health and medical sciences, and multidisciplinary sciences. Journals from these disciplines are less likely than journals from the natural sciences to be included by WoS. Their odds are between 2.5 and 3.3 times lower than journals from the natural sciences. Conversely, the odds of the arts and humanities are 2.13 (CI 0.85 to 3.72) times higher than the natural sciences journals although the result is more uncertain.

With regards to *language*, English shows a likely positive effect on indexing of 1.5 (CI 0.96 to 2.4) times the odds of Spanish language journals, while Portuguese has a likely negative effect of 0.6 (CI 0.3 to 1.2), i.e., around 1.6 times lower odds than Spanish journals. Finally, journals produced by private companies and research institutes seem to have some advantage over journals produced by universities. The odds of being included by WoS are 1.7 (CI 0.93 to 3.16) for private companies and 1.5 (CI 0.8 to 2.5) for research institutes.

Table 5 Results of the logistic regression

	Dependent Variable: Indexed by WoS			
Variables	**Model 1**	**Model 2**	**Model 3**	**Qualitative overall effect size**
Editorial Standards				
Peer review	0.97 (0.7,1.34)		1.00 (0.73,1.37)	Unclear
External authorship	2.68 (0.93,7.74)		2.70 (0.95,7.69)	Likely positive
Editorial openness	1.31 (0.94,1.82)		1.47 (1.07,2.02)	Likely positive
Regularity	1.15 (0.77,1.71)		1.15 (0.78,1.70)	Unclear
Abstract / keywords in two languages	1.20 (0.77,1.85)		1.36 (0.89,2.10)	Unclear
Journal Characteristics				
h5index	1.18 (1.15,1.22)	1.18 (1.15,1.22)	1.2 (1.17,1.24)	Most likely positive
journalAge	1.01 (1.01,1.02)	1.01 (1.01,1.02)	1.01 (1.00,1.02)	Most likely trivial
Magazine	1.44 (0.79,2.62)	1.41 (0.77,2.58)	1.48 (0.83,2.66)	Unclear
Trade Journal	0.79 (0.53,1.18)	0.77 (0.52,1.16)	0.86 (0.58,1.27)	Unclear
Government/int org.	1.41 (0.67,2.94)	1.35 (0.65,2.82)	1.33 (0.66,2.67)	Unclear
Private Company	1.61 (0.92,2.81)	1.62 (0.93,2.82)	1.84 (1.08,3.16)	Likely positive
Research Institute	1.55 (0.95,2.53)	1.54 (0.94,2.52)	1.31 (0.83,2.05)	Likely positive
Scientific society	0.82 (0.57,1.18)	0.8 (0.56,1.15)	0.86 (0.61,1.23)	Unclear
Discipline				
Agricultural sciences	1.14 (0.61,2.14)	1.11 (0.59,2.07)	1.18 (0.64,2.17)	Unclear
Arts and humanities	1.57 (0.88,2.8)	1.52 (0.85,2.71)	2.13 (1.22,3.72)	Likely positive
Engineer. and tech.	1.24 (0.6,2.55)	1.26 (0.62,2.57)	1.41 (0.70,2.85)	Unclear
Med. and health sci.	0.3 (0.18,0.49)	0.29 (0.18,0.47)	0.34 (0.21,0.55)	Most likely negative
Multidisciplinary	0.26 (0.14,0.46)	0.25 (0.14,0.44)	0.30 (0.17,0.53)	Most likely negative
Social sciences	0.35 (0.22,0.54)	0.33 (0.21,0.51)	0.40 (0.26,0.62)	Most likely negative
Language				
English	1.45 (0.9,2.33)	1.53 (0.96,2.43)	1.48 (0.97,2.26)	Likely positive
Portuguese	0.62 (0.34,1.13)	0.64 (0.35,1.17)	0.61 (0.36,1.03)	Likely negative
Country				
Argentina	0.19 (0.1,0.38)	0.18 (0.09,0.36)		Most likely negative
Brazil	**0**.55 (0.35,0.87)	0.56 (0.36,0.89)		Very likely negative
Chile	0.75 (0.46,1.22)	0.68 (0.42,1.1)		Unclear
Colombia	0.08 (0.04,0.17)	0.08 (0.04,0.16)		Most likely negative
Mexico	**0**.39 (0.24,0.62)	0.39 (0.25,0.63)		Most likely negative
Portugal	**0**.22 (0.07,0.68)	0.22 (0.07,0.69)		Very likely negative
Venezuela	**0**.30 (0.14,0.61)	0.30 (0.15,0.63)		Very likely negative
Other variables				
HighQ		1.66 (1.25,2.20)		Very likely positive
GDPPC Tertile T2			7.92 (3.97,15.81)	Most likely positive
GDPPC Tertile T3			12.27 (6.17,24.42)	Most likely positive
Constant	**0.06 (0.02,0.22)**	**0.2 (0.11,0.35)**	**0 (0,0.01)**	
Observations	1,360	1,360	1,360	
Hosmer & Lemeshow R^2	0.26	0.26	0.23	
Nagelkerke R^2	0.36	0.36	0.33	
-2 Log Likelihood	1,007.82	1004.72	1,038.72	

Note 1: Reference categories: Spain for country, Spanish for language, natural sciences for discipline, scholarly journal for type of journal, educational organisation for type of organisation. Probabilities based on a minimum worth value of 1.1 odds ratio.

Note 2: only countries and languages with significant coefficients are shown. Countries excluded from the table are: Chile, Costa Rica, Cuba, Dominican Republic, Ecuador, Peru, Puerto Rico, and Uruguay. Language excluded: Catalan. Each one of the three models is specified in table 2.

4.2 Further interpretation of regression results based on examples and predicted probabilities

Some examples help to expand the results obtained from the regression. When exploring countries, the most extreme instance is that of journals such as Cuban, which are completely absent from WoS. However, there are some Cuban journals with h-Index and age equal to, or above, other journals covered by WoS. This is the case of the *Revista Cubana de Salud Pública*. This journal is 18 years old and has an h-Index of 14 (6 points above average in its field of medical and health sciences). WoS indexes 41 journals with equal or lower h-Index.

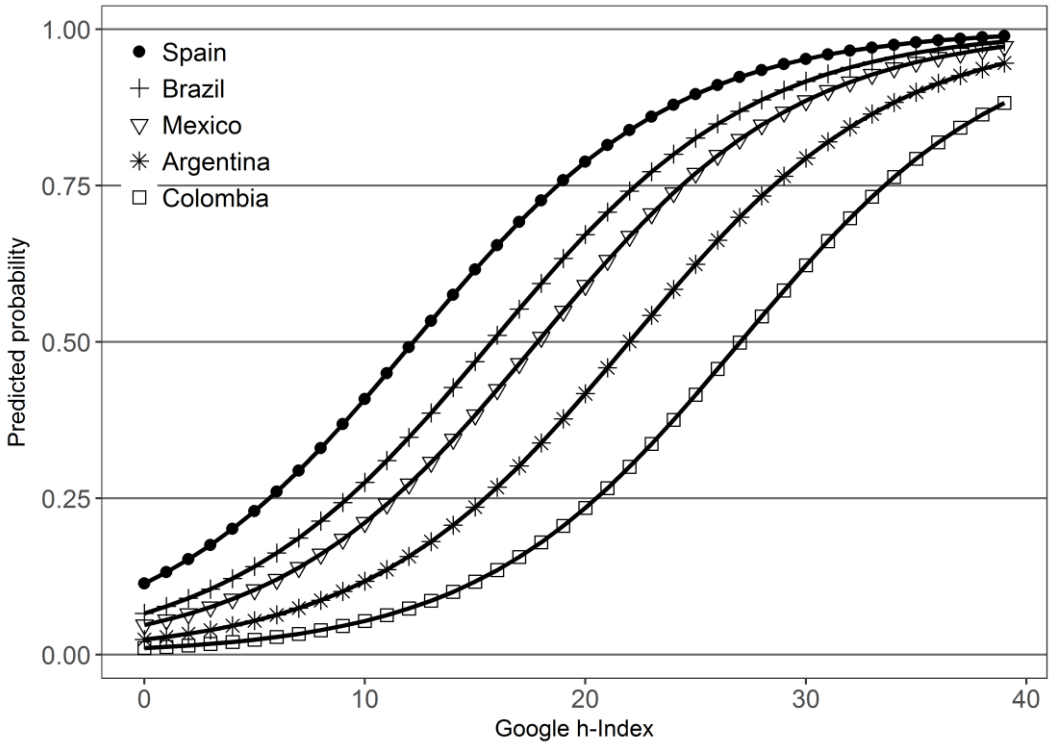
An interesting case is that of journals in a similar discipline that have comparable universalistic criteria but different indexing status. For instance, *Cadernos de pesquisa Fundação Carlos Chagas* is a Brazilian journal on Education that has been published since 1971 and has an h-index of 12. The Spanish journal *Revista de Educación (*Madrid*)* started in 1952 and has an h-index of 11. Despite the similarity of their indicators, the Spanish journal is indexed[10] while the Brazilian is not.

Other cases could be mentioned, such as the case of 21 Brazilian journals in the social sciences that despite having a higher h-Index than Spain's average in the same field (avg = 8) are not indexed. This applies more generally to journals in the social sciences. They have a lower probability of being indexed by WoS as compared to journals in the natural sciences, despite similar average indicators on h-Index (8 for social sciences and 7 for natural sciences) and age (30 for social sciences and 25 for natural sciences). Below we present a general overview to further explore the above observations. Figure 1 shows graphically the predicted probability of inclusion in WoS at every level of h-Index for the top five producers of journals in the sample, keeping other variables at their means. It can be observed that other things being equal, journals produced in Spain are more likely than others to be covered by WoS at every level of h-index. It has to be noted that the probabilities of journals from Spain, Brazil, and Mexico in the sample tend to converge at the highest levels of h-Index. However, Colombia and Argentina show lower odds even at these h-Index levels.

[10] This journal has an impact factor in 2013 of 0.2 (Revista de Educación 2016)

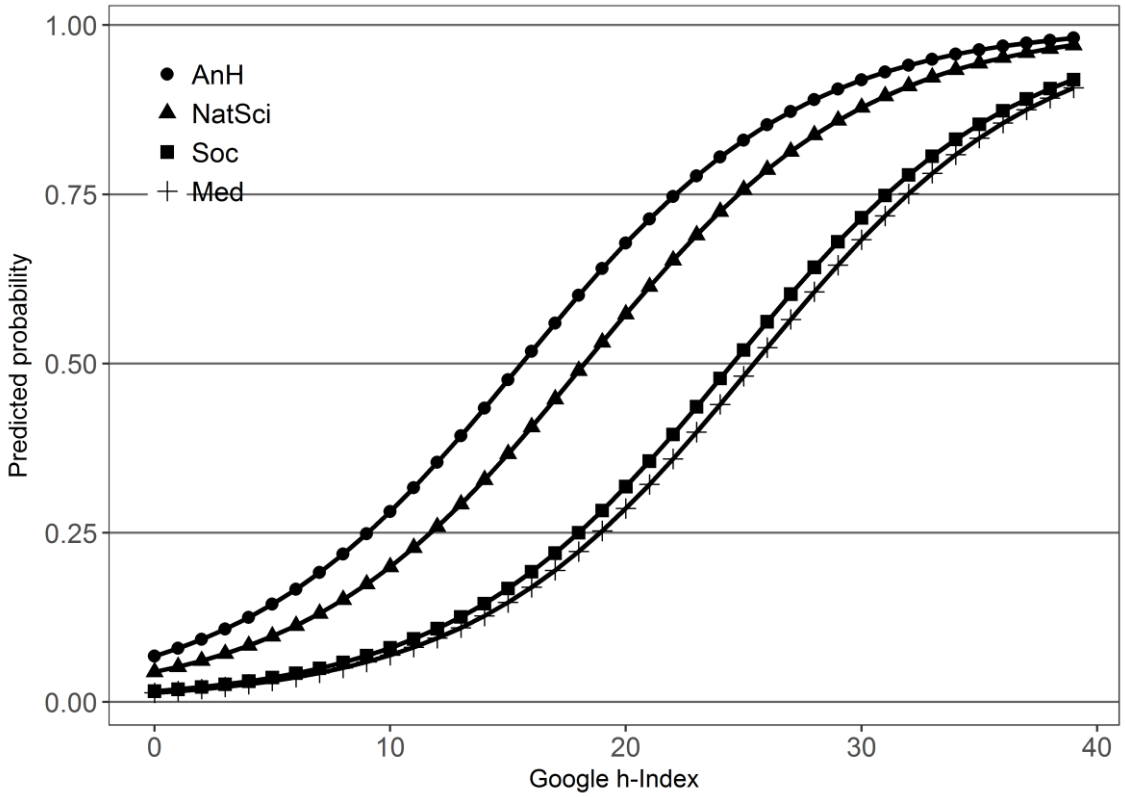
Figures 2 and 3 show differences in probability of being covered for disciplines and languages respectively. It can be seen that journals from arts and humanities and natural sciences have higher probabilities of being covered by WoS at every level of h-Index than journals from the social sciences and health and medicine. Meanwhile, English dominates as compared to Spanish and Portuguese. Finally, table 6 provides predicted probabilities by discipline and country, keeping other variables at their means. It can be seen that the probability of a journal from a certain discipline varies by country and vice versa.

Figure 1 Predicted probability of inclusion by WoS at every level of h-Index for the top five producers of journals in Latin America, Spain, and Portugal



Source: Own elaboration based on regression results from model 2, using software package R

Figure 2 Predicted probability of inclusion by WoS at every level of h-Index for journals from selected disciplines in Latin America, Spain, and Portugal



Source: Own elaboration based on regression results from model 2, using software package R

Figure 3 Predicted probability of inclusion by WoS at every level of h-Index journals published in English, Spanish, and Portuguese in Latin America, Spain, and Portugal

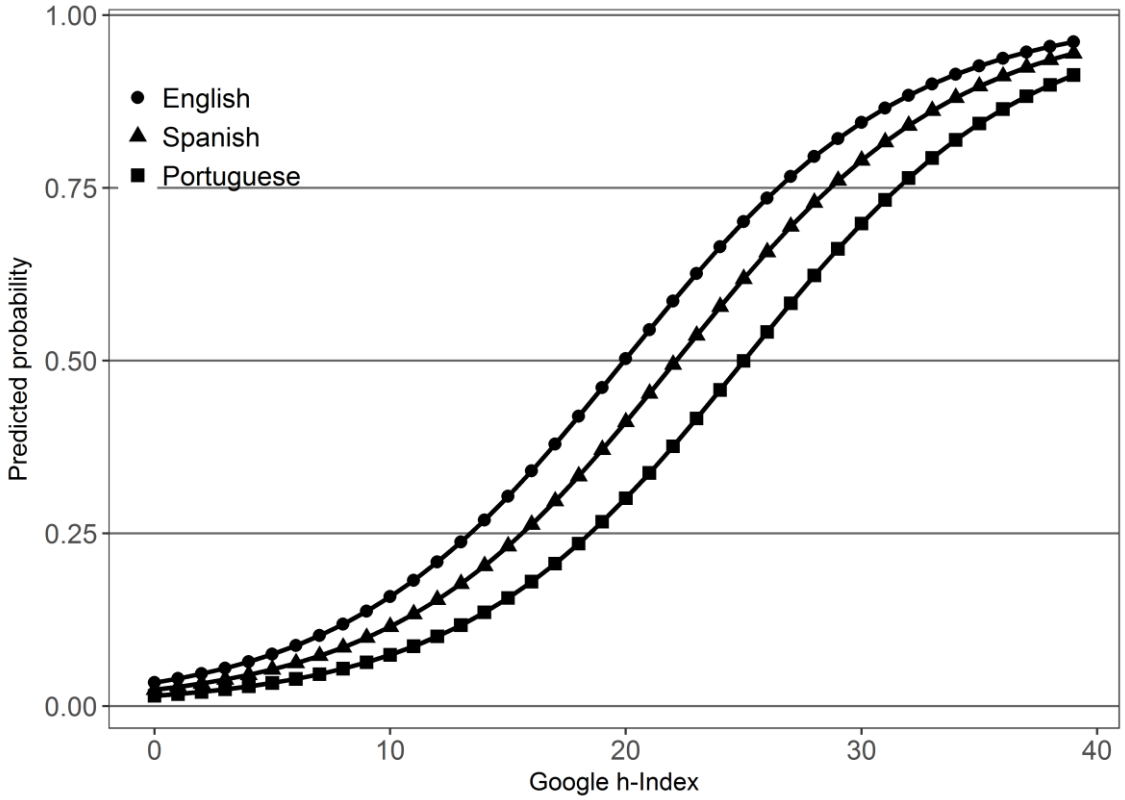


Table 6 Predicted probability of inclusion by WoS for the top five producers of journals according to disciplines

	Country				
Discipline	Spain	Brazil	Mexico	Argentina	Colombia
Agricultural sciences	0.46	0.32	0.25	0.14	0.07
Arts and Humanities	0.54	0.40	0.32	0.19	0.09
Engineering	0.48	0.34	0.27	0.15	0.07
Medicine	0.18	0.11	0.08	0.04	0.02
Multidisciplinary	0.16	0.10	0.07	0.04	0.02
Natural Sciences	0.43	0.29	0.23	0.13	0.06
Social sciences	0.21	0.13	0.09	0.05	0.02

Source: Own elaboration based on regression results from model 1, using software package R

4.3 Goodness of fit and accuracy of the models

Models 1 and 2 have an accuracy of 77% and model 3 has an accuracy of 76%, which constitute an improvement over an estimated accuracy by chance of 68%. Pseudo-R^2 measures are between 23% and 36%, and models 1 and 2 produced the highest reductions in -2LL. All the measures show that the three models improve classification by chance and are useful in understanding the relationships between universalistic and particularistic variables with regards to coverage by WoS.

4.4 Robustness

The results presented were shown to be robust after tests of variance inflation factor (VIF), linearity of the logit, and outlier detection (see supplementary material). Following Hosmer, Lemeshow and Sturdivant (2013, pp. 197, 360) outliers were detected by looking at standardised residuals greater than 3 or less than -3, as well as influential observations with Cook's distance greater than 1. The accuracy of the models improved after controlling for outliers by 3%, reaching approximately 80%. The coefficients remained stable in direction although they changed in strength for countries as most of the outliers were concentrated on countries with few indexed journals. After checking the outliers for correctness of their data, we confirmed that they are valid observations of journals produced in Latin America, Spain, and Portugal. In addition, all observations fell within accepted VIF and tolerance values of less than 10, indicating that multicollinearity is not a concern in this sample. For these reasons the models were kept without modification.

5. Discussion and conclusions

The findings in this article showed the extent to which different universalistic and particularistic variables are related to the inclusion of journals in WoS: given two journals from the same country, discipline, and language, universalistic characteristics such as h-index may have a large positive effect on their inclusion. However, given two journals with equal h-index, age, and editorial standards, one may have a large advantage over the other because of its place of publication, discipline, language or other ascribed characteristics.

Based on the results, it is possible to say that research assessments that rely too heavily on the assumption that WoS (and other bibliographic databases) assess journals only on the basis of universalism, fail to acknowledge that some journals are judged “more equally” than others by these databases. This confirms for journals what Zuckerman and Merton (1971, p. 86) and Cole and Cole (1973, p. 37) observed for peer review and appointment in academic positions: that both universalistic and particularistic standards may be involved in the evaluation of science (in this study we showed the degree to which this happens in the inclusion of journals in a well-established database). For this reason, attributing values of ‘quality’ only to journals based on assumptions of universalism in the assessment of science is misleading.

Our study showed different effect sizes for universalistic and particularistic variables. With regards to the positive effect size of h-Index, it was noted that it can be large in theory because this indicator can be increased by the number of papers and citations. However, given that journals in Latin America, Spain, and Portugal do not usually have high h-Indices and that increasing citation-based indicators has proven very difficult for non-English language journals, it is unrealistic to expect a qualitative jump on this indicator. Such an expectation is also exacerbated by the fact that these journals are published mainly by universities located in low and middle income countries. The option, in terms of universalistic characteristics, is for editors to increase the editorial standards of journals with the expectation that this will improve their chances of being covered by WoS. In fact, improvement of editorial standards has been one of the main objectives of regional initiatives such as Latindex (Cetto, Alonso-Gamboa & Cordoba Gonzalez 2010). Yet, as we have shown in model 2, fulfilling all editorial standards does not yield an improvement in odds comparable to, for instance, being produced in Spain.

Despite the above findings, WoS is promoted by policy makers in regions such as Latin America, and by WoS itself, as a point of reference for editors to improve editorial standards. This implies that they are being oriented in the direction of WoS’ particular coverage distribution. This coverage distribution, as it has been shown, favours certain types of journals. The negative coefficients for all countries as compared to Spain, coupled with the small but positive effect size of

English as compared to Spanish and Portuguese suggest that WoS is oriented towards specific research communities that are not the focus of the majority of journals in Latin America, Spain, and Portugal. Furthermore the advantage of Spanish over Portuguese and the different direction and effect sizes of the coefficients for disciplines reinforces this observation. Therefore, being covered by WoS is to a good extent an indicator of community belonging or readership and less an indicator of quality.

An objection to this argument could be that arts and humanities journals in the sample have higher odds on average than natural sciences journals, which does not seem to support the global analyses of coverage of WoS (see, for instance, Chavarro, 2017, chapter 5). As a preliminary answer, it could be argued that these results show some effect of the particular disciplinary composition of communities in Latin America, Spain, and Portugal on the coverage of WoS. This effect may be due to the market opportunity that emerging economies represent for database companies. In relation to this point, the large positive effect of GDP on indexing suggests that coverage decisions such as which disciplines to include and the extent of that inclusion (see Testa 2011) are affected by commercial interests. A more thorough study on how database coverage and market expansion are linked in the case of emerging economies could help to better understand this issue, and to predict whether the disciplinary distribution of journals in these databases is likely to change substantially in the near future.

Other explanations include international pressure from countries with a well-established scientific tradition such as Germany to cover more journals from non-traditional disciplines and changes of guidelines from new owners of the databases, or internal pressures from selection committees of journals that may recommend expansion of content in WoS. In any case, the most likely explanation for changes in coverage is a combination of factors that have less to do with journal ‘quality’ than any of the aforementioned reasons.

A relevant finding that helps to substantiate the above point is that private companies and research institutes have higher odds than universities to be covered by WoS[11]. Latin America has a journal publishing tradition that dates

[11] We thank an anonymous reviewer for bringing this issue to our attention.

back to the 1960s. Since then, most journals have been produced by universities and made available openly, even before the term “open access” became popular. This contrasts with the US or the Netherlands in which big publishers play a dominant role.

Although the effect size of private companies in our study is small as compared to other effect sizes, it could signal the beginning of a radical change in the journal publishing business in Latin America, Spain and Portugal. In these regions, publishing houses such as Emerald, Taylor and Francis, and Elsevier are acquiring journals like CLADEA (a business and management journal produced by Latin American business and management faculties). They also provide editorial services to journals in the region, which probably increases their publication costs. There are also some pharmaceutical companies, and other private organisations that produce journals classified in this category. By way of speculation, the result might indicate the emergence of a private business model that could become dominant in the region if it is more recognised than public business models by research evaluation and international organisations. The question is whether this private model will continue to serve the same research community and readership as the traditional public model, and what changes in the content of research published this implies.

Empirically, our study has contributed to a more detailed understanding of the distribution of journals in WoS, which is one of the most important global data sources for research evaluation. Significantly, our analysis expands conventional coverage analyses because it tests the criteria for coverage, as prompted by Garfield (1997), rather than describing it only on the basis of the concentration of journals.

With respect to methodology, we used estimation thinking instead of conventional null hypothesis testing [12] . Estimation thinking allowed us to see some relationships that were absent in our initial analysis based on null hypothesis testing. Specifically, the use of *p-values* to assess statistical significance of relationships in our initial analysis underestimated the effect sizes of the variables *language*, *private companies, research institutes, arts and humanities, external*

[12] This was suggested by an anonymous reviewer, to whom we are indebted.

authorship, and editorial openness. Confidence intervals were more helpful in unveiling these relationships and allowed us to provide a more robust argument and interpretation of the data. Moreover, by providing confidence intervals other studies can build on our results to increase the accuracy of indicators through meta-analysis (Cumming 2012).

It is important to note that the results of this study apply to the sample of journals in Latin America, Spain, and Portugal. A global scale study is needed to confirm the results presented here, but the information required for this global analysis is not publicly available as WoS does not publish the reasons for the inclusion or exclusion of each journal. Because of this, replicating the criteria for the global coverage of WoS remains a challenge to be addressed by future research. However, some studies suggest that our findings apply to other regional settings, such as Eastern Europe and some Nordic countries (Kosanović & Šipka 2013; Utrobičić et al. 2014; Sivertsen, 2016). Also, it has to be noted that the variables included in this study by no means exhaust all the variables that are related to coverage decisions. For instance, the content of a journal may have a large influence on its coverage by databases (Rafols, I., Ciarli, T., & Chavarro, D. 2015)[13].

This paper contributes toward the literature on research evaluation, specifically on the scrutiny of indicators (Hicks et al. 2015) and the study of research excellence (Vessuri, Guédon, and Cetto 2014; Bianco, Grass, & Sutz 2016). With regards to the study of research excellence, our article advances and elucidates the universalistic and particularistic arguments that are considered in research evaluation when based on journals. To repeat, research assessments that use WoS as a universalistic tool (Bianco, Grass, & Sutz 2016) to identify high quality journals in the region ignore asymmetries in coverage and reproduce them (Aguado et al. 2014; Packer & Meneghini 2007; Rafols, Ciarli, & Chavarro 2015).

An initiative to reduce these asymmetries is the inclusion of Scielo Citation Index into WoS' interface, with the expectation that having access to Scielo journals from WoS will give them more "visibility" to a wider research community. Although this may be possible, the quest for visibility comes at the cost of "own journal

[13] We thank an anonymous reviewer for this insight.

inclusion criteria independence" (Vélez-Cuartas, Lucio-Arias and Leydesdorff, 2015, p. 36). For instance, Scielo Brazil established a percentage of original papers by discipline that require them to be written in English as part of a criteria for indexing journals in their database (Scielo, 2015, p. 16). Although it is not clear if this requirement is related to an agreement with WoS, a question arises about how much these kind of *particularistic* criteria violate the autonomy of journals and authors and push them into a subordinate integration for the sake of "international visibility".

Vessuri, Guédon, & Cetto (2014) have argued that policies that equate excellence with publication in journals by WoS may increase the reputation of some scientists, but have the potential to decrease the reputation of the majority of researchers. In a similar way, we argue that policies that equate journal quality with coverage by WoS may increase the number of journals and publications in WoS, but decrease the recognition of the science published in other journals. This is detrimental to research communities that produce a substantial number of papers in journals that are not covered by WoS but collectively provide an important communication platform/arena for their research (Chavarro, Tang & Rafols 2016).

It is useful to note that some countries are explicitly not using WoS for national research evaluation due to some of the reasons above and especially because of its lack of completeness of coverage (Sivertsen 2016). For instance, Portugal, Belgium (Flanders), Denmark, Finland, and Norway[14] are using what is known as the "Norwegian model". This model was developed by Sivertsen in collaboration with representatives of Norwegian universities, and commissioned by the Norwegian Ministry of Education and Research and the Norwegian Association of Higher Education Institutions (Sivertsen, 2010). The Norwegian model attempts coverage of all peer-reviewed literature beyond the coverage of commercial databases, and to produce an indicator that is used to compare outputs across disciplines. Also, In the Netherlands there is an ongoing experiment on self-assessment of arts and humanities and social sciences departments, which may be a starting point to alternative ways of measuring

[14] We thank an anonymous reviewer for this comment.

intellectual contributions in these areas (Spaapen, 2014). These examples illustrate that it is possible to adopt different ways of understanding and measuring scientific production for policy making purposes without an over-reliance on commercial databases.

As a concluding remark, countries or regions that consider adopting or adapting the Norwegian or Dutch model, or experimenting with their own, will want to establish what would be a good publication mix for their research evaluation policy. In particular alternative models will need to address to what extent they should focus on linking research communities to global networks versus focusing on the needs of regional, local or national stakeholders. The first goal may be achieved by publications in journals edited by 'global' research networks (including but not limited to) the ones covered by WoS or Scopus. The second aim may be best served by including publications in journals which communicate research related to potential socio-economic benefits to a specific country or in issues under-represented in the dominant databases (Chavarro, Tang & Rafols 2016). By considering these two aspects in consultation with research communities, as in the case of Norway, research policies will have the potential of producing more informed research assessments that recognise the actual diversity of knowledge production and dissemination, instead of restricting the development or evolution of academic publishing.

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Supplementary material

Test of assumptions of logistic regression

Linearity

The numeric variables were tested for the assumption of linearity of the logit (table A1). The logs of the variables are not significant, showing that the assumption is not violated.

Table A1 Test of linearity of numeric variables

	Coefficient	Std. E	Error	t
(Intercept)	-0,371	0.1076	-3,45	**<0.001**
h-Index	0.25	0.12	2.06	>0.05
journalAge	0.08	0.04	1.88	>0.05
Log h-Index	-0.03	0.04	-0.944	>0.05
Log journalAge	-0.02	0.001	-1.623	>0.05

Multicollinearity

Finally, multicollinearity was tested by using the VIF test, which shows how much the estimation of coefficients is inflated by multicollinearity. The VIF test shows that multicollinearity is not a concern as none of the values of the statistic is greater than 10.

Table A3 VIF test for multicollinearity (model 1)

Variables	VIF	Df	Tolerance VIF^(1/(2*Df))
PeerRes	1.13	1	1.06
ExAu	1.02	1	1.01
EdOp	1.13	1	1.06
Regul	1.09	1	1.04
AbsKeyLang	1.04	1	1.02
h5index	1.07	1	1.03
journalAge	1.10	1	1.05
typePubClean	1.05	2	1.01
typeOrgClean	1.23	4	1.03

Table A4 VIF test for multicollinearity (model 2)

Variables	VIF	Df	Tolerance VIF^(1/(2*Df))
PeerRes	1.19	1	1.09
ExAu	1.04	1	1.02
EdOp	1.24	1	1.11
Regul	1.13	1	1.06
AbsKeyLang	1.16	1	1.07
hindex	1.38	1	1.17
journalAge	1.16	1	1.07
typePubClean	1.23	2	1.05
discipline	2.14	6	1.06
language	2.22	3	1.14
typeOrgClean	1.89	4	1.08
Country	3.48	14	1.05

Table A5 VIF test for multicollinearity (model 3)

Variables	VIF	Df	Tolerance VIF^(1/(2*Df))

h5index	1.38	1	1.18
journalAge	1.16	1	1.08
typePubClean	1.22	2	1.05
discipline	2.06	6	1.06
language	2.12	3	1.13
typeOrgClean	1.85	4	1.08
country	3.33	14	1.04
HighQ	1.19	1	1.09

Table A6 VIF test for multicollinearity (model 4)

Variables	**VIF**	**Df**	**Tolerance VIF^(1/(2*Df))**
PeerRes	1.16	1	1.08
ExAu	1.03	1	1.02
EdOp	1.19	1	1.09
Regul	1.11	1	1.05
AbsKeyLang	1.13	1	1.06
h5index	1.31	1	1.14
journalAge	1.13	1	1.06
typePubClean	1.18	2	1.04
typeOrgClean	1.61	4	1.06
discipline	1.92	6	1.06
language	1.47	3	1.07
GDPPC2005Tertile	1.34	2	1.08

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