

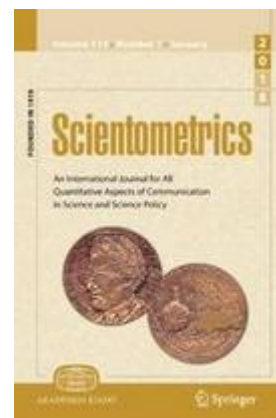
The presence of the Encyclicals in Web of Science: a bibliometric approach

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Abstract The encyclicals, also known as papal letters, are documents that have a profound influence on the Catholic Church and, as a result, on the West. This research seeks to explore the impact and areas of influence of these documents according to the citations and length they have had in publications indexed in Web of Science. In addition to the nature and citations of the encyclicals spanning the pontificates of Leo XIII and Francis I, this study analyses the characteristics of the citing publications, such as subject matter, co-cited authors as well as the institution and country of publication. The production of encyclicals according to pontificate is irregular. This study shows that encyclicals on social themes are the ones with the greatest impact on science, particularly *Rerum Novarum* and the encyclicals commemorating it. Beyond the fields of Theology and Philosophy, encyclicals are used as referents in multiple themes, particularly in today's great social themes of economics, politics, war, well-being, social inequality and human development. Likewise, the fact that the papal letters are co-cited together with great thinkers, such as Adam Smith, Karl Marx, Max Weber, Martin Heidegger, or theologians like Karl Rahner, indicates their importance. Lastly, Catholic universities are observed to be the principal source of studies in which the encyclicals provide theoretical referents.

Keywords: Encyclicals; Web of Science; Theology; Non-source documents; Bibliometric analysis.

1. Introduction

On May 24 2015, Pope Francis I published *Laudato Si*, an encyclical that sets out the Catholic Church's official stance on ecological considerations, warning humanity of the consequences of a consumerism that shows little regard for the environment. This papal letter attracted world-wide media attention and almost immediately had a far-reaching impact on the scientific literature of the Humanities (Castillo 2016; Introvigne 2016; Peters 2016; Ulanowicz 2016; Vallier 2016), the Social Sciences (Bové 2016; Dann and Dann 2016; Horell 2016) and the hard sciences (Berryman and Sauvé 2017; Nuzzo et al. 2016). The encyclicals, as theoretical documents with a highly charged moral and ethical dimension, also have a considerable influence on Western society. The question, therefore, that this paper attempts to answer is: What is the impact of the encyclicals on the works indexed in Web of Science?

This paper is a study of monographs in theology, a field of the Humanities. The encyclicals, which are not indexed in Web of Science, constitute important points of reference in the Catholic religion. As such, our aim is to study the impact of these papal documents by analysing the publications in Web of Science in which they are cited. In other words, "the tree will be known by its fruits". (Mathew 7; 16). This study considers the scientific transcendence of the papal letters covering the period spanning the pontificates from Leo XIII (1878), author of *Rerum Novarum*, to Francis I's *Laudato Si* (2015). In short, we analyse the presence of the pontifical magisterium in publications indexed in Web of Science.

For Catholics the encyclicals offer explanations relevant to the historical circumstances of the Christian revelation. Even though there is no lack of motives relating to doubts and needs to clarify doctrinal positions (theological, social and so forth) or moral ones (guidance on the conduct of Catholics in situations of perplexity or discrepancy), the content of the papal encyclicals may respond to the internal needs of the Catholic Church, or to papal initiatives that have little bearing on the political, social or cultural relevance of a given time.

To gauge the impact of the encyclicals on science, we selected subject matter to analyse the scientific repercussion of encyclicals in terms of citations they receive in publications in Web of Science. We do not claim that this is an effective method to determine the influence of either the encyclicals or Catholicism on intellectual, cultural or public life, only that it allows us to assess the presence of the more important Catholic doctrinal output (the encyclicals) in specialised academic journals. However, we do believe that the intended analysis is a valid indicator for estimating such influence. This paper proposes a method to undertake this task and attempts to demonstrate its validity and the usefulness of the results.

As non-source documents, the encyclicals they are not indexed in Web of Science (Butler and Visser 2006) and other databases like Scopus. Therefore these documents are not usually subject to quantitative analyses, either individually or in the context of the discipline. However, they can be identified through bibliographic databases where they are subsequently cited in indexed publications. Web of Science and Scopus have been shown to be inconsistent in accurately representing output in the Humanities (Nederhof et al. 1989; Sivertsen 2009, 2014). However, the bibliography of indexed publications contains a second

set, that of the cited documents, which provides the sources. This study seeks to characterise the tree (the encyclicals) through its fruit (the citing documents).

It should be noted that Theology is a field of study in which books acquire great symbolic value, to the detriment of journals, as noted in studies on the most used documentary typologies by fields. The theses of Whalen (1965) and of Heussman (1970) calculate the percentage of books in the fields of theology at 71.5%, accounting for 73.9% of the total number of documents. Kellsey and Knievel (2005) state that, within Theology, the area of Religion increases the number of citations to monographs by 88.2%, which takes precedence over the Humanities. Further, Kellsey and Knievel show how the language of the sources of output varies: English dominates but shares terrain with languages such as German and Italian, and even Latin is on a par with French.

The chief objective of this research is to study the repercussion of encyclicals in publications indexed in Web of Science and to characterise the citing documents (theme and source). In particular, it seeks:

- To analyse the encyclicals from Pope Leo XIII up to Pope Francis I's *Laudato Si*, in terms of output per pope, length, citations received and general theme of each encyclical.
- To analyse the theoretical context of the publications citing the encyclicals. Co-word and co-author citation analysis.
- To analyse the geographical context (countries and production institutions) in which the encyclicals provide theoretical references.

2. Material and Methods

This paper constitutes a bibliometric analysis applied to two sets of documents: the first set, the encyclicals spanning the period from Pope Leo XIII (1878- *Inescrutabili Dei Consilio*) to Pope Francis I up to 2015 (*Laudato si*); and the second set, publications indexed in Web of Science that cite these encyclicals up to 2016. We decided to begin the analysis in the pontificate of Leo XIII for the following reasons: first, Leo XIII was the first pontiff to attempt to define the Catholic Church's position on the social and political realities of its time, following the "papal exile" of Pius IX; second, Leo XIII's papacy issued a record number of encyclicals, some of them of a social and universal nature (Hoverstad 2008). This explains why the encyclicals previous to Leo XIII are often disregarded (Guerrero 1996).

The encyclicals of the period under study were identified using the Vatican website (<http://w2.vatican.va>), which lists them chronologically by pontificate. The second set of documents studied are scientific publications indexed in the Web of Science Core Collection that cite any encyclical occurring in the first set (studies recorded up to December 31 2016). Web of Science is a scientific citation indexing service with multiple databases that have a subset of databases. The core of the service is formed by Science Citation Index Expanded (SCIE), Social Science Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Book Citation Index (BKCI), Conference Proceedings Citation Index y (CPCI) and Emerging Source Citation Index (ESCI), since they are intended for indexing the worlds' foremost scientific sources (journals, congresses and book publishers), which explains why this subset is frequently used to conduct bibliometric research. Although Web of Science includes a product for books (Book

Citation Index (BKCI), with a clear bias towards the Humanities, it only indexes book collections published by international academic publishers mainly from English-speaking countries (Torres-Salinas et al. 2014), (Gorraiz and Purnell 2013).

To locate non-source documents in Web of Science, we entering the title of each encyclical in the “Cited References” option and restricted the search parameter to “Core Collections”. The fact that the titles of the papal letters are in Latin meant it was easy to identify each scientific publication citing the encyclicals under study.

The publications were downloaded in Web of Science format and processed with the ISI:EXE program of Leydesdorff, social network analysis software Pajek (Batagelj 2008) and VosViewer (van Eck and Waltman 2010). Table I summarises the work procedure, which was carried out in four stages; three of which correspond to the data collection and the last to the quantitative and relational analysis of the data (Table II).

Table I. Methodological process of biometric analyses of the studied Encyclicals 1878-2015

Stages
1. Identification of Encyclicals (1878-2015)
2. Classification of Encyclicals by theme
3. Medición del tamaño de las encíclicas por palabras.
4. Search for citations in Web of Science (Core Collection)
5. Analysis of encyclicals and citing bibliography
5.1. Co-word analysis of citing bibliography
5.2. Co-cited author analysis
5.3. Analysis of countries and centres of production of citing bibliography

Table II. Description and justification of the elements analysed from the encyclicals and from the publications citing the encyclicals

Analysis of the encyclicals	
Encyclical output by Pope	Analysis of the number of the encyclicals issued by each pope since Leo XIII as well as the citations received in Web of Science by year of pontificate and total number of encyclicals written.
Extensión de las encíclicas	Se contabiliza la extensión de las encíclicas a través del conteo de palabras de la versión en latín de las encíclicas. No obstante, en aquellas encíclicas en las que no hay una verisión en latín, se utiliza el idioma original, por ejemplo el alemán en "Mit Brennender Sorge" o el italiano en "Satis Cognitum".
Most cited encyclicals	Identification of the encyclicals cited more than 4 times (Top 50) according to the number of citations received in Web of Science (Figure 1). The diagram was

made with Tableau 10.3.

Thematic categorisation of the encyclicals Categorisation of the encyclicals according to this study's own thematic classification based on the previous classification of Fernando Guerrero (1996). Subsequently, the "weight" of these categories is calculated on the basis of the number of encyclicals and citations received (As mentioned *previously, the encyclicals on the Church's Social Doctrine and on the socio-political order have the highest number of citations (Table 4). Those dealing with internal Church questions, such as doctrinal aspects of the interpretation and study of the Bible, have a lower impact. The topic of the encyclicals appears to be a factor that prevails over their length as regards citations.*

Table IV).

Analysis of the publications citing the encyclicals in Web of Science (1,833 publications)

Map of co-words From the publications citing the encyclicals in Web of Science (1,833 publications), a co-word network is made with VosViewer (van Eck and Waltman 2010) using the terms in the titles and the abstracts. Subsequently, the network is analysed and the terms that co-occur most frequently are pruned (on at least 30 occasions) using Pajek (Batagelj 2008). The Kamada-Kawai (Kamada and Kawai 1988) algorithm was used for the visualisation. The purpose of the study of co-word maps is to show the hidden cognitive structure in a given field (Ahlgren et al. 2015).

Co-cited authors The sample of citing publications is analysed to identify what other authors have been cited in conjunction with the encyclicals (Table V). The Top 60 are then displayed. This shows us what additional authors are usually cited – and hence the intellectual context – in the studies that reference the encyclicals. According to White and Griffith (1981) the occurrence of an author in a discipline extends beyond the authors' name and relates directly to his or her theoretical knowledge, methodologies and accumulated work. The authors, therefore, provide a good subject of study for conducting thematic analyses, since they are themes in themselves.

Countries The country where the publications are written is established by that of the authors where at least one encyclical is cited. Seventeen countries have the highest output. (Figure 3).

Institution The institutions are analysed according to their relationship with the authors of the research in which at least one encyclical is cited. The Top 60 institutions are shown (Table VI).

3. Analysis and Results

This study covers 230 encyclicals, half of which (115) are cited in 1,833 publications indexed in Web of Science on 2,793 occasions, since 960 publications cite more than one encyclical. The pontiffs with the highest output are Leo XIII, Pius XII and Pius XI, whom together penned 160 encyclicals (69%); however, John Paul II is the most cited pope, with 1,023 references (36%), followed by Leo XIII (457), Pius XI (352) and Paul VI (344). There is a direct relationship between the number of encyclicals and

duration each pontificate, even though the levels of output are clearly different. The most prolific popes are Leo XIII (3.48 encyclicals per year), Pius XII (2.2 per year) and Pius XI (2.11 per year). The last three pontiffs have the lowest level of annual output, although they have no uncited encyclicals. John Paul II's encyclicals are the most cited (1023), even though his writings rank fifth in encyclical production. In second place are the papal letters of Leo XIII, with 457 citations. It is important to highlight the low impact of the encyclicals of Pius X and Benedict XV, continuators Leo XIII. Por otra parte, es importante indicar una diferencia fundamental, las encíclicas que reciben citas tiene una extension promedio de 8561, mientras que las encíclicas que no reciben citas son muy inferiores en tamaño,

The more recent popes are generally the most cited. The further we go back in time, the less likely it is to find cited encyclicals. It should be noted that all the encyclicals of the last three pontiffs are cited and only two out of the eight written by Pope Paul VI receive no citations. Thus, the number of uncited encyclicals increases as we move back in time. Indeed, from John XXIII, the encyclicals not cited in World of Science account for some 50% for each pope. The analysis of the temporal variation of the impact of the encyclicals clearly indicates a gradual increase in the attention they receive in World of Science.

Table III. Encyclical output from Leo XIII to Francis I (2015), length and citations received in Web of Science

Pontiff	Encyclicals	Encyclicals year	Citations*	Citations/year	Uncited Encyclicals	Average Words
Francis (2013 -)	2	0.38	18	9	0	23390
Benedict XVI (2005-2013)	3	0.50	188	62.67	0	17492
John Paul II (1978-2006)	14	0.53	1023	73.07	0	21953
Paul VI (1963-1978)	8	2.20	344	43	2	7059
John XXIII (1958-1963)	11	2.20	239	21.73	6	7790
Pius XII (1939-1958)	40	2.11	146	3.65	24	4845
Pius XI (1922-1939)	33	1.94	352	10.67	16	5850
Benedict XV (1914-1922)	12	1.50	8	0.67	7	3158
Pius X (1903-1914)	20	1.82	34	1.7	11	4082
Leo XIII (1878-1903)	87	3.48	457	5.25	49	2875

*Citations studied up to 2016

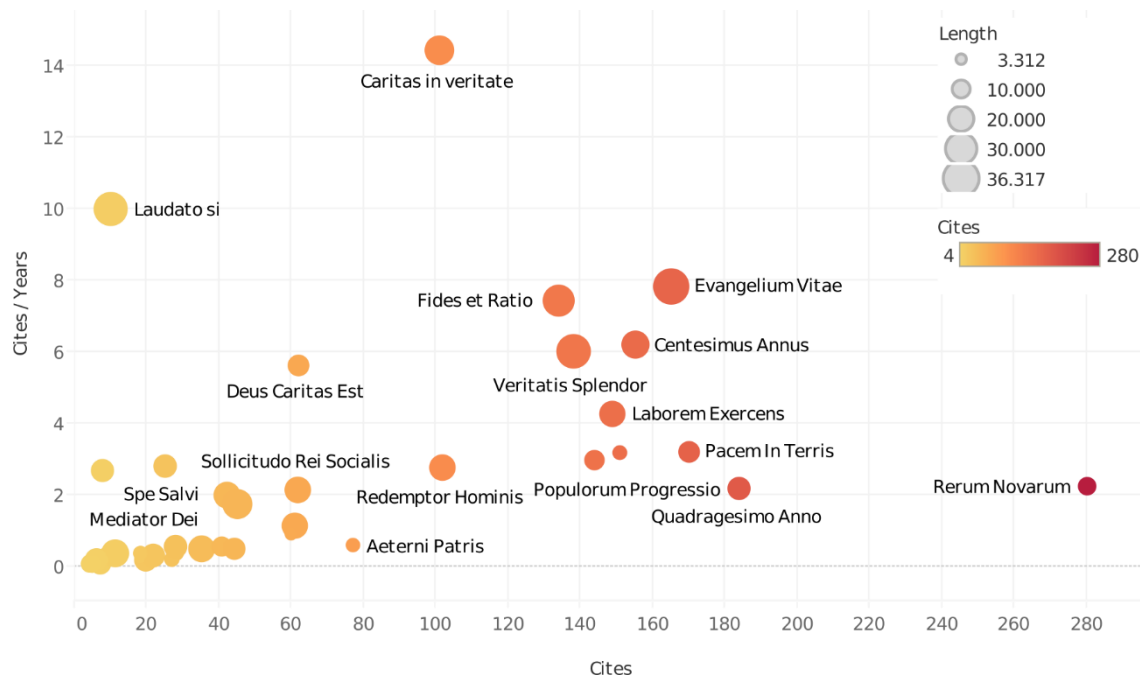
The scientific relevance of the encyclicals appears to be less directly associated their age or with the pope who promulgated them, and more with the topic of each encyclical. For example, the most cited encyclical is *Rerum Novarum* (1891). The second and fifth encyclicals with the most citations are *Quadragesimo Anno* and *Centesimus Annus* (Figure 1), which commemorate *Rerum Novarum*. The generic theme of all the encyclicals is the Church's social doctrine. The focus on "social matters" and on the socio-political order in general is borne out by the stance of *Pacem in Terris* (third) and *Populorum Progressio* (eighth).

The analysis of citations by year (Figure 1) yields recently issued encyclicals that, despite their low number of citations due to the short time interval, are necessarily regarded as influential. This applies as much to *Caritas in veritate*, by Benedict XVI (which receives the most citations per year) as *Laudato si*,

which had only been available for one year at the time this analysis was conducted. John Paul II ranks as the most highly cited author of encyclicals.

Likewise, we find, in general terms, that the most cited encyclicals are the longest ones. This is evident when the word count of each encyclical is compared with the number of citations/year.

Figure 1. Most cited encyclicals according to number of citations, citations/year and length



As mentioned previously, the encyclicals on the Church's Social Doctrine and on the socio-political order have the highest number of citations (Table 4). Those dealing with internal Church questions, such as doctrinal aspects of the interpretation and study of the Bible, have a lower impact. The topic of the encyclicals appears to be a factor that prevails over their length as regards citations.

Table IV. Topics, output and number of accumulated citations in Web of Science

AREAS	ENCYCLICALS	CITATIONS	CITATIONS / ENCYCLICALS	TOTAL WORDS
Social doctrine of the Church	9	955	106.11	132.877
Morals	20	604	30.2	172.029
Dogma	14	382	27.29	154.693
Socio-political order	7	368	52.57	40.874
Spirituality	23	254	11.04	222.126
Evangelisation	13	78	6	75.904
Unity of faith	4	68	17	39.956
Situation of the church	10	40	4	33.494
Liturgy	2	36	18	22.102
Family	2	7	3.5	6.607

Education	1	5	5	10.964
Training of clergy	3	4	1.33	17.766
Ecumenism	1	1	1	3.072
Holy scripture	1	1	1	9.748

It is also interesting to know the subject of the publications that cite the encyclicals. As would be expected, most of the citations occur in studies on Religion and Philosophy, but also from other areas of the Humanities and the Social Sciences, including History, Political Science, Sociology, Law, Ethics and, to a lesser extent, Journals of Sciences, as in the case of *Laudato Si*.

Analysis of the co-word map (Figure 2) shows the large number of topics where encyclicals have been cited as theoretical referents. Beyond the specifically theological and philosophical areas (salvation, spirituality, beliefs, interreligious dialogue, metaphysics, etc.), these pontifical documents have been contextualised above all in the social field and, in some cases, the scientific; more often than not concerning the ethical dimension of these themes (abortion, euthanasia, human embryos and sexuality). Similarly, citations from the encyclicals are found in the field of ecology, also with an ethical focus on environmental matters contextualised with “the common”. In relation to the Social Sciences, the most developed field, the encyclicals are used in the interpretation of the key issues of modern society, including Politics, War, Welfare and Social Inequalities, Human Development and Gender Studies.

Figure 2. Co-word map of the publications citing the Encyclicals



The study of the co-cited authors in the 1,833 publications that refer explicitly to the encyclicals is important since it provides an overview of the wide range of the discussions dealt with. The most cited document is the Bible, followed by theological texts, especially by Karl Rahner and Joseph Ratzinger (in writings done prior to his papacy) and the political philosopher John Rawls (Table V). Several classical philosophers and theologians also co-cited include St. Thomas Aquinas, St. Augustine, Aristotle, Karl Marx, Adam Smith, Immanuel Kant, Friedrich Nietzsche, Martin Heidegger and John Stuart Mill. In general, nineteenth- and twentieth-century theologians and philosophers predominate alongside classical figures, major influences in Catholic thought (especially scholastics and Aristotle). It is worth pointing out that 8 out of the Top 6 authors, including the most frequently cited Karl Rahner, belongs to the Society of Jesus.

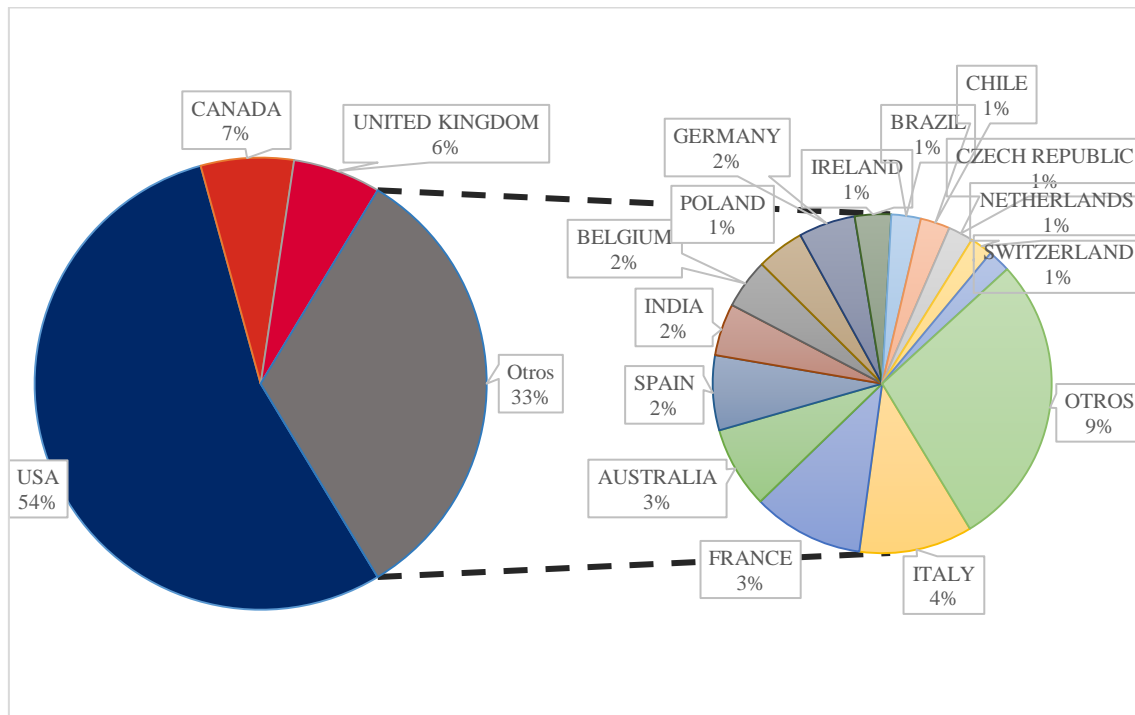
Table V. Authors with a co-citation of more than 37 publications in the scientific literature citing the encyclicals (1878-2015)

Authorities	Co-citations	Authorities	Co-citations	Authorities	Co-citations
Bible	612	Augustine	66	Paul Tillich	50
Karl Rahner S.J.	236	Aristotle	66	Ronald Dworkin	50
Joseph Ratzinger	212	Richard A. McCormick	65	Walter Kasper	49
John Rawls	137	Martin Heidegger	65	E. Schillebeeckx O.P.	48
Thomas Aquinas	137	Avery Dulles S.J.	65	Lisa Sowle Cahill	48
Yves M-J. Congar O.P.	127	Germain Grisez	62	Paul Ricoeur	44
Gregory Baum	124	Hans Kung	61	Adam Smith	43
Jacques Maritain	112	Max Weber	60	Juan Luis Segundo S.J.	43
John Courtney Murray S.J.	108	Michael Novak	60	David J. O'Brien	43
Alasdair MacIntyre	105	Jurgen Habermas	60	Martin Luther	43
Gustavo Gutierrez O.P.	102	Désiré-Joseph Mercier	59	Karl Barth	43
Charles E. Curran	101	Peter L. Berger	57	Peter Singer	42
Karl Marx	94	Ludwig Wittgenstein	56	John T. Noonan Jr	41
Étienne Gilson	79	Walter M. Abbott S.J.	56	Jacques Derrida	40
David Hollenbach S.J.	78	Michael Walzer	55	Hannah Arendt	40
Immanuel Kant	75	Bern. J. F. Lonergan S.J.	54	Alfred N. Whitehead	39
Charles Taylor	70	Paul Ramsey	52	Friedrich Nietzsche	39
Andrew Greeley	70	Johann Baptist Metz	52	James Turner Johnson	39
John Finnis	70	Stanley Hauerwas	52	Jürgen Moltmann	38
Leonardo Boff O.F.M.	66	Jon Sobrino S.J.	51	John Stuart Mill	38

* **Initialisms:** S.J. Society of Jesus (Jesuits); O.P. Order of Preachers (Dominicans); OF M. Order of Friars Minor (Franciscans).

The distribution of the citing countries of the encyclicals shows that more than half of the publications studied were written in the United States (54%), followed by Canada (7%) and the United Kingdom (6%) (Figure 3), accounting for 67% of the total. The remaining 33% originated in countries such as Italy (4%), France (3%), Australia (3%), Spain (2%), India (2%), and Belgium (2%)

Figure 3. Publications indexed in Web of Science that cite the encyclicals. Distribution by country of production



The most productive research institutions (Table VI), in terms of the number of publications that cite the encyclicals as theoretical referents, are shown to be universities belonging to the Catholic Church. There is, furthermore – as in Web of Science in general – a major presence of North American universities. Not even Theology circumvents this dominance. It should also be noted that the citing publications originate from the foremost international institutions, such as those of the universities of Oxford, Harvard, Princeton, Trinity College, Cambridge and the French CNRS. Catholic universities in Europe, which are in the minority, are represented by the Catholic University of Leuven (Belgium), the University of Navarra (Spain) and the Università del Sacro Cuore (Italy). Again, we highlight the influence of the Society of Jesus, which runs several of these universities.

Table VI. Top 60 leading research institutions citing the encyclicals under study

UNIVERSITIES	DOCS	UNIVERSITIES	DOCS	UNIVERSITIES	DOCS
Catholic Univ. of America	41	California State Univ. System	10	Univ. System of Georgia	7

Univ. of Notre Dame	38	Dharmaram Vidya Kshetram	10	Univ. System of Maryland	7
Boston College	26	Princeton Univ.	10	Univ. of Western Ontario	7
Georgetown Univ.	22	Santa Clara Univ.	10	Weston Sch Theol	7
Univ. of London	20	Univ. of Michigan	9	Univ. Palackého	6
Marquette Univ.	19	Univ. of Michigan System	9	Durham Univ.	6
Univ. of Toronto	19	Duquesne Univ.	8	Emory Univ.	6
Univ. of Oxford	17	Mcgill Univ.	8	Trinity College Dublin	6
Villanova Univ.	17	Snt Johns Univ. Collegeville	8	Univ. of Cambridge	6
Univ. Catholique Louvain	16	Snt Jouis Univ	8	Univ. of London Heythrop Coll.	6
Fordham Univ.	15	Indiana Univ. System	7	Univ. of San Francisco	6
Loyola Univ. Chicago	14	Jesuit Sch. Theol	7	Univ. of South Carolina	6
Saint John's Univ.	14	Pont. Univ. Catolica de Chile	7	Univ. of South Carolina Columbia	6
Stat. Univ. System of Florida	13	Providence Coll	7	Univ. of South Carolina System	6
Univ. of Navarra*	13	Rice Univ.	7	Univ. of West Georgia	6
Harvard Univ.	12	Univ. Lille Nord	7	Cath. Univ. Sacred Heart	5
Laval Univ.	12	Univ. of Quebec	7	CNRS	5
Univ. of California System	12	Univ. of St Andrews	7	Creighton Univ.	5
Kings College London	11	Univ. of St Thomas Minnesota	7	Indiana Univ. Bloomington	5
Australian Catholic Univ.	10	Univ. of Virginia	7	Natl. Catholic Bioth Ctr.	5

*The shaded boxes correspond to Catholic research institutions.

4. Discussion and Conclusions

The present study aimed to analyse the impact of the encyclicals on the scientific literature, particularly the citations these documents receive in published studies in the Core Collection of Web of Science. The study of the encyclicals is very limited due to their highly specific typology and the absence of referential databases that facilitate their direct study. With this in mind, we adopted a strategy to study their first-level presence in the scientific literature, which was based on the analysis of their subject matter and use through citing publications. The study examined 230 encyclicals (written between the pontificates of Leo XIII and Francis I), half of which are cited in 1,833 publications indexed in Web of Science, with an irregular distribution by encyclicals and pontificates.

The results show that the encyclicals serve as theoretic referents in scientific research papers for the Western World and this appears to increase with the passage of time, especially in Christian academia. Indeed, in North America it is the universities of the Catholic Church that boast the highest output of publications of these characteristics. These data confirm that, in the Christian world, the encyclicals are a citable referent in a wide range of academic fields; not only in theological and philosophical subjects, but also in the social sciences, especially in that concerning their ethical aspects. We should note that Web of Science's increased coverage in of journals and countries may partly explain the growth in citations of these documents.

The impact of each encyclical is chiefly linked to its specific theme. Hence, the most cited document, *Rerum Novarum* (1891), also known as the Magna Carta of Social Catholic Teaching (Escobar 1990), addresses both the social and working conditions as well as the rise of the socialist movement (Lusvardi 2012). This papal letter became the focal point for reflection of many Catholic intellectuals in this field (Curran 1981). The content not directly related to its dissemination in academic research is of less interest (Lusting 1990; O'Neill 2012). As regards citation scores, *Quadragesimo Anno* and *Centesimus Annus* (in second and fifth place, mark the 40th anniversary and the centenary respectively of *Rerum Novarum*. Beside these, *Laborem Exercens*, addresses the protection of workers' rights (Barrera 1997). The interest in social questions and the socio-political order in general is further confirmed by the stance of *Pacem in terris* (in third place) and *Populorum Progressio* (eighth place), the first encyclical on global human development (Clark 2012). Social questions, in the broad sense, have had the greatest impact on the citing publications. This is consistent with the thematic areas in which the encyclicals are cited (excluding theology and philosophy): economics, social equality, development, social welfare, politics and gender studies. This fact also lends coherence, to a different degree, to thinkers who also cite the encyclicals: St. Thomas Aquinas, St. Augustine, Aristotle, Karl Marx, Adam Smith, and John Stuart Mill.

Benedict XVI's *Caritas in veritate* (Turkson 2012) has more citations per year, precisely because its theme – love – is relevant to all areas of life (Gelabert, 2007 and Müller, 2014). The second most cited papal letter is *Laudato si*, which at the time of this study had only been in circulation for a year. The thematic breadth, which is reflected in its length (the longest of all the encyclicals under study), probably contributes to its impact in a wide variety of subjects (Camacho 2016). In third place, *Evangelium Vitae*, written by John Paul II, highlights the threat that capitalism poses to humanity (Breen 2008), a burning issue with far-reaching implications in both the theological and social fields. John Paul II ranks as the most cited author: his first encyclical, *Redemptor hominis*, qualified as a programmatic document (Blanco 2011), is frequently cited in theological research since it contains all the topics that he would develop in his later encyclicals (Aranda 2007).

As mentioned above, *Laudato Si* is the most recent and longest encyclical. Our analysis of the length of the encyclicals shows, in general terms, a clear trend towards a gradual increase in breadth as they approach the present day. Two levels are observed in this trend. First, the encyclicals up to the Second Vatican Council had an average of length of 4162 words; while those written immediately following John XXIII and Paul VI averaged 7424 words. However, from John Paul II onwards the encyclicals reach a second level, averaging almost eight times longer than those of Leo XIII. The number of words in each encyclical by both that pontiff and his two immediate predecessors averages 20,945. These figures are also an indirect indicator of the thematic breadth and depth of the encyclicals. We suggest, therefore, that these documents, so long and so close in time, are more likely to be cited than older encyclicals, which are usually more specific and narrower in scope. Over time, the encyclicals have become extensive *summa theologiae* on specific themes.

The impact of the encyclicals also has a direct bearing on the historical contexts in which the pontificates are framed. For example, of the few encyclicals written by Benedict XV, due to his short papacy (8 years), half of them are occupied by the First World War, and the other four by the immediate post-war period. Clearly, this was a time when there was more of a need for humanitarian action than for reflective reception. Pope Pius X's also brief pontificate (11 years) focused on the internal doctrinal problem of the modernist movement. The dearth of citations from the profuse output of Pius XII (with 40 encyclicals) is likely related to the release of documents pertaining to the hastily arranged Second Vatican Council. The preparation and discussion and subsequent commentary of the Council relegated and linked the late pontiff's encyclicals to the end of an era, in order to herald a new one of total renewal and theological reflection.

One striking aspect of this study is that no citations were found for half of the encyclicals. Several factors account for this phenomenon: antiquity, subject and target of audience. The uncited encyclicals are usually old; unlike the encyclicals from the last three pontificates, which have been cited. The least cited subjects are of a strictly Catholic nature, greatly reducing their audience and possibilities of being a referent in social sciences.

The co-word analysis from the citing publications reveals various points of interest. First, there is a preponderance of encyclicals referring to social aspects, such as Politics, Economy or War. Other issues that are developed, yet peripheral to the whole, include Euthanasia, Abortion, Gender Studies, Beliefs, Spirituality, Morality or Philosophy. Common to all of these themes is the presence of moral aspects: responsibility, ethics, charity, humanity, conscience, inequality, solidarity, etc. This bias is adequate to the subject of this study and the encyclicals contribute the evangelical dimension to the subjects covered.

The popes, as authors of the encyclicals, are held up as theoretical influences alongside eminent nineteenth-century (Adam Smith, Karl Marx, John Stuart Mill, Friedrich Nietzsche ...) and twentieth-century philosophers and theologians (Max Weber, Martin Heidegger, Ludwig Wittgenstein, Jurgen Habermas ...) Historical thinkers, such as Aristotle, St. Augustine or St. Thomas Aquinas, also stand out. Naturally, this does not imply any adherence to or concurrence of thought, since the scientific field is enriched by related and divergent positions in equal measure. An example of this is the occurrence of theologians of Liberation Theology, such as Leonardo Boff, Gustavo Gutierrez and Juan Luis Segundo. This analysis has allowed us to identify the theoretical framework and its main actors within which the encyclicals have been contextualized in leading research.

It is also interesting to note that a large number of the most co-cited thinkers belong to the Society of Jesus. This characteristic may be explained for two reasons: first, the academic tradition of the order has spawned innumerable men of science; second, the vast majority of the Catholic universities identified as sources of the citing documents are run by the Society of Jesus. Hence, it is logical that the intellectual publications of its most outstanding members would be known and divulged.

The results by country, biased by the coverage of Web of Science, delimit the validity of this study, due more to the leading role of World of Science in international scientific and academic output, than its exclusion of other contributions from specific fields of knowledge (theological, for example). Thus, it is

precisely the dominance of English-speaking research that explains why traditionally Catholic countries with a broad theological output (Catholic in particular, or Christian in general), appear as secondary in the study, in spite of their extensive output, which cites the encyclicals in various branches of knowledge.

The results of this study, as well as highlight the uneven scientific impact of the encyclicals, provide a good introduction to the study of the encyclicals regarding their broad contextualization, their authors, theoretical references and diversity of themes to which they are related. The findings also offer data that allows for a deeper development of their study. The proposed methodology can be reproduced and applied to similar publications that, although not scientific, are presumed to have a certain repercussion in the field of research (monographs, speeches, laws).

One possible future line of research is a study of the repercussions of the encyclicals, without restricting the object of study to publications, since, as indicated in the introduction, in the area of Theology, monographs provide the main source of information. Another secondary aspect reflected in this study is the influence of authors and universities of the Society of Jesus in the area of Theology. These results could constitute a foundation for a future study that analyses the influence of the Jesuits in theological research.

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