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ABSTRACT

The end of the European Paradox*

This paper evaluates the European Paradox according to which Europe plays a leading world role in terms of scientific excellence, measured in terms of the number of publications, but lacks the entrepreneurial capacity of the U.S. to transform this excellent performance into innovation, growth, and jobs. Citation distributions for the U.S., the European Union (EU), and the rest of the world are evaluated using a pair of high- and low-impact indicators, as well as the mean citation rate. The dataset consists of 3.6 million articles published in 1998-2002 with a common five-year citation window. The analysis is carried at a low aggregation level: the 219 sub-fields identified with the Web of Science categories distinguished by Thomson Scientific. The problems posed by international co-authorship and the multiple assignments of articles to sub-fields are solved following a multiplicative strategy. We find that, although the EU has more publications than the U.S. in 113 out of 219 sub-fields, the U.S. is ahead of the EU in 189 and 163 sub-fields in terms of the high- and low-impact indicators. Furthermore, we verify that using the high-impact indicator the U.S./EU gap is usually greater than when using the mean citation rate.

JEL Classification: O31, Y80 and Z00

Keywords: citation analysis, European Paradox, journal classification, normalization, research performance and Web of Science categories

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1. INTRODUCTION

The following two facts are well known. Firstly, since the mid-1990s the EU –namely, the 15 countries forming the European Union before the 2004 accession–, has published somewhat more scientific papers in the periodical literature than the U.S. Secondly, as soon as one takes into account the citation impact per publication the relative situation of the EU and the U.S. is completely reversed. Moreover, the EU performs particularly badly among highly cited papers.

Ignoring the second fact, the executive summary of the first REIST (*Rapport européen sur les indicateurs scientifiques et technologiques*) published separately in 1994 by Ugur Muldur and Luc Soete, launched the so-called “European Paradox”, according to which Europe plays a leading world role in terms of scientific excellence but lacks the entrepreneurial capacity of the U.S. to transform this excellent performance into innovation, growth, and jobs. One year later, the European Commission *Green Paper on Innovation* popularized the idea. According to Delanghe, Sloan, and Muldur (2011), although “*the precise point the Commission wanted to make through the European Paradox concept ... was often misunderstood*”, “*the idea generated much fruitful policy debate*” (p. 394). As a matter of fact, in the academic literature we find rather different views about the first axes of the Paradox. For example, in his influential contribution King (2004) states that “*the EU now matches the United States in the physical sciences, engineering and mathematics, although still lags in the life sciences*”. On the other hand, Dosi *et al.* (2009) conclude: “*no overall ‘European paradox’ with a lead in science but weak ‘downstream’ links is observed*” (see also Dosi *et al.* 2006, and previous working papers). The trouble with these two views is that King’s statement refers to the share of total citations, which is a mere consequence of the European superiority in the volume of publications, while Dosi *et al.*’s conclusion is based on somewhat limited evidence. The issue is important, since an incorrect diagnosis can hardly lead to adequate policies.

Recent results in Albarrán *et al.* (2010) –which contain a review of the official and academic literature– shed useful light on the question. That paper uses a large dataset, consisting of about 3.6 million articles published in 1998-2002 in more than 8,000 academic or professional journals in 36 languages indexed by Thomson Scientific. This is a convenient dataset because each article can be

assigned to only one of 22 broad scientific fields. The first finding is that the mean citation rate (MCR hereafter) in the U.S. is greater than in the EU in all 22 fields. However, it is well known that citation distributions are highly skewed in the sense that a large proportion of articles get none or few citations while a small percentage of them account for a disproportionate amount of all citations.¹ Since in this situation average-based indicators may not adequately summarize these distributions, Albarrán *et al.* (2010) also compare the publication shares of the U.S. and the EU at every percentile of the world citation distribution in each field. The evidence indicates that among the most influential articles, in 21 out of 22 fields the dominance of the U.S. over the EU is overwhelming.

Nevertheless, this evidence suffers from the following weakness: the mere percentage of articles satisfying some interesting condition only captures what can be referred to as the *incidence* aspect of the phenomenon in question. Albarrán *et al.* (2011b) introduced a novel methodology for the evaluation of research units of a certain size that overcomes this shortcoming. This methodology begins with the observation that, due to their skewness, the upper and lower parts of citation distributions are typically very different. Consequently, it seems useful to describe a citation distribution by means of two real valued functions defined over the subsets of articles with citations above or below a *critical citation line* (CCL hereafter). These are referred to as a *high-* and a *low-impact indicator*, respectively.² Next, the question of which low-impact indicators might be used is answered in terms of a family of size- and scale-invariant indices –originally suggested by Foster *et al.* (1984)– that satisfies a number of desirable properties, and has been widely used for the measurement of economic poverty in the last 25 years. These same properties lead to the selection of an equally convenient class of high-impact measures. As shown in Albarrán *et al.* (2011b), certain members of these two families are capable of simultaneously

¹ See *inter alia* Seglen (1992), Shubert *et al.* (1987) for evidence concerning scientific articles published in 1981-85 in 114 sub-fields, Glänzel (2007) for articles published in 1980 in 12 broad fields and 60 middle-sized disciplines, Albarrán and Ruiz-Castillo (2011) for articles published in 1998-2002 in the 22 fields already mentioned, and Albarrán *et al.* (2011a) for these same articles classified in 219 Web of Science categories and a number of intermediate disciplines and broad scientific fields according to three aggregation schemes.

² Economists will surely recognize that the key to this approach is the identification of a citation distribution with an income distribution. Once this step is taken, the measurement of low-impact, which starts with the definition of low-citation papers as those with citations below the CCL, coincides with the measurement of economic poverty. In turn, once low-impact has been identified with economic poverty, it is equally natural to identify the measurement of high-impact with the measurement of a certain notion of economic affluence.

taking into account not only the incidence, but also what we call the *intensity*, and the *citation inequality* that affect the high-and low-impact phenomena they attempt to measure. Given any CCL, the high-impact level according to our preferred indicator increases with (i) the proportion of high-impact papers (incidence), (ii) the average gap between the number of citations received by high-impact papers and the CCL (intensity), and (iii) the citation inequality among high-impact papers (citation inequality). In turn, the low-impact level increases with (i) the proportion of low-impact papers (incidence), (ii) the average gap between the CCL and the number of citations received by low-impact papers (intensity), and (iii) the citation inequality among low-impact papers (citation inequality).

For this methodology to be of interest, it must be shown that it is useful in practice. Using the dataset already described, Albarrán *et al.* (2011c) presented the first empirical application of this approach for the evaluation of the citation impact in three geographical areas: the U.S., the EU, and the remaining countries grouped in an area referred to as the rest of the world (RW hereafter). It is found that when the CCL is fixed at the 80th and the 95th percentiles of the world citation distribution, the U.S. performs dramatically better than the EU and the rest of the world (RW hereafter) according to high- and low-impact indicators in all scientific fields.

This paper addresses the following fundamental problem that limits the interest of the above results. It is well known that citation practices vary widely across scientific fields. Consequently, to ensure the maximum of homogeneity one should always work at the lowest aggregation level that the data allows for. However, as has been indicated, in our previous contributions we have worked at the level of the rather broad, heterogeneous fields originally distinguished by Thomson Scientific (Albarrán *et al.*, 2010, 2011c, d). Thus, as pointed out by a referee “*the results of the paper [Albarrán *et al.* (2011d)] could be translated as that the U.S. is disproportionally active in the highest impact subject category/-ies in all 22 fields*”. To verify whether the referee is right, this paper makes international comparisons at the sub-field level, where sub-fields are identified with the 219 Web of Science (WoS hereafter) categories also distinguished by Thomson Scientific. The citation impact of the U.S., the EU, and the RW is evaluated in terms of the MCR, as well as in terms of the high- and low-impact indicators.

The difficulty is that in our dataset articles are assigned to WoS categories through the assignment of the journals where they have been published. It is well known that many journals are unambiguously assigned to one specific category, but many other typically receive a multiple assignment. This is an important problem. For example, in the dataset used in this paper 42% of the articles are assigned to two or more, up to a maximum of six sub-fields. For reasons explained below, we overcame this difficulty by following a multiplicative strategy where each article is classified into as many sub-fields as WoS categories in the original dataset. Thus, if a paper is assigned to three sub-fields, it should be independently counted three times, once in each of the sub-fields in question, without altering the original number of citations in each case.

The rest of this paper consists of three Sections and an Appendix. Section 2 presents the data, and the methods used to assign articles to geographical areas and sub-fields. Section 3 presents the results about the U.S./EU gap using different types of indicators. The Appendix contains some individual results at the sub-field level. Section 4 briefly describes some extensions, and offers some concluding comments.

2. DATA, METHODS, AND DESCRIPTIVE STATISTICS

2.1. Assignment of Articles to Geographical Areas

Since we wish to address a homogeneous population, in this paper only research articles or, simply, articles are studied. Our sample consists of 3,648,524 articles published in 1998-2002, as well as the more than 28 million citations they receive using a five-year citation window for each one.

Articles are assigned to geographical areas according to the institutional affiliation of their authors as recorded in the Thomson Scientific database on the basis of what had been indicated in the by-line of the publications. The assignment of internationally co-authored papers among areas is problematic (see *inter alia* Anderson *et al.*, 1988). From a U.S. geopolitical point of view, for example, we want to give as much weight to an article written in a U.S. research center as we give to another co-authored by researchers working at a U.S. and a European university. Thus, we side with many other authors in

recommending a multiplicative strategy according to which in every internationally co-authored article a whole count is credited to each contributing area (see *inter alia* the influential contributions by May, 1997, and King, 2004, as well as the references in Section II in Albarrán *et al.*, 2010). Only domestic articles, or articles exclusively authored by one or more scientists affiliated to research centers either in the U.S., the EU, or the RW alone, are counted once.

In this way, the space of articles is expanded as much as necessary beyond the initial size arriving to what we call the *geographical extended count*. The total extended number of 4,142,281 articles is 13.5% larger than in the original dataset. However, as explained in Herranz and Ruiz-Castillo (2011a), working with the geographical extended count does not distort much the features that characterize the original distribution.

2. 2. Assignment of Articles to Sub-fields

As indicated in the Introduction, sub-fields are identified with the 219 WoS categories distinguished by Thomson Scientific. The problem is that only about 58% of articles in our dataset are assigned to a single WoS category. What is to be done with the articles assigned to two or more sub-fields? There are two ways to deal with this situation. The first follows a *fractional* strategy, according to which each publication is fractioned into as many equal pieces as necessary, with each piece assigned to a corresponding sub-field. The second procedure follows a *multiplicative* strategy according to which each paper is wholly counted as many times as necessary in the several sub-fields to which it is assigned.

As indicated in Herranz and Ruiz-Castillo (2011b), there are two reasons why the multiplicative strategy might be preferable. Firstly, assume that there are two articles assigned to a certain sub-field. The first article is only assigned to this sub-field, while the second is also assigned to other sub-fields. Why should the weights associated to both articles in computing any statistic be entirely different as implied by the fractional strategy? It can be argued that in the study of any sub-field all articles should count equally regardless of the role some of them may play in other sub-fields. In this way, the space of articles is expanded as much as necessary beyond the geographical extended count in what we call

the *double extended sub-field count*, which in our case reaches 6,512,031 articles, or 57.7% more than the number of articles in the geographical extended count. However, this is not that worrisome in the sense that, since this strategy does not create any interdependencies among the sub-fields involved, it is still possible to separately investigate every sub-field in isolation, independently of what takes place in any other sub-field. This is the reason why, in their study of citation distributions, Albarrán *et al.* (2011a) follow a multiplicative strategy.

Secondly, assume that we want to evaluate the citation impact of different research units in a certain sub-field. In the computation of any citation impact indicator a fractional strategy reduces the role of articles published in journals assigned to several sub-fields. Therefore, this strategy would hurt relatively more those research units with highly cited articles of this type. It can be argued that, from a normative point of view, this implication distorts the evaluation of research units in a given sub-field. This is the additional reason why, as in Herranz and Ruiz-Castillo (2011a, b, c), in this paper we follow the multiplicative strategy.

2.3. Descriptive Statistics

To save space, many relevant statistics can be found in the Working Paper version of this article, Herranz and Ruiz-Castillo (2011d). In particular, columns 1 to 3 in Table A in Appendix I in that version present the information about the number of articles, and the MCR at the sub-field level. For convenience, sub-fields are grouped into 20 aggregate categories and four very broad grand-fields that include Life Sciences, Physical Sciences, Other Natural Sciences, and Social Sciences.³

Two points should be noted. Firstly, publication practices across sub-fields are known to be very different. Consequently, distribution sizes are expected to differ greatly. Specifically, in our dataset mean size is 29,735 articles and the standard deviation is 33,826. Secondly, given the differences in citation practices across sub-fields, MCRs vary also widely. The mean and standard deviation are 6.1

³ This is part of an aggregation scheme built in Albarrán *et al.* (2011a), which borrow from the schemes recommended by Tijssen and van Leeuwen (2003) and Glänzel and Schubert (2003) with the aim of maximizing the possibility that a power law represents the upper tail of each of the corresponding citation distributions. It is not claimed that this scheme provides an accurate representation of the structure of science. It is rather a convenient simplification for the presentation of information at the sub-field level in this paper.

and 3.7. The maximum is reached in Cell Biology and Development Biology with 22.5 and 20.2 citations, while the minimum is in Engineering, Marine and Engineering, Petroleum with 1 and 1.2, respectively.

It should be noted that the share of all articles is approximately 29%, 33% and 38% for the U.S., the EU, and the RW, respectively. More importantly, the EU has more articles than the U.S. in 113 of 219 sub-fields, or about 52% of them (see columns 1 to 4 in Table B in Appendix I in Herranz and Ruiz-Castillo, 2011d). These 113 sub-fields are allocated as follows over grand-fields: 35 out of 77 sub-fields in Life Sciences, 30 out of 36 sub-fields in Physical Sciences, 47 out of 77 sub-fields in Other Natural Sciences, and only one out of 33 sub-fields in the Social Sciences. On the other hand, the correlation coefficients between the geographical areas' publication effort across sub-fields indicate that there is little difference in the way all areas allocate such effort (see columns 5 to 7 in Table B in Appendix I in Herranz and Ruiz-Castillo, 2011d).

3. EMPIRICAL RESULTS

3.1. The FGT Families of Low- and High-impact Indicators

Consider the idea of using two indicators to describe any citation distribution: a high- and a low-impact measure defined over the set of articles with citations below or above a CCL. In the first empirical application of this methodology, Albarrán *et al.*, (2011c) use a family of high- and low-impact indicators that satisfies a number of desirable properties, including size- and scale-invariance. In view of the sub-field differences in size and MCR that we have reviewed in Section II.3 this is a very convenient property to have.

In this paper, we use one high- and one low-impact indicator, denoted by H and L , which are members of these families. While average-based measures are silent about the distributive characteristics on either side of the mean, H and L are sensitive to the citation inequality in the sense that an increase in the coefficient of variation increases both of them (The indicators are briefly introduced in Appendix II

in Herranz and Ruiz-Castillo, 2011d, which also contains a brief discussion of some of their more important properties).

The CCL is fixed equal to the 80th percentile of each sub-field distribution (see column 4 in Table A in Appendix I in Herranz and Ruiz-Castillo, 2011d). CCL values are always greater than the MCRs, but the difference is relatively small. On average, the 80th percentile is reached at 8.8 citations while the MCR is equal to 6.1. The reason is that the percentage of articles that receive citations less than or equal to the MCR at every aggregation level is on average approximately 70% (see Glänzel, 2007, 2010, and Albarrán *et al.*, 2011a).

3. 2. High- and Low-impact Results

Let $\mathbf{c} = (\mathbf{c}^1, \dots, \mathbf{c}^K)$ be the partition of citation distribution \mathbf{c} into K geographical areas, indexed by $k = 1, \dots, K$. Denote by $H(\mathbf{c})$ and $H(\mathbf{c}^k)$ the high-impact indicators for the world as a whole and for $k =$ U.S., EU, RW, and by $L(\mathbf{c})$ and $L(\mathbf{c}^k)$ the low-impact indicators for the world as a whole and for $k =$ U.S., EU, RW. To adequately interpret the results below, it is important to make it explicit that, from a normative point of view, for any area k it is preferable to have a high $H(\mathbf{c}^k)$ and a low $L(\mathbf{c}^k)$.

Both H and L are decomposable in the sense that the overall high- and low-impact measures for a citation distribution \mathbf{c} can be expressed as:

$$H(\mathbf{c}) = \sum_k \omega_k H(\mathbf{c}^k),$$

and

$$L(\mathbf{c}) = \sum_k \omega_k L(\mathbf{c}^k),$$

where ω_k is the area's publication share (see Albarrán *et al.*, 2011b, for technical details). In order to quantify the relative situation of any area in a given field, it is convenient to refer to the ratio $\omega_k H(\mathbf{c}^k)/H(\mathbf{c})$ as area k 's observed contribution (OC hereafter) relative to the overall high-impact level. We may ask: what is this area's expected contribution (EC hereafter) to that level? Clearly, its publication share ω_k . Thus, the ratio $OC/EC = H(\mathbf{c}^k)/H(\mathbf{c})$ is greater than, equal to, or smaller than

one as area k OC is greater than, equal to, or smaller than this area EC, namely its publication share ω_k . Similarly, the ratio $L(\mathbf{c}^k)/L(\mathbf{c})$ is greater than, equal to, or smaller than one as area k OC is greater than, equal to, or smaller than area k EC, or ω_k . These contributions can be easily calculated with the information about $H(\mathbf{c})$, $H(\mathbf{c}^k)$, $L(\mathbf{c})$ and $L(\mathbf{c}^k)$ provided in Table C in Appendix I in Herranz and Ruiz-Castillo (2011d). A summary of results about observed contributions to high- and low-impact levels for the U.S. and the EU is in Table 1.

Table 1 around here

On the other hand, to assess the high- and low-impact gaps between the U.S. and the EU it is appropriate to use the ratios $H(\mathbf{c}^{US})/H(\mathbf{c}^{EU})$ and $L(\mathbf{c}^{US})/L(\mathbf{c}^{EU})$ which are in columns 1 and 2 in Table D in the Appendix to this paper. A summary of results about the U.S./EU gaps is in Table 2.

Table 2 around here

Let us begin by analyzing high-impact aspects. In Table 1A it can be observed that the contribution of the U.S. to overall high-impact levels is below what can be expected from its publication share in only 11 out of 219 sub-fields. However, this is the case for the EU in 118 sub-fields (see the last two rows in Table 1A). At the other extreme, the U.S. and the EU contributions to the world high-impact levels is above 51% of their publication shares in 95 and four cases, respectively (the four European cases are: Urban Studies; Integrative and Complementary Medicine; Mining and Mineral Processing, and Engineering, Petroleum). Generally, the situation of the EU is particularly weak in the Life and the Physical Sciences. On the contrary, the U.S. contribution to the world high-impact levels is more than 20% above its publication share in 60 out of 77 sub-fields among the Life Sciences, and in all 36 sub-fields among the Physical Sciences.

What are the implications for the U.S./EU gap of the situation just reviewed? The EU is ahead of the U.S. in 22 sub-fields within the Natural Sciences and nine within the Social Sciences (see the summary results in Table 1B). The details are interesting. (i) Within Life Sciences, the EU is ahead in Biology (sub-fields 1 and 2 in Table C in the Appendix), some behavioral sciences (sub-fields 65, and

66), Integrative and Complementary Medicine (sub-field 43), and a few sub-fields of lesser importance in Clinical Medicine III. (ii) Within the 36 Physical Sciences, the EU is ahead only in Acoustics (sub-field 90). (iii) Among the Other Natural Sciences, the EU is ahead in three Engineering sub-fields (120, 130, and 131), two in Materials Science (140, and 141), Mining and Mineral Processing (sub-field 155) in Geosciences, and five sub-fields in Agricultural and Environment and Plant and Animal Sciences. (iv) Among the Social Sciences, the EU is ahead in Linguistics, Geography, and Urban Studies (sub-fields 212, 200, and 203), as well as seven other lesser ones; a truly poor showing when it is compared with the record achieved by the U.S. in the remaining 189 sub-fields. It suffices to note that in 57 natural sciences and 13 social sciences the U.S. has a high-impact indicator at least twice as large as the one for the EU (see Table 1B).

As far as low-impact, the EU situation is more favorable: its contribution to world levels is below its publication share in 137 out of 219 sub-fields. In particular, this is the case in 60 out of 73 Other Natural Sciences (see Table 2A). However, except in this grand-field, the U.S. contribution to world low-impact levels is below its publication share in more sub-fields than the EU. It should be noted that outstanding performances are much less likely in low- than in high-impact: the U.S. and the EU contributions to world levels is below their respective publication shares by more than 20% in five sub-fields each, for a total of 10 out of 219 sub-fields. In contrast, the two areas achieve a similar performance in the high-impact case in 169 and 33 sub-fields, respectively, for a total of 202 cases (compare the last two rows in Tables 1B and 2B). As expected from the above, relative to the high-impact case the U.S./EU low-impact gap reveals a weaker U.S. dominance. It suffices to say that the EU is now ahead in 24 out of 73 Other Natural Sciences, and a total of 56 out of 219 sub-fields. Moreover, when the U.S. is ahead, most of the time the gap is small (see Table 2B).

The more frequent high-impact ranking –the U.S. above the EU, and the EU above the RW– holds in 166 sub-fields. This same ranking holds in 154 sub-fields in the low-impact case. However, the RW or the EU leads in publications in 136 out of 186 sub-fields in the natural sciences, but only in two out of 33 cases in the social sciences (see columns 1 to 4 in Table B in Appendix I in Herranz and Ruiz-

Castillo, 2011d). This contrast should serve to conclude without further statistical analysis that the connection for any geographical area between having a large publication share in a given field and a good index of high- or low-impact is practically non-existent.

A different matter is the relationship between the publication effort devoted to the various sub-fields in each geographical area (columns 5 to 7 in Table B in Appendix I in Herranz and Ruiz-Castillo, 2011d) and the high- and low-impact levels achieved across sub-fields. The correlation coefficient between publication efforts and high-impact levels is only 0.036 for the U.S., 0.056 for the EU, and 0.011 for the RW. Thus, there is practically no connection between these variables. On the other hand, the correlation coefficient between publication efforts and low-impact levels according to L is -0.35 for the U.S., -0.18 for the EU, and 0.08 for the RW, indicating a weak association between publication effort and a good low-impact performance (a low L value) in the U.S. and EU cases.

The conclusion is inescapable: a substantial publication effort by a geographical area in a given sub-field does not guarantee a good performance by this area in terms of a large high-impact level or a small low-impact index in that category. Similarly, a large volume of publications in specific sub-fields by any of the three large geographical areas does not guarantee a relatively good high-impact performance in those sub-fields. This is very damaging indeed for the proponents of a European Paradox where the good health of European science is assessed in terms of large publication shares.

3.3. Average-based versus High-impact Measurement of the U.S./EU Gap

Finally, we turn to the measurement of the U.S./EU gap in terms of average-based indicators. Let N_s^k be the number of distinct articles, indexed by $i = 1, \dots, N_s^k$, which are assigned to sub-field s and have at least one author working in area k in the double extended sub-field count according to the multiplicative strategy. Denote by $c_s^k = \{c_{si}^k\}$ the citation distribution of area k in sub-field s , where c_{si}^k is the number of citations received by article i . The MCR of unit k at the sub-field level s , M_s^k , is defined as

$$M_s^k = \sum_i c_{si}^k / N_s^k.$$

Of course, at the sub-field level, that is, at the maximum degree of homogeneity allowed by our data, for any k M_s^k is an acceptable indicator of the area's citation performance. Let

$$M_s = \sum_k \sum_i c_{si}^k / N_s = \sum_k (N_s^k / N_s) M_s^k$$

be the world MCR in sub-field s . The average-based indicator for area k in sub-field s , A_s^k , is defined as

$$A_s^k = M_s^k / M_s. \quad (1)$$

When A_s^k is above (below) one it means that the articles considered have received, on average, more (less) citations than the world as a whole. Of course,

$$\sum_k (N_s^k / N_s) A_s^k = \sum_k [(N_s^k / N_s) M_s^k] / M_s = M_s / M_s = 1.$$

The citation gap between any two areas k and v is measured by $A_s^k / A_s^v = M_s^k / M_s^v$. Table E in Appendix I in Herranz and Ruiz-Castillo (2011d) presents the indicators A_s^k defined in equation (1) for all geographical areas and all sub-fields, as well as the measures of the U.S./EU and RW/EU gaps, A_s^{US} / A_s^{EU} and A_s^{RW} / A_s^{EU} , respectively, which happen to be the ratios of the corresponding means: M_s^{US} / M_s^{EU} and M_s^{RW} / M_s^{EU} . Sub-fields are ordered by the size of the U.S./EU gap within each field. These massive results are appropriately summarized in Table 3.

Table 3 around here

The resulting picture is quite dramatic: the U.S. MCR is greater than that of the EU in 174, or almost 80% of the 219 sub-fields (This percentage is slightly greater for the natural sciences). These sub-fields represent 92% of all articles in the corresponding double extended count. In 105 sub-fields the U.S./EU gap is greater than 20%, while in 31 sub-fields, representing about 15% of all articles, the U.S./EU gap is greater than 40%. On the other hand, the dominance of the EU over the RW is even greater (see the lower panel in Table 3): in only 18 sub-fields, representing 2.3% of the total number of articles, the RW is ahead, while in 109 sub-fields, representing 64% of the total number of articles, the EU/RW gap is greater than 20%.

Column 3 in the Appendix to this paper includes the results about the U.S./EU gap according to the MCR, M^{US}_s/M^{EU}_s , while column 4 compares this measurement of the gap and the one using the high-impact indicator H . The situation is illustrated in Figure 1, where sub-fields are classified into four large aggregates corresponding to Life Sciences, Physical Sciences, Other Natural Sciences, and Social Sciences.

Figure 1 around here

From an ordinal point of view, there are few reversals: in 21 cases the EU is ahead according to the MCR and behind according to the H index, while in six cases the opposite is the case. It should be noted that in only 24 sub-fields the U.S./EU gap is greater according to the MCR. From a cardinal point of view, differences between the results obtained with the two approaches are of a large order of magnitude: among the 195 sub-fields for which the U.S./EU high-impact gap is greater than the gap according to the MCR, in 110 cases the difference is between 20% and 50%, and 32 additional cases the difference is greater than 50%. The fact that the U.S./EU gap at the sub-field level in the double extended sub-field count tends to decrease when we measure it with the MCR is exactly what was found in Albarrán *et al.* (2011d) in the case in which articles are classified by Thomson Scientific into only one of 22 broad fields.

4. CONCLUSIONS

This paper has questioned the truth of the European Paradox according to which Europe plays a leading world role in terms of scientific excellence, measured in terms of the number of publications, but lacks the entrepreneurial capacity of the U.S. to transform this excellence into innovation, growth, and jobs. The citation performance of the U.S., the EU, and the RW in 219 sub-fields, identified with the corresponding WoS categories, has been compared using two types of indicators: a pair of high- and low-impact indicators introduced in Albarrán *et al.* (2011b), and the MCR. The dataset consists of 3.6 million articles published in 1998-2002 with a common five-year citation window. A multiplicative

strategy has been followed to solve the problems posed by international co-authorship and the multiple assignments of articles to sub-fields.

Before continuing any further, it is important to comment on some of the limitations of this paper. Firstly, scientists as well as policy makers may justifiably have reservations, even serious doubts, about the role of citation analysis in the evaluation of research. Our own defense of the uses of citation-based indicators in the context of what Weingart (2005) calls “*informed peer review*”, is in Section II of Ruiz-Castillo (2011). Furthermore, the striking regularities that characterize the shape of citation distributions in the natural and the social sciences at all aggregation levels (see *inter alia* Albarrán and Ruiz-Castillo, 2011, and Albarrán *et al.*, 2011a) indicates that, in spite of the myriad of motives guiding specific citations by researchers, citation distributions constitute a useful instrument for the evaluation of research units of any size. Secondly, it is well known that Thomson Scientific databases suffer from an English bias. This might very well influence the results obtained in two different directions. Some might argue that as far as the Social Sciences, and perhaps also as far as Psychology and Psychiatry and the Behavioral Sciences are concerned, the Thomson Scientific database favors the U.S. versus the EU.⁴ On the other hand, the remarkable findings of van Leeuwen *et al.* (2001), and van Raan *et al.* (2011) indicate that publications in non-English language journals covered by Thomson Scientific are counted as part of the output of countries, but they generally have a very low impact because, for example, only a few scientists outside Germany, Austria and Switzerland are able to read German; there is a similar situation for French. Thus, these non-English publications will ‘dilute’ considerably the impact of countries such as Germany, Austria and France. This is particularly the case for the more application-oriented fields such as clinical medicine and engineering, and also for the social sciences and humanities. Therefore, in comparing the citation performance of English and non-English countries it might be desirable to eliminate non-English journals altogether –a possibility beyond the scope of this paper because our dataset lacks information on journals. Thus, taking also into account that English

⁴ As economists and/or members of Economics Departments, we believe that members of the European Economic Association and many other colleagues in Economics accept the information in the Social Citation Index and the Social Sciences Citation Index as valid in our field.

can be considered the international language of science, in this paper we have followed the usual practice of using the TS data under the reasonable assumption that “*the international journal publications in these databases provide a satisfactory representation of internationally accepted (‘mainstream’) research, especially high-quality ‘laboratory based’ basic research in the natural sciences, medical sciences, and life sciences conducted in the advanced industrialized nations*” (EC, 2003, p. 439).

Be that as it may, the European Paradox is definitely put to rest. It is true that the EU has more publications than the U.S. in 113 sub-fields. Overall, the EU has 3.2% more publications than the U.S. However, judging from the high-impact perspective, the EU is ahead of the U.S. only in 30 out of 219 sub-fields. In 57 and 14 sub-fields within the natural and the social sciences, respectively, the U.S. has a high-impact indicator at least twice as large as the EU. When we measure the U.S./EU gap by low-impact indicators the EU situation is somewhat more favorable. For example, the EU is ahead in 56 out of 219 sub-fields. The paper has also compared the consequences of measuring the U.S./EU gap using the high-impact indicator or using the MCR. The gap is greater according to the latter only in 22 sub-fields. In the remaining 197 sub-fields the gap is considerably greater when measured by the high-impact indicator. At any rate, according to the MCR the U.S. dominates the EU in 172 out of 219 sub-fields.

Several robustness tests have been performed (to save space, only a summary of results are included here; further details can be found in Herranz and Ruiz-Castillo, 2011d). Firstly, in regard to the problem of the multiple assignment of articles to sub-fields, the paper has studied some of the consequences of using a fractional rather than a multiplicative strategy. The U.S./EU gap according to the MCR is strictly greater according to the fractional strategy in 137 sub-fields, or 63% of the total. However, gap differences are not very large: only in 20 cases –of which 17 reflect a worsening of the EU situation– this difference in absolute value is 10% greater than the U.S./EU gap under the multiplicative strategy. As in Herranz and Ruiz-Castillo (2011b), the similarity of citation characteristics of articles published in journals assigned to one or several sub-fields guarantees that choosing one of the two strategies may not lead to a radically different picture in this practical application. Secondly,

after raising the CCL from the 80th to the 95th percentile of world citation distributions the EU is ahead of the U.S. in exactly the same number of sub-fields as before, namely, 30. The main difference is that the U.S. dominance in the remaining 189 sub-fields is somewhat greater: for example, the 71 cases in which the U.S. high-impact indicator was more than 100% greater than that of the EU when the CCL was fixed at the 80th percentile now become 99. Nevertheless, the impact of raising the CCL is also of a small order of magnitude.

The problem with the European Paradox is that it is exclusively based on the number of publications. However, as already pointed out in Albarrán *et al.* (2010, 2011c) for the 22 broad fields distinguished by Thomson Scientific, this paper confirms that there is no connection between publication shares and high- or low-impact levels. As a matter of fact, geographical areas do not seem to specialize in these sub-fields where they enjoy a comparative advantage measured by the $A_s^k = M_s^k/M_s$ ratio: the correlation coefficients between this indicator and the ratio of an area's to the world's publication effort are -0.52 , -0.08 , and -0.13 for the U.S., the EU, and the RW, respectively. Forces explaining publication efforts are different from the ones explaining relative success measured by citation impact.

In this scenario, although the EU often publishes more articles than the U.S., the fundamental fact is the overwhelming dominance of the U.S. over the EU. Likewise, although the RW usually is the area with more publications, it exhibits the worst citation performance in almost all cases. In brief, this paper has established that the European Paradox masks a truly *European Drama*: judging from citation impact at the lowest aggregation level, the dominance of the U.S. over the EU in the basic and applied research published in the periodical literature is almost universal.

The present analysis might be extended in several directions, of which we will mention only three. Firstly, although working at the sub-field level is essential, for many practical problems the interest of investigating larger aggregates is undeniable. This task poses the well-known problem that aggregation procedures should correct for differences in citation practices across sub-fields. In Herranz and Ruiz-Castillo (2011b) we suggest a novel normalization procedure for the multiplicative approach,

while in Herranz and Ruiz-Castillo (2011c) we apply this procedure for the first time for the evaluation of the U.S., the EU, and the RW using both average-based and high- and low-impact citation indicators. Secondly, it should be noted that our high-impact indicator is not robust to the presence of a handful of articles with a truly phenomenal number of citations. Therefore, it would also be interesting to explore the European Paradox using indicators of citation excellence robust to extreme observations. Thirdly, before policy recommendations can be suggested the results in this paper should be extended towards specific countries within the EU and the RW, and even individual research centers. It would be important to analyze domestic and internationally co-authored articles separately. In the European case, the latter should differentiate between intra-European cooperation and cooperation with the U.S. and the rest of the world.

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Table 1A. Geographical Areas' Observed Contribution (OC) To the Overall High-impact Level. Summary At the Sub-field Level

	OC Below Its Publication Share	OC Above Its Publication Share:			(5) = 2+3+4	Total = 1+5
	(1)	0-20% (2)	21-50% (3)	> 51% (4)		
A. Life Sciences						
U.S.	4	13	33	27	73	77
EU	59	11	6	1	18	77
B. Physical Sciences						
U.S.	0	0	9	27	36	36
EU	22	10	4	0	14	36
C. Other Natural Sciences						
U.S.	4	12	20	37	69	73
EU	35	25	11	2	38	73
NATURAL SCIENCES = A + B + C						
U.S.	8	25	62	91	178	186
EU	116	46	21	3	70	186
D. Social Sciences						
U.S.	3	14	12	4	30	33
EU	21	3	8	1	12	33
TOTAL = A + B + C + D						
U.S.	11	39	74	95	208	219
EU	118	49	29	4	101	219

Table 1B. Summary of the U.S./EU High-impact Gap at the Sub-field Level

Number of Sub-fields in which:	EU IS AHEAD	U.S. IS AHEAD:			Total	TOTAL
		0 - 50% (2)	51% - 100% (3)	> 100% (4)		
	(1)	(2)	(3)	(4)	(5)	(6)
A. Life Sciences	8	21	30	18	69	77
B. Physical Sciences	1	7	12	16	35	36
C. Other Natural Sciences	12	22	16	23	61	73
NATURAL SCIENCES = A + B + C	21	50	58	57	165	186
D. Social Sciences	9	7	3	14	24	33
TOTAL = A + B + C + D	30	57	61	71	189	219

Table 2A. Geographical Areas' Observed Contribution (OC) To the Overall Low-impact Level. Summary At the Sub-field Level

	OC Above Its Publication Share (1)	OC Below Its Publication Share:				(5) = (1) + (4)
		≤ 20% (2)	> 20% (3)	4) = (2) + (3)		
A. Life Sciences						
U.S.	12	60	5	65	77	
EU	50	25	2	27	77	
B. Physical Sciences						
U.S.	0	30	6	36	36	
EU	22	10	0	10	36	
C. Other Natural Sciences						
U.S.	14	51	8	59	73	
EU	13	59	1	60	73	
NATURAL SCIENCES = A + B + C						
U.S.	26	141	19	160	186	
EU	66	117	3	120	186	
D. Social Sciences						
U.S.	8	24	1	25	33	
EU	16	15	2	17	33	
TOTAL = A + B + C + D						
U.S.	34	165	5	167	219	
EU	82	132	5	137	219	

Table 2B. Summary of the U.S./EU Low-impact Gap at the Sub-field Level

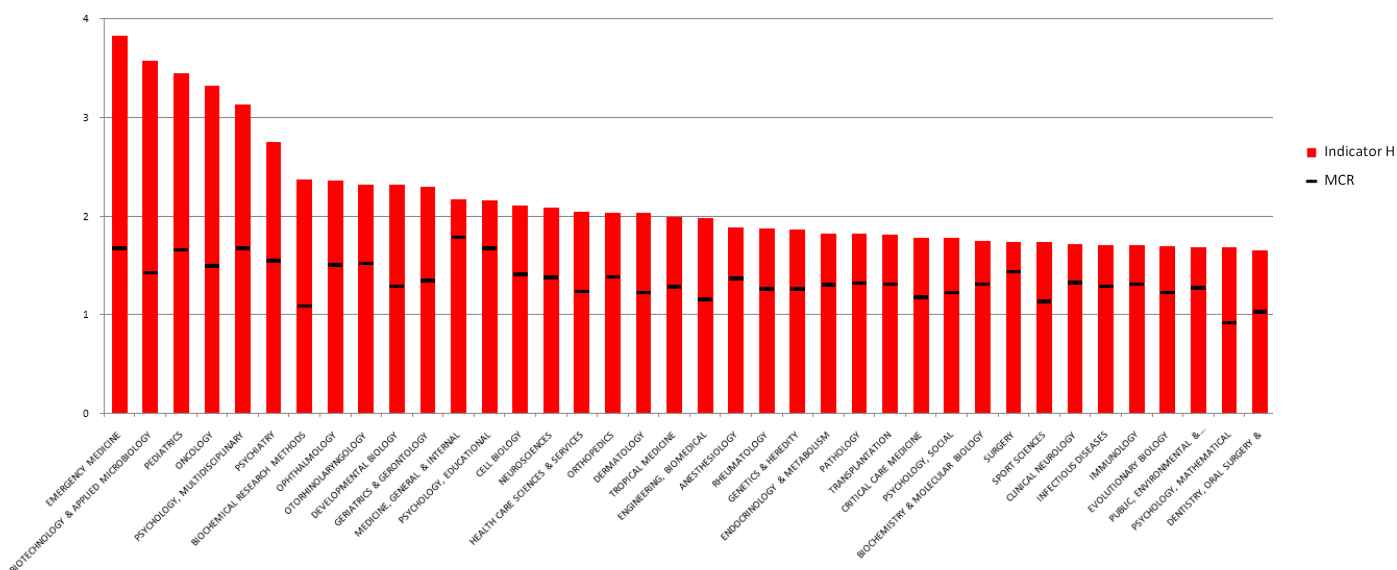
Number of Sub-fields in which:	EU AHEAD (1)	U.S. AHEAD:			TOTAL (5) = (1) + (4)
		Small < 20% (2)	Large > 20% (3)	Total = (2)+(3) (4)	
A. Life Sciences	15	41	21	69	77
B. Physical Sciences	6	25	5	36	36
C. Other Natural Sciences	24	47	2	71	73
NATURAL SCIENCES = A + B + C	45	113	28	141	186
D. Social Sciences	11	14	8	25	33
TOTAL = A + B + C + D	56	127	36	201	219

Table 3. Comparison Between Geographical Areas At the Sub-field Level According to the Mean Citation Rate

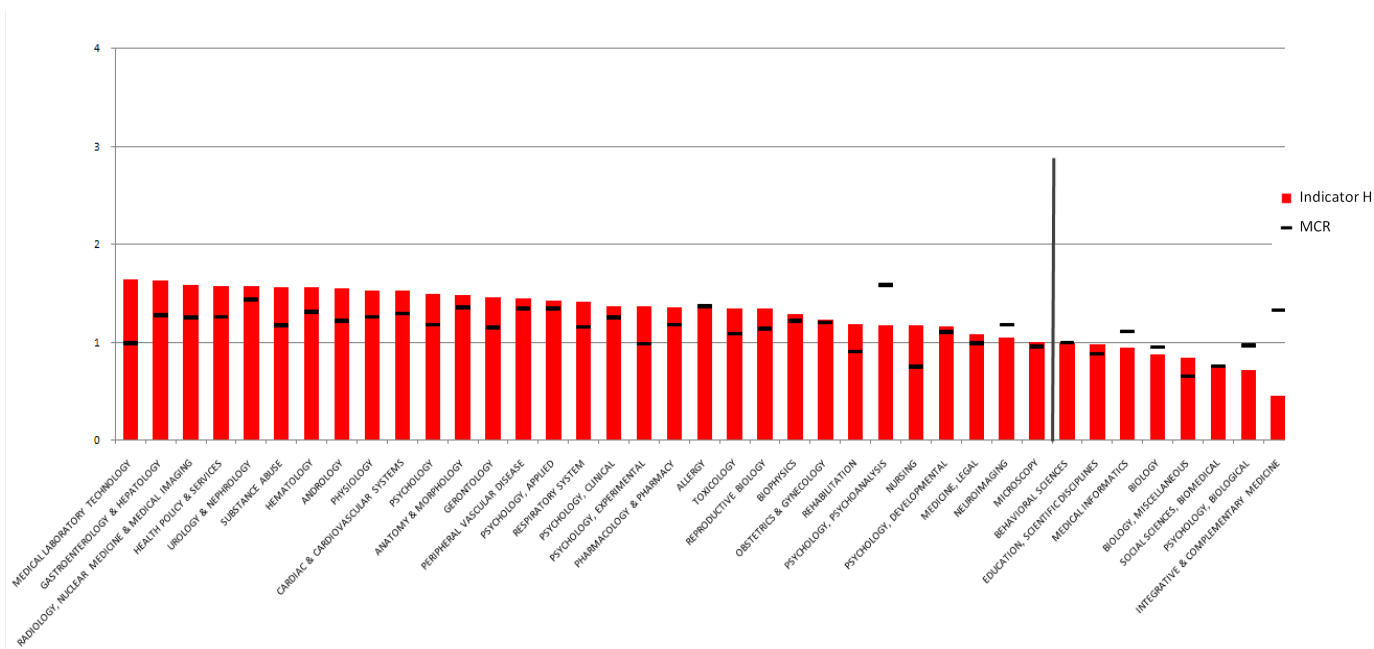
Number of Sub-fields in which: (4)	The U.S versus the EU				TOTAL (5) = (1) +
	EU Ahead	< 20% (2)	U.S. Ahead:		
	(1)		≥ 20% (3)	Total (4) = (2) + (3)	
1. Life Sciences	12	22	43	65	77
2. Physical Sciences	1	14	21	35	36
3. Other Natural Sciences	21	26	26	52	73
4. NATURAL SCIENCES = 1 + 2 + 3	34	62	90	152	186
5. Social Sciences = 4 + 5	11	7	15	22	33
ALL SCIENCES	45	69	105	174	219

Number of Sub-fields in which: (4)	The RW versus the EU				TOTAL (5) = (1) +
	RW Ahead	< 20% (2)	EU Ahead:		
	(1)		≥ 20% (3)	Total (4) = (2) + (3)	
1. Life Sciences	8	48	21	69	77
2. Physical Sciences	0	6	30	36	36
3. Other Natural Sciences	2	26	45	71	73
4. NATURAL SCIENCES = 1 + 2 + 3	10	80	96	176	186
5. Social Sciences = 4 + 5	8	12	13	25	33
ALL SCIENCES	18	92	109	201	219

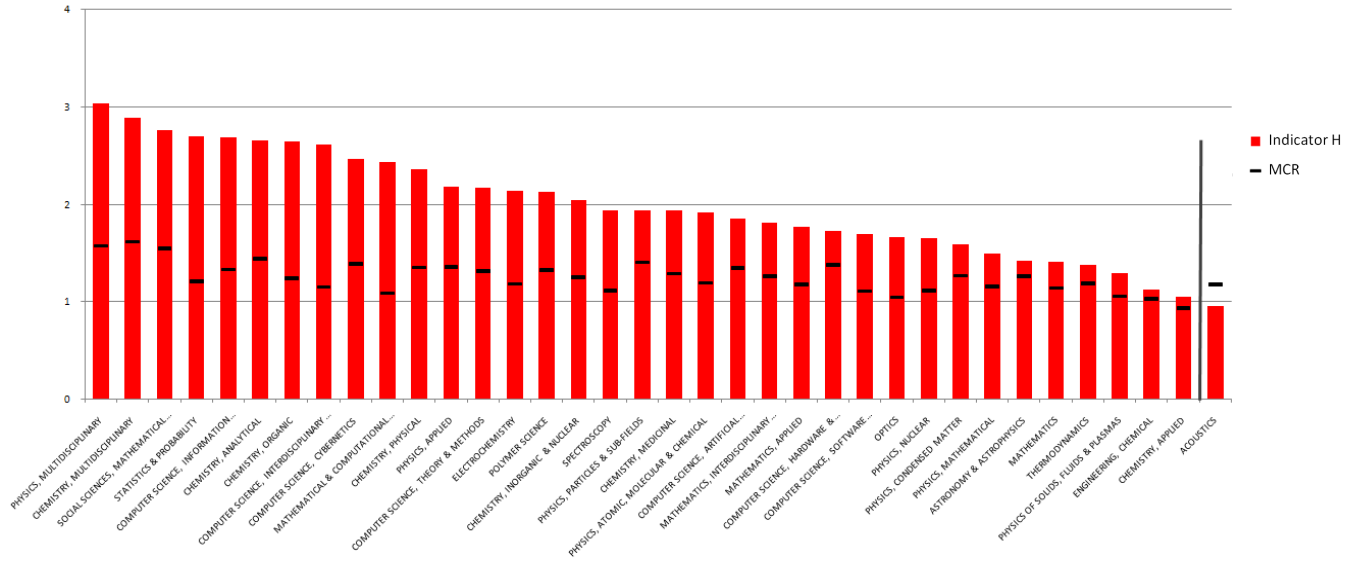
Figure 1. The U.S./EU gap at the sub-field level according to the high-impact indicator H and the Mean Citation Rate. Sub-fields are classified into six groups



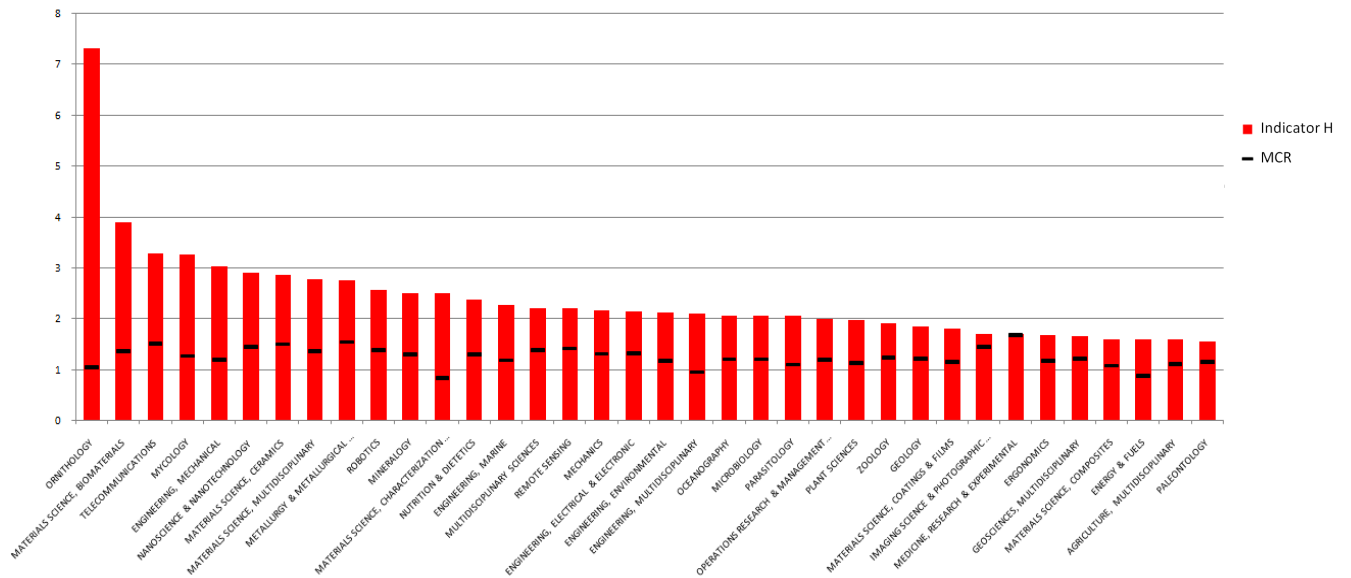
A. Life Sciences I



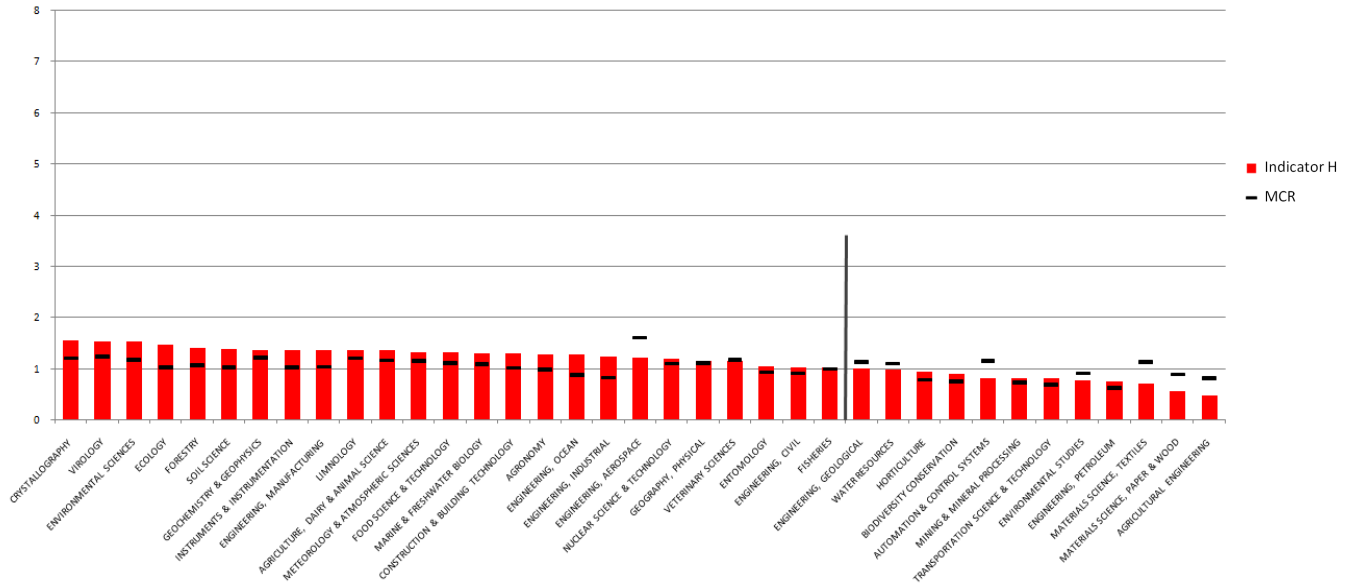
B. Life Sciences II



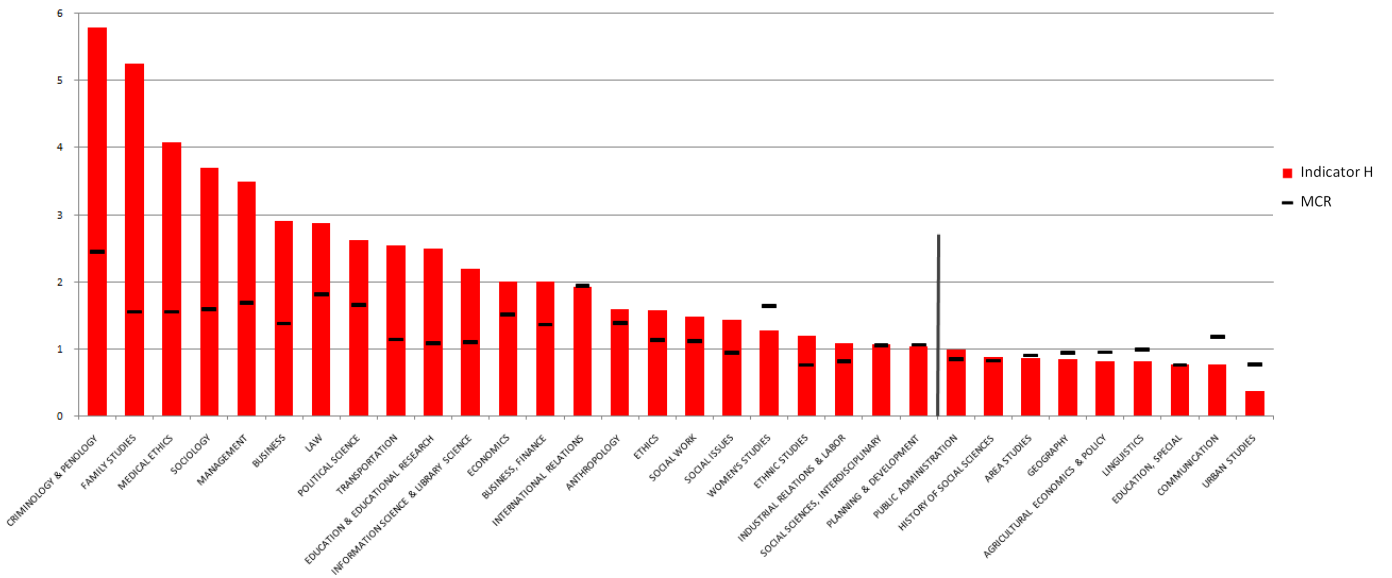
C. Physical Sciences



D. Other Natural Sciences I



E. Other Natural Sciences II



F. Social Sciences

APPENDIX I

Table A. Number of Articles, Mean Citation Rates, and Critical Citation Lines In the Double Extended Sub-field Count

	Number of Articles (1)	% (2)	MCR (3)	Critical Citation Line (4)
A. LIFE SCIENCES				
<i>I. BIOSCIENCES</i>				
1. BIOLOGY	28,017	0.43	7.9	12
2. BIOLOGY, MISCELLANEOUS	475	0.01	3.6	6
3. EVOLUTIONARY BIOLOGY	13,542	0.21	12.9	19
4. BIOCHEMICAL RESEARCH METHODS	37,350	0.57	9.5	13
5. BIOCHEMISTRY & MOLECULAR BIOLOGY	248,933	3.82	17	24
6. BIOPHYSICS	56,436	0.87	11.1	16
7. CELL BIOLOGY	97,545	1.5	22.5	32
8. GENETICS & HEREDITY	74,782	1.15	16.9	24
9. DEVELOPMENTAL BIOLOGY	19,590	0.3	20.2	30
<i>II. BIOMEDICAL RESEARCH</i>				
10. PATHOLOGY	32,518	0.5	9.6	14
11. ANATOMY & MORPHOLOGY	6,756	0.1	5.8	9
12. ENGINEERING, BIOMEDICAL	21,597	0.33	6.9	11
13. BIOTECH. & APPLIED MICROBIOLOGY	69,781	1.07	9.5	13
14. MEDICAL LABORATORY TECHNOLOGY	10,927	0.17	6.4	9
15. MICROSCOPY	4,496	0.07	6.3	10
16. PHARMACOLOGY & PHARMACY	111,320	1.71	8.3	12
17. TOXICOLOGY	34,066	0.52	7.3	11
18. PHYSIOLOGY	49,225	0.76	10.7	17
<i>III. CLINICAL MEDICINE I (INTERNAL)</i>				
19. CARDIAC & CARDIOVASCULAR SYSTEMS	60,300	0.93	12.2	17
20. RESPIRATORY SYSTEM	30,928	0.47	10.5	16
21. ENDOCRINOLOGY & METABOLISM	55,583	0.85	13.3	20
22. ANESTHESIOLOGY	18,037	0.28	7	11
23. CRITICAL CARE MEDICINE	14,301	0.22	11.4	17
24. EMERGENCY MEDICINE	6,864	0.11	4.1	7
25. GASTROENTEROLOGY & HEPATOLOGY	37,885	0.58	11.2	16
26. MEDICINE, GENERAL & INTERNAL	66,266	1.02	15.1	13
27. TROPICAL MEDICINE	9,193	0.14	5.7	9
28. HEMATOLOGY	47,323	0.73	17.5	26

29. ONCOLOGY	91,359	1.4	14.8	21
30. ALLERGY	9,706	0.15	9.2	14
31. IMMUNOLOGY	94,351	1.45	14.9	21
32. INFECTIOUS DISEASES	37,806	0.58	12.3	19
IV. CLIN. MED. II (NON-INTERNAL)				
33. GERIATRICS & GERONTOLOGY	10,141	0.16	8.2	13
34. OBSTETRICS & GYNECOLOGY	34,907	0.54	6.9	11
35. ANDROLOGY	1,605	0.02	5.7	9
36. REPRODUCTIVE BIOLOGY	18,956	0.29	9.7	15
37. GERONTOLOGY	7,334	0.11	7.4	12
38. DENTISTRY, ORAL SURGERY	23,294	0.36	5.5	8
39. DERMATOLOGY	22,848	0.35	6.2	10
40. UROLOGY & NEPHROLOGY	36,254	0.56	9.6	15
41. OTORHINOLARYNGOLOGY	18,492	0.28	4.4	7
42. OPHTHALMOLOGY	28,918	0.44	7.2	11
43 INTEGRATIVE & COMPLEMENTARY MED.	2,633	0.04	4.4	7
44. CLINICAL NEUROLOGY	73,322	1.13	9.8	15
45. PSYCHIATRY	47,038	0.72	9.9	15
46. RADIOLOGY, NUCLEAR MED. & IMAGING	58,950	0.91	7.9	12
47. ORTHOPEDICS	25,624	0.39	5.9	9
48. RHEUMATOLOGY	11,821	0.18	11.5	17
49. SPORT SCIENCES	22,548	0.35	6	10
50. SURGERY	109,354	1.68	6.5	10
51. TRANSPLANTATION	22,663	0.35	7	10
52. PERIPHERAL VASCULAR DISEASE	40,847	0.63	16.4	24
53. PEDIATRICS	45,506	0.7	5.9	9
V. CL. MED. III (HEALTH & OTHER SCS.)				
54. HEALTH CARE SCIENCES & SERVICES	15,058	0.23	5.9	9
55. HEALTH POLICY & SERVICES	9,388	0.14	6.3	9
56. MEDICINE, LEGAL	4,565	0.07	4.5	7
57. NURSING	9,105	0.14	3	5
58. PUBLIC, ENVIRON. & OCCUP. HEALTH	56,693	0.87	7.4	11
59. REHABILITATION	14,513	0.22	4.3	7
60. SUBSTANCE ABUSE	8,382	0.13	7.6	12
61. EDUCATION, SCIENTIFIC DISCIPLINES	8,371	0.13	2.9	4
62. MEDICAL INFORMATICS	7,007	0.11	4.3	7
VI. NEUROSCIENCE & BEHAVIOR				
63. NEUROIMAGING	6,826	0.1	10.9	17

64. NEUROSCIENCES	125,782	1.93	13.6	20
65. BEHAVIORAL SCIENCES	16,450	0.25	8.9	13
66. PSYCHOLOGY, BIOLOGICAL	4,429	0.07	7.5	11
67. PSYCHOLOGY	17,977	0.28	7.9	12
68. PSYCHOLOGY, APPLIED	8,732	0.13	4.7	7
69. PSYCHOLOGY, CLINICAL	18,978	0.29	7.5	12
70. PSYCHOLOGY, DEVELOPMENTAL	10,994	0.17	7.8	12
71. PSYCHOLOGY, EDUCATIONAL	5,601	0.09	5.2	8
72. PSYCHOLOGY, EXPERIMENTAL	17,565	0.27	7.6	12
73. PSYCHOLOGY, MATHEMATICAL	1,930	0.03	5.1	8
74. PSYCHOLOGY, MULTIDISCIPLINARY	19,785	0.3	4.9	7
75. PSYCHOLOGY, PSYCHOANALYSIS	2,504	0.04	2.7	4
76. PSYCHOLOGY, SOCIAL	10,717	0.16	6.3	9
77. SOCIAL SCIENCES, BIOMEDICAL	6,669	0.1	5.4	8

B. PHYSICAL SCIENCES

VII. CHEMISTRY

78. CHEMISTRY, MULTIDISCIPLINARY	107,816	1.66	8.9	13
79. CHEMISTRY, INORGANIC & NUCLEAR	55,337	0.85	6.7	11
80. CHEMISTRY, ANALYTICAL	73,439	1.13	7.5	11
81. CHEMISTRY, APPLIED	37,068	0.57	5.6	9
82. ENGINEERING, CHEMICAL	64,146	0.99	4.3	7
83. CHEMISTRY, MEDICINAL	27,721	0.43	7.5	11
84. CHEMISTRY, ORGANIC	84,274	1.29	7.9	12
85. CHEMISTRY, PHYSICAL	143,582	2.2	7.8	12
86. ELECTROCHEMISTRY	22,040	0.34	7.6	12
87. POLYMER SCIENCE	61,649	0.95	6.2	9

VIII. PHYSICS

88. PHYSICS, MULTIDISCIPLINARY	101,780	1.56	9.3	12
89. SPECTROSCOPY	35,126	0.54	5.8	9
90. ACOUSTICS	15,991	0.25	4	6
91. OPTICS	61,373	0.94	5.6	8
92. PHYSICS, APPLIED	143,531	2.2	5.8	8
93. PHYSICS, ATOMIC, MOLECULAR & CHEMICAL	74,351	1.14	8.6	13
94. THERMODYNAMICS (CLASSICAL PHYSICS)	19,276	0.3	3.5	5
95. PHYSICS, MATHEMATICAL	41,061	0.63	5.9	9
96. PHYSICS, NUCLEAR	33,146	0.51	5.6	8
97. PHYSICS, PARTICLES & FIELDS	50,532	0.78	10	14

98. PHYSICS, CONDENSED MATTER	130,377	2	5.7	9
99. PHYSICS OF SOLIDS, FLUIDS & PLASMAS	29,720	0.46	7.3	11

IX. SPACE SCIENCES

100. ASTRONOMY & ASTROPHYSICS	82,073	1.26	12.5	18
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X. MATHEMATICS

101. MATHEMATICS, APPLIED	61,964	0.95	2.8	4
102. STATISTICS & PROBABILITY	27,188	0.42	4.7	6
103. MATHEMATICS, INTERDISC. APPL.	19,976	0.31	4.2	6
104. SOCIAL SCIENCES, MATH. METHODS	6,078	0.09	4.3	6
105. PURE MATHEMATICS	76,078	1.17	2.1	3

XI. COMPUTER SCIENCE

106. COMP. SC., ARTIFICIAL INTELLIGENCE	26,462	0.41	4	6
107. COMPUTER SCIENCE, CYBERNETICS	4,865	0.07	2.7	4
108. COMP. SC., HARDWARE & ARCHITECTURE	14,163	0.22	3.2	4.4
109. COMP. SC., INFORMATION SYSTEMS	22,925	0.35	3.5	5
110. COMP. SC., INTERDIS. APPLICATIONS	30,920	0.47	4.8	6
111. COMP. SC., SOFTWARE ENGINEERING	19,570	0.3	2.8	4
112. COMP. SC., THEORY & METHODS	37,783	0.58	2.5	4
113. MATHEMATICAL & COMPUT. BIOLOGY	8,621	0.13	9	10

C. OTHER NATURAL SCIENCES

XII. ENGINEERING

114. ENG., ELECTRICAL & ELECTRONIC	131,115	2.01	3.6	5
115. TELECOMMUNICATIONS	21,591	0.33	2.9	4
116. ONSTRUCTION & BUILDING TECH.	9,010	0.14	2.4	4
117. ENGINEERING, CIVIL	23,183	0.36	2.4	4
118. ENGINEERING, ENVIRONMENTAL	22,096	0.34	6.6	10
119. ENGINEERING, MARINE	417	0.01	1	2
120. TRANSPORTATION SC. & TECHNOLOGY	6,365	0.1	1.5	2
121. ENGINEERING, INDUSTRIAL	13,858	0.21	2.2	4
122. ENGINEERING, MANUFACTURING	14,516	0.22	2.4	4
123. ENGINEERING, MECHANICAL	40,995	0.63	2.9	5
124. MECHANICS	48,002	0.74	3.8	6
125. ROBOTICS	3,231	0.05	2.6	4
126. INSTRUMENTS & INSTRUMENTATION	43,348	0.67	3.9	6
127. IMAGING SC. & PHOTOGRAPHIC TECH.	5,449	0.08	5.6	8
128. ENERGY & FUELS	26,298	0.4	3.5	6
129. NUCLEAR SCIENCE & TECHNOLOGY	42,406	0.65	3.4	5

130. ENGINEERING, PETROLEUM	6,974	0.11	1.2	2
131. AUTOMATION & CONTROL SYSTEMS	18,140	0.28	3	5
132. ENGINEERING, MULTIDISCIPLINARY	22,062	0.34	2.8	4
133. ERGONOMICS	3,299	0.05	3.3	5
134. OPERATIONS RES. & MANAG. SCIENCE	20,897	0.32	2.8	5
<i>XIII. MATERIALS SCIENCE</i>				
135. MATERIALS SCIENCE, BIOMATERIALS	7,382	0.11	9.6	15
136. MATERIALS SCIENCE, CERAMICS	21,255	0.33	3.5	6
137. MAT. SC., CHARAC. & TESTING	6,606	0.1	1.5	2
138. MAT. SC., COATINGS & FILMS	24,592	0.38	5.5	9
139. MATERIALS SCIENCE, COMPOSITES	10,368	0.16	2.5	4
140. MATERIALS SCIENCE, PAPER & WOOD	6,577	0.1	2	3
141. MATERIALS SCIENCE, TEXTILES	4,923	0.08	2	3
142. METALLURGY & METALL. ENGIN.	42,534	0.65	3.5	5
143. NANOSCIENCE & NANOTECHNOLOGY	22,069	0.34	5.8	8
<i>XIV. GEOSCIENCES</i>				
144. GEOCHEMISTRY & GEOPHYSICS	32,728	0.5	7.6	12
145. GEOGRAPHY, PHYSICAL	10,440	0.16	6.9	11
146. GEOLOGY	9,447	0.15	6.1	10
147. ENGINEERING, GEOLOGICAL	5,253	0.08	2.7	4
148. PALEONTOLOGY	8,039	0.12	4.9	8
149. REMOTE SENSING	5,869	0.09	5.6	8
150. OCEANOGRAPHY	22,387	0.34	7.7	12
151. ENGINEERING, OCEAN	3,725	0.06	2.9	4
152. METEOROLOGY & ATMOSPH. SCS.	33,043	0.51	8.2	12
153. ENGINEERING, AEROSPACE	12,910	0.2	1.8	3
154. MINERALOGY	9,038	0.14	5.5	9
155. MINING & MINERAL PROCESSING	7,333	0.11	3.1	5
<i>XV. AGRICULT. & ENVIRONMENT</i>				
156. AGRICULTURAL ENGINEERING	4,880	0.07	3.3	5
157. AGRICULTURE, MULTIDISCIPLINARY	15,859	0.24	4.8	8
158. AGRONOMY	26,490	0.41	4.5	7
159. LIMNOLOGY	6,362	0.1	7.2	11
160. SOIL SCIENCE	15,683	0.24	5.1	8
161. BIODIVERSITY CONSERVATION	7,186	0.11	6.5	10
162. ENVIRONMENTAL SCIENCES	78,593	1.21	6.7	10
163. ENVIRONMENTAL STUDIES	10,681	0.16	3.6	6
164. FOOD SCIENCE & TECHNOLOGY	46,497	0.71	5.1	8

165. NUTRITION & DIETETICS	23,879	0.37	8.5	13
166. AGRIC., DAIRY & ANIMAL SCIENCE	23,741	0.36	3.8	6
167. HORTICULTURE	11,415	0.18	4.8	7

XVI. BIOLOGY

168. ORNITHOLOGY	4,902	0.08	4.2	6
169. ZOOLOGY	38,570	0.59	5.6	9
170. ENTOMOLOGY	21,639	0.33	4	7
171. WATER RESOURCES	28,222	0.43	4.4	7
172. FISHERIES	17,207	0.26	5.3	8
173. MARINE & FRESHWATER BIOLOGY	37,027	0.57	6.1	10
174. MICROBIOLOGY	63,814	0.98	11.2	17
175. PARASITOLOGY	13,268	0.2	6.2	10
176. VIROLOGY	24,543	0.38	15.1	23
177. FORESTRY	12,289	0.19	5.4	8
178. MYCOLOGY	6,973	0.11	5.3	8
179. PLANT SCIENCES	73,854	1.13	7.5	11
180. PURE AND APPLIED ECOLOGY	46,672	0.72	8.6	13
181. VETERINARY SCIENCES	54,380	0.84	3.8	6

XVII. MULTIDISCIPLINARY

182. MULTIDISCIPLINARY SCIENCES	27,961	0.43	3.2	4
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XVIII. RESIDUAL SUB-FIELDS

183. MATERIALS SCIENCE, MULT.	153,666	2.36	4.9	7
184. CRYSTALLOGRAPHY	32,344	0.5	4.4	6
185. GEOSCIENCES, MULTIDISCIPLINARY	54,564	0.84	5.6	9
186. MEDICAL, RES. & EXPERIMENTAL	48,413	0.74	14.7	18

D.SOCIAL SCIENCES

XIX. SOCIAL SCIENCES, GENERAL

187. CRIMINOLOGY & PENOLOGY	3,259	0.05	3.5	6
188. LAW	9,714	0.15	3.4	5
189. POLITICAL SCIENCE	12,582	0.19	2.4	4
190. PUBLIC ADMINISTRATION	3,595	0.06	2.5	4
191. ETHNIC STUDIES	817	0.01	1.9	3
192. FAMILY STUDIES	5,268	0.08	4.2	7
193. SOCIAL ISSUES	4,257	0.07	2.6	4
194. SOCIAL WORK	4,956	0.08	2.7	4
195. SOCIOLOGY	12,668	0.19	3	5
196. WOMEN'S STUDIES	3,757	0.06	2.8	5

197. EDUCATION & EDUCATIONAL RES.	15,755	0.24	2.4	4
198. EDUCATION, SPECIAL	3,055	0.05	3.7	6
199. AREA STUDIES	3,491	0.05	1.4	2
200. GEOGRAPHY	5,876	0.09	4.3	6
201. PLANNING & DEVELOPMENT	6,403	0.1	3.1	5
202. TRANSPORTATION	2,100	0.03	3.5	6
203 URBAN STUDIES	4,856	0.07	3.1	5
204. ETHICS	3,667	0.06	2.4	4
205. MEDICAL ETHICS	972	0.01	3.8	6
206. ANTHROPOLOGY	6,884	0.11	3.2	5
207. COMMUNICATION	5,052	0.08	3	5
208. DEMOGRAPHY	2,364	0.04	4.2	6
209. HISTORY OF SOCIAL SCIENCES	1,346	0.02	1.4	2
210. INFORMATION SC. & LIBRARY SC.	9,167	0.14	2.9	4
211. INTERNATIONAL RELATIONS	6,460	0.1	2.3	3
212. LINGUISTICS	6,031	0.09	4.3	7
213. SOCIAL SCIENCES, INTERD.	8,996	0.14	2.4	4
XX. ECONOMICS & BUSINESS				
214. AGRICULTURAL ECONOMICS & POLICY	2,034	0.03	2.6	4
215. ECONOMICS	40,420	0.62	3.6	5
216. INDUSTRIAL RELATIONS & LABOR	2,197	0.03	3.3	5
217. BUSINESS	10,516	0.16	5.1	8
218. BUSINESS, FINANCE	6,982	0.11	4.9	7
219. MANAGEMENT	14,854	0.23	4.7	7
ALL CATEGORIES	6,512,031	100	8	11
Mean Values	29,735	-	6.1	8.8
Standard Deviation	33,826	-	3.4	5.0

Table B. Publication Shares and Publication Effort By Geographical Area In the Double Extended Sub-field Count

Effort:	Publication Shares:				Publication		
	U.S. (1)	EU (2)	RW (3)	Total (4)	U.S. (5)	EU (6)	RW (7)
A. LIFE SCIENCES							
<i>I. BIOSCIENCES</i>							
1. BIOLOGY	29.6	30.7	39.7	100	0.43	0.41	0.45
2. BIOLOGY, MISCELLANEOUS	31.6	28.2	40.2	100	0.01	0.01	0.01
3. EVOLUTIONARY BIOLOGY	35.2	33.9	30.9	100	0.25	0.22	0.17
4. BIOCHEMICAL RESEARCH METHODS	29.5	37.8	32.6	100	0.58	0.67	0.49
5. BIOCHEMISTRY & MOLECULAR BIOLOGY	33.9	32	34.1	100	4.42	3.77	3.41
6. BIOPHYSICS	27.9	32.7	39.4	100	0.83	0.87	0.89
7. CELL BIOLOGY	36.2	32.9	30.9	100	1.85	1.52	1.21
8. GENETICS & HEREDITY	34.7	34.7	30.5	100	1.36	1.23	0.92
9. DEVELOPMENTAL BIOLOGY	40.4	31.4	28.2	100	0.42	0.29	0.22
<i>II. BIOMEDICAL RESEARCH</i>							
10. PATHOLOGY	30.6	34.8	34.5	100	0.52	0.54	0.45
11. ANATOMY & MORPHOLOGY	24.6	39.9	35.5	100	0.09	0.13	0.1
12. ENGINEERING, BIOMEDICAL	30.9	37.5	31.6	100	0.35	0.38	0.27
13. BIOTECH. & APPLIED MICROBIOLOGY	25.9	33.4	40.7	100	0.95	1.1	1.14
14. MEDICAL LABORATORY TECHNOLOGY	36.1	33.5	30.4	100	0.21	0.17	0.13
15. MICROSCOPY	24.7	38.3	37	100	0.06	0.08	0.07
16. PHARMACOLOGY & PHARMACY	27.8	33	39.3	100	1.62	1.74	1.75
17. TOXICOLOGY	35.6	29.7	34.7	100	0.64	0.48	0.47
18. PHYSIOLOGY	39	28.5	32.5	100	1.01	0.66	0.64
<i>III. CLINICAL MEDICINE I (INTERNAL)</i>							
19. CARDIAC & CARDIOVASCULAR SYSTEMS	35.1	36.9	28.1	100	1.11	1.05	0.68
20. RESPIRATORY SYSTEM	34.6	37.4	28	100	0.56	0.55	0.35
21. ENDOCRINOLOGY & METABOLISM	31.4	38.9	29.7	100	0.92	1.02	0.66
22. ANESTHESIOLOGY	25.8	46.4	27.8	100	0.24	0.4	0.2
23. CRITICAL CARE MEDICINE	33.8	39.9	26.3	100	0.25	0.27	0.15
24. EMERGENCY MEDICINE	52.3	33.4	14.2	100	0.19	0.11	0.04
25. GASTROENTEROLOGY & HEPATOLOGY	24.4	39.3	36.2	100	0.49	0.71	0.55
26. MEDICINE, GENERAL & INTERNAL	28.5	36.8	34.7	100	0.99	1.15	0.92
27. TROPICAL MEDICINE	12.8	25.3	61.9	100	0.06	0.11	0.23
28. HEMATOLOGY	32.8	40.2	27	100	0.81	0.9	0.51
29. ONCOLOGY	34	35.5	30.4	100	1.63	1.54	1.12
30. ALLERGY	23.4	49	27.5	100	0.12	0.23	0.11
31. IMMUNOLOGY	35.2	34.6	30.2	100	1.74	1.55	1.14
32. INFECTIOUS DISEASES	37.7	35.8	26.5	100	0.75	0.64	0.4
<i>IV. CL. MEDICINE II (NON-INTERNAL)</i>							
33. GERIATRICS & GERONTOLOGY	44.9	34.1	20.9	100	0.24	0.16	0.09
34. OBSTETRICS & GYNECOLOGY	30.8	39.3	29.8	100	0.56	0.65	0.42

35. ANDROLOGY	23.9	30.2	45.9	100	0.02	0.02	0.03
36. REPRODUCTIVE BIOLOGY	26.6	38.9	34.6	100	0.26	0.35	0.26
37. GERONTOLOGY	60.3	21.6	18.1	100	0.23	0.08	0.05
38. DENTISTRY, ORAL SURGERY	29.5	34.7	35.8	100	0.36	0.38	0.33
39. DERMATOLOGY	27.3	44.4	28.3	100	0.33	0.48	0.26
40. UROLOGY & NEPHROLOGY	32.7	38	29.3	100	0.62	0.65	0.43
41. OTORHINOLARYNGOLOGY	36.9	36.4	26.7	100	0.36	0.32	0.2
42. OPHTHALMOLOGY	36.2	33.1	30.7	100	0.55	0.45	0.36
43. INTEGRATIVE & COMPLEMENTARY MED.	21.3	26.2	52.4	100	0.03	0.03	0.06
44. CLINICAL NEUROLOGY	30.3	39	30.7	100	1.17	1.35	0.9
45. PSYCHIATRY	38.5	36.4	25.1	100	0.95	0.81	0.47
46. RADIOLOGY, NUCLEAR MED. & IMAGING	33.8	37.9	28.3	100	1.05	1.06	0.67
47. ORTHOPEDICS	40.6	33.9	25.5	100	0.55	0.41	0.26
48. RHEUMATOLOGY	23.4	47.2	29.3	100	0.15	0.26	0.14
49. SPORT SCIENCES	45.6	28.9	25.5	100	0.54	0.31	0.23
50. SURGERY	33.6	34.2	32.2	100	1.93	1.77	1.41
51. TRANSPLANTATION	29.3	38.7	32	100	0.35	0.41	0.29
P52. PERIPHERAL VASCULAR DISEASE	35.2	38	26.9	100	0.75	0.73	0.44
53. PEDIATRICS	35.6	33.4	31	100	0.85	0.72	0.57
V. CL. MED. III (HEALTH & OTHER SCS.)							
54. HEALTH CARE SCIENCES & SERVICES	52	27.9	20.2	100	0.41	0.2	0.12
55. HEALTH POLICY & SERVICES	68.1	15.3	16.7	100	0.34	0.07	0.06
56. MEDICINE, LEGAL	32.5	37.6	29.9	100	0.08	0.08	0.05
57. NURSING	58.6	24.2	17.2	100	0.28	0.1	0.06
58. PUBLIC, ENVIRON. & OCCUP. HEALTH	40.7	29.1	30.2	100	1.21	0.78	0.69
59. REHABILITATION	55.7	23.5	20.8	100	0.42	0.16	0.12
60. SUBSTANCE ABUSE	59.3	21.8	18.9	100	0.26	0.09	0.06
61. EDUCATION, SCIENTIFIC DISCIPLINES	60.3	18.6	21.1	100	0.27	0.07	0.07
62. MEDICAL INFORMATICS	38.2	38.5	23.3	100	0.14	0.13	0.07
VI. NEURO, SCIENCE & BEHAVIOR							
63. NEUROIMAGING	32.3	41.4	26.3	100	0.12	0.13	0.07
64. NEUROSCIENCES	35.1	34	30.9	100	2.32	2.02	1.56
65. BEHAVIORAL SCIENCES	40.7	33.1	26.2	100	0.35	0.26	0.17
66. PSYCHOLOGY, BIOLOGICAL	46.1	29.9	24	100	0.11	0.06	0.04
67. PSYCHOLOGY	45.3	32.6	22.1	100	0.43	0.28	0.16
68. PSYCHOLOGY, APPLIED	63.1	19.4	17.5	100	0.29	0.08	0.06
69. PSYCHOLOGY, CLINICAL	61.2	22.9	15.9	100	0.61	0.21	0.12
70. PSYCHOLOGY, DEVELOPMENTAL	60.1	21	18.9	100	0.35	0.11	0.08
71. PSYCHOLOGY, EDUCATIONAL	58.5	19.2	22.3	100	0.17	0.05	0.05
72. PSYCHOLOGY, EXPERIMENTAL	43.4	34.3	22.3	100	0.4	0.28	0.16
73. PSYCHOLOGY, MATHEMATICAL	59.3	21	19.6	100	0.06	0.02	0.02
74. PSYCHOLOGY, MULTIDISCIPLINARY	48.9	25.1	26	100	0.51	0.23	0.21
75. PSYCHOLOGY, PSYCHOANALYSIS	51	38.1	10.9	100	0.07	0.05	0.01
76. PSYCHOLOGY, SOCIAL	55.3	23.7	21.1	100	0.31	0.12	0.09
77. SOCIAL SCIENCES, BIOMEDICAL	38.3	26.8	34.9	100	0.13	0.08	0.09

B. PHYSICAL SCIENCES

VII. CHEMISTRY

78. CHEMISTRY, MULTIDISCIPLINARY	18.1	23.7	58.2	100	1.02	1.21	2.52
79. CHEMISTRY, INORGANIC & NUCLEAR	15.8	38.7	45.5	100	0.46	1.01	1.01
80. CHEMISTRY, ANALYTICAL	19.4	35	45.5	100	0.75	1.22	1.34
81. CHEMISTRY, APPLIED	17	32.2	50.8	100	0.33	0.56	0.76
82. ENGINEERING, CHEMICAL	19.5	30.8	49.7	100	0.66	0.93	1.28
83. CHEMISTRY, MEDICINAL	25.7	28.2	46.2	100	0.37	0.37	0.51
84. CHEMISTRY, ORGANIC	20.3	34.7	45	100	0.9	1.39	1.52
85. CHEMISTRY, PHYSICAL	17.9	34.8	47.3	100	1.35	2.37	2.72
86. ELECTROCHEMISTRY	16.3	29.6	54.1	100	0.19	0.31	0.48
87. POLYMER SCIENCE	16.2	28	55.8	100	0.52	0.82	1.38

VIII. PHYSICS

88. PHYSICS, MULTIDISCIPLINARY	17.2	30.9	51.8	100	0.92	1.49	2.11
89. SPECTROSCOPY	22	34.2	43.8	100	0.41	0.57	0.62
90. ACOUSTICS	29.5	33.1	37.4	100	0.25	0.25	0.24
91. OPTICS	23.2	31.4	45.4	100	0.75	0.91	1.12
92. PHYSICS, APPLIED	21.1	27.6	51.3	100	1.59	1.88	2.95
93. PHYSICS, ATOMIC, MOLEC. & CHEMICAL	23.9	36.3	39.8	100	0.93	1.28	1.19
94. THERMODYNAMICS (CLASSICAL PHYSICS)	24	27.4	48.6	100	0.24	0.25	0.38
95. PHYSICS, MATHEMATICAL	21.1	35.7	43.1	100	0.46	0.69	0.71
96. PHYSICS, NUCLEAR	18.6	33.7	47.7	100	0.32	0.53	0.63
97. PHYSICS, PARTICLES & FIELDS	22.7	35.4	41.9	100	0.6	0.85	0.85
98. PHYSICS, CONDENSED MATTER	16.2	35.3	48.5	100	1.11	2.18	2.54
99. PHYSICS OF SOLIDS, FLUIDS & PLASMAS	28.2	34.2	37.6	100	0.44	0.48	0.45

IX. SPACE SCIENCES

100. ASTRONOMY & ASTROPHYSICS	31.5	34.8	33.7	100	1.36	1.35	1.11
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X. MATHEMATICS

101. MATHEMATICS, APPLIED	23.7	33.5	42.8	100	0.77	0.98	1.06
102. STATISTICS & PROBABILITY	33.8	32.2	34	100	0.48	0.41	0.37
103. MATHEMATICS, INTERDISC. APPL.	27.6	35.5	36.9	100	0.29	0.34	0.3
104. SOCIAL SCIENCES, MATH. METHODS	39.7	37.3	23	100	0.13	0.11	0.06
105. PURE MATHEMATICS	23.5	32.2	44.3	100	0.94	1.16	1.35

XI. COMPUTER SCIENCE

106. COMP. SC., ARTIFICIAL INTELLIGENCE	26.4	35.9	37.7	100	0.37	0.45	0.4
107. COMPUTER SCIENCE, CYBERNETICS	22.8	30.2	47	100	0.06	0.07	0.09
108. COMP. SC., HARDWARE & ARCHITECTURE	40	22.6	37.5	100	0.3	0.15	0.21
109. COMP. SC., INFORMATION SYSTEMS	36.3	26.4	37.2	100	0.44	0.29	0.34
110. COMP. SC., INTERDIS. APPLICATIONS	31.7	32	36.3	100	0.51	0.47	0.45
111. COMP. SC., SOFTWARE ENGINEERING	37.3	28.9	33.8	100	0.38	0.27	0.27
112. COMP. SC., THEORY & METHODS	27.2	40.3	32.5	100	0.54	0.72	0.49
113. MATHEMATICAL & COMPUT. BIOLOGY	39.5	33	27.5	100	0.18	0.13	0.1

C. OTHER NATURAL SCIENCES

XII. ENGINEERING

114. ENG., ELECTRICAL & ELECTRONIC	29.5	27	43.6	100	2.03	1.67	2.29
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115. TELECOMMUNICATIONS	32.1	25.3	42.6	100	0.36	0.26	0.37
116. CONSTRUCTION & BUILDING TECH.	27.8	30.6	41.6	100	0.13	0.13	0.15
117. ENGINEERING, CIVIL	35.1	24.6	40.4	100	0.43	0.27	0.38
118. ENGINEERING, ENVIRONMENTAL	32.5	31.9	35.6	100	0.38	0.33	0.32
119. ENGINEERING, MARINE	28.3	37.2	34.5	100	0.01	0.01	0.01
120. TRANSPORTATION SC. & TECHNOLOGY	48.2	20.6	31.2	100	0.16	0.06	0.08
121. ENGINEERING, INDUSTRIAL	31.2	24.2	44.6	100	0.23	0.16	0.25
122. ENGINEERING, MANUFACTURING	24.6	25.4	50.1	100	0.19	0.17	0.29
123. ENGINEERING, MECHANICAL	27.8	26	46.2	100	0.6	0.5	0.76
124. MECHANICS	24.4	31.2	44.4	100	0.61	0.71	0.86
125. ROBOTICS	27.6	29.6	42.8	100	0.05	0.05	0.06
126. INSTRUMENTS & INSTRUMENTATION	22.8	33.9	43.3	100	0.52	0.7	0.75
127. IMAGING SC. & PHOTOGRAPHIC TECH.	32.9	30.5	36.6	100	0.09	0.08	0.08
128. ENERGY & FUELS	23.3	27.2	49.6	100	0.32	0.34	0.52
129. NUCLEAR SCIENCE & TECHNOLOGY	18.9	34.2	46.9	100	0.42	0.69	0.8
130. ENGINEERING, PETROLEUM	34.9	18.2	46.9	100	0.13	0.06	0.13
131. AUTOMATION & CONTROL SYSTEMS	24.4	30.9	44.6	100	0.23	0.27	0.32
132. ENGINEERING, MULTIDISCIPLINARY	29.8	27.2	43	100	0.34	0.28	0.38
133. ERGONOMICS	33	39	28	100	0.06	0.06	0.04
134. OPERATIONS RES. & MANAG. SCIENCE	32.1	29.9	38	100	0.35	0.3	0.32
XIII. MATERIALS SCIENCE							
135. MATERIALS SCIENCE, BIOMATERIALS	25.4	36.3	38.3	100	0.1	0.13	0.11
136. MATERIALS SCIENCE, CERAMICS	12.1	29.8	58	100	0.14	0.3	0.49
137. MAT. SC., CHARAC. & TESTING	20.5	27	52.5	100	0.07	0.08	0.14
138. MAT. SC., COATINGS & FILMS	19.5	32	48.5	100	0.25	0.37	0.48
139. MATERIALS SCIENCE, COMPOSITES	19.5	29.1	51.4	100	0.11	0.14	0.21
140. MATERIALS SCIENCE, PAPER & WOOD	23.2	33.7	43.1	100	0.08	0.1	0.11
141. MATERIALS SCIENCE, TEXTILES	19	20	61	100	0.05	0.05	0.12
142. METALLURGY & METALL. ENGIN.	13.5	24.3	62.2	100	0.3	0.49	1.06
143. NANOSCIENCE & NANOTECHNOLOGY	25	32.7	42.4	100	0.29	0.34	0.37
XIV. GEOSCIENCES							
144. GEOCHEMISTRY & GEOPHYSICS	28.5	34.4	37	100	0.49	0.53	0.49
145. GEOGRAPHY, PHYSICAL	26.2	37.2	36.6	100	0.14	0.18	0.15
146. GEOLOGY	25.4	32.6	42	100	0.13	0.15	0.16
147. ENGINEERING, GEOLOGICAL	25.3	26.2	48.6	100	0.07	0.07	0.1
148. PALEONTOLOGY	20.5	40.6	38.9	100	0.09	0.15	0.13
149. REMOTE SENSING	35	32.1	32.8	100	0.11	0.09	0.08
150. OCEANOGRAPHY	28.9	32.9	38.2	100	0.34	0.35	0.34
151. ENGINEERING, OCEAN	39.9	23.1	37	100	0.08	0.04	0.06
152. METEOROLOGY & ATMOSPH. SCS.	36.2	30.8	33	100	0.63	0.48	0.44
153. ENGINEERING, AEROSPACE	39.5	25.9	34.6	100	0.27	0.16	0.18
154. MINERALOGY	18.5	37.3	44.2	100	0.09	0.16	0.16
155. MINING & MINERAL PROCESSING	21.4	22.1	56.5	100	0.08	0.08	0.17
XV. AGRIC. AND ENVIRONMENT							
156. AGRICULTURAL ENGINEERING	37.1	25.7	37.2	100	0.09	0.06	0.07
157. AGRICULTURE, MULTIDISCIPLINARY	14.4	35.1	50.5	100	0.12	0.26	0.32

158. AGRONOMY	25.4	27.2	47.4	100	0.35	0.34	0.5
159. LIMNOLOGY	40.3	27.6	32.1	100	0.13	0.08	0.08
160. SOIL SCIENCE	22.8	34.3	42.9	100	0.19	0.25	0.27
161. BIODIVERSITY CONSERVATION	40.3	25.4	34.3	100	0.15	0.09	0.1
162. ENVIRONMENTAL SCIENCES	30.6	32.9	36.5	100	1.26	1.22	1.15
163. ENVIRONMENTAL STUDIES	37.3	35.4	27.2	100	0.21	0.18	0.12
164. FOOD SCIENCE & TECHNOLOGY	20.4	37.3	42.3	100	0.5	0.82	0.79
165. NUTRITION & DIETETICS	31.9	36.1	32	100	0.4	0.41	0.31
166. AGRIC., DAIRY & ANIMAL SCIENCE	23.7	28.9	47.3	100	0.3	0.33	0.45
167. HORTICULTURE	28.2	28.4	43.4	100	0.17	0.15	0.2
XVI. BIOLOGY							
(ORGANISMIC & SUPRAORG. LEVEL)							
168. ORNITHOLOGY	35.4	32	32.6	100	0.09	0.07	0.06
169. ZOOLOGY	31.5	28.6	39.9	100	0.64	0.52	0.62
170. ENTOMOLOGY	37.3	23.9	38.9	100	0.42	0.24	0.34
171. WATER RESOURCES	26.3	33.3	40.4	100	0.39	0.44	0.46
172. FISHERIES	24.6	24.4	51	100	0.22	0.2	0.35
173. MARINE & FRESHWATER BIOLOGY	24.1	36.4	39.6	100	0.47	0.64	0.59
174. MICROBIOLOGY	26.2	39.4	34.4	100	0.88	1.19	0.88
175. PARASITOLOGY	19.8	32	48.2	100	0.14	0.2	0.26
176. VIROLOGY	37.8	35	27.3	100	0.49	0.41	0.27
177. FORESTRY	31.6	33.2	35.2	100	0.2	0.19	0.17
178. MYCOLOGY	19	37.2	43.8	100	0.07	0.12	0.12
179. PLANT SCIENCES	21.1	32.4	46.5	100	0.82	1.13	1.38
180. PURE AND APPLIED ECOLOGY	35.4	30	34.6	100	0.87	0.66	0.65
181. VETERINARY SCIENCES	27.8	31.9	40.2	100	0.79	0.82	0.88
XVII. MULTIDISCIPLINARY							
182. MULTIDISCIPLINARY SCIENCES	22.7	22.7	54.5	100	0.33	0.3	0.61
XVIII. RESIDUAL SUB-FIELDS							
183. MATERIALS SCIENCE, MULT.	16.9	30.7	52.4	100	1.36	2.23	3.23
184. CRYSTALLOGRAPHY	12.9	34.1	53	100	0.22	0.52	0.69
185. GEOSCIENCES, MULT.	25.7	32.1	42.2	100	0.74	0.83	0.92
186. MED., RES. & EXPERIMENTAL	35	30.5	34.4	100	0.89	0.7	0.67
D. SOCIAL SCIENCES							
XIX. SOCIAL SCIENCES, GENERAL							
187. CRIMINOLOGY & PENOLOGY	48.1	31.8	20.1	100	0.08	0.05	0.03
188. LAW	79.8	12.1	8.1	100	0.41	0.06	0.03
189. POLITICAL SCIENCE	53.5	27.3	19.2	100	0.35	0.16	0.1
190. PUBLIC ADMINISTRATION	47.3	29.3	23.4	100	0.09	0.05	0.03
191. ETHNIC STUDIES	62.4	23.9	13.7	100	0.03	0.01	0
192. FAMILY STUDIES	71.8	11.8	16.4	100	0.2	0.03	0.03
193. SOCIAL ISSUES	54.5	24.2	21.3	100	0.12	0.05	0.04
194. SOCIAL WORK	64.8	16.6	18.6	100	0.17	0.04	0.04
195. SOCIOLOGY	46.3	25.7	27.9	100	0.31	0.15	0.14
196. WOMEN'S STUDIES	64.7	14.7	20.5	100	0.13	0.03	0.03

197. EDUCATION & EDUCATIONAL RES.	60.5	20.7	18.8	100	0.5	0.15	0.12
198. EDUCATION, SPECIAL	73.5	15.2	11.3	100	0.12	0.02	0.01
199. AREA STUDIES	45.9	19.2	34.9	100	0.08	0.03	0.05
200. GEOGRAPHY	30.9	45.6	23.6	100	0.1	0.13	0.06
201. PLANNING & DEVELOPMENT	36.9	36.2	26.9	100	0.12	0.11	0.07
202. TRANSPORTATION	42	26.9	31	100	0.05	0.03	0.03
2003 URBAN STUDIES	51.6	26.6	21.8	100	0.13	0.06	0.04
204. ETHICS	56	20	24	100	0.11	0.03	0.04
205. MEDICAL ETHICS	32	43.6	24.4	100	0.02	0.02	0.01
206. ANTHROPOLOGY	43.5	24.2	32.2	100	0.16	0.08	0.09
207. COMMUNICATION	63.8	20.5	15.6	100	0.17	0.05	0.03
208. DEMOGRAPHY	50.9	24.9	24.2	100	0.06	0.03	0.02
209. HISTORY OF SOCIAL SCIENCES	40.2	38.3	21.5	100	0.03	0.02	0.01
210. INFORMATION SC. & LIBRARY SC.	55.4	26.1	18.5	100	0.27	0.11	0.07
211. INTERNATIONAL RELATIONS	44.2	33.2	22.6	100	0.15	0.1	0.06
212. LINGUISTICS	52.6	25.7	21.7	100	0.17	0.07	0.05
213. SOCIAL SCIENCES, INTERD.	54	26.2	19.8	100	0.25	0.11	0.07
XX. ECONOMICS & BUSINESS							
214. AGRICULTURAL ECONOMICS & POLICY	53.1	19.9	26.9	100	0.06	0.02	0.02
215. ECONOMICS	44	32.4	23.5	100	0.93	0.62	0.38
216. INDUSTRIAL RELATIONS & LABOR	59.3	21.8	18.8	100	0.07	0.02	0.02
217. BUSINESS	60.1	21	18.8	100	0.33	0.1	0.08
218. BUSINESS, FINANCE	66.8	17.3	15.9	100	0.24	0.06	0.04
219. MANAGEMENT	45.4	31.6	23	100	0.35	0.22	0.14
ALL CATEGORIES	29.3	32.5	38.3	100	100	100	100

Table C. High- and Low-impact Indicators for the U.S., the EU, and the RW at the Sub-field Level

	HIGH- IMPACT				LOW-IMPACT			
	U.S. ALL (1) (8)	EU (2)	RW (3)	ALL (4)	U.S. (5)	EU (6)	RW (7)	
A. LIFE SCIENCES								
<i>I. BIOSCIENCES</i>								
1. BIOLOGY	0.765	0.874	0.326	0.624	0.38	0.36	0.59	0.46
2. BIOLOGY, MISCELLANEOUS	0.269	0.321	0.402	0.337	0.55	0.4	0.44	0.46
3. EVOLUTIONARY BIOLOGY	0.635	0.374	0.273	0.435	0.31	0.36	0.42	0.36
4. BIOCHEMICAL RESEARCH METHODS	13.65	5.748	8.093	8.848	0.37	0.36	0.42	0.38
5. BIOCHEMISTRY & MOLECULAR BIOLOGY	1.863	1.064	0.698	1.21	0.31	0.39	0.5	0.40
6. BIOPHYSICS	3.012	2.337	1.836	2.328	0.31	0.35	0.45	0.38
7. CELL BIOLOGY	1.488	0.705	0.556	0.942	0.34	0.44	0.52	0.43
8. GENETICS & HEREDITY	1.504	0.806	0.611	0.989	0.35	0.42	0.49	0.42
9. DEVELOPMENTAL BIOLOGY	0.963	0.415	0.343	0.616	0.35	0.42	0.51	0.42
<i>II. BIOMEDICAL RESEARCH</i>								
10. PATHOLOGY	1.278	0.704	0.404	0.776	0.36	0.42	0.51	0.43
11. ANATOMY & MORPHOLOGY	0.64	0.432	0.206	0.403	0.31	0.42	0.49	0.42
12. ENGINEERING, BIOMEDICAL	0.555	0.281	0.295	0.37	0.4	0.43	0.44	0.42
13. BIOTECH. & APPLIED MICROBIOLOGY	5.834	1.634	1.876	2.822	0.34	0.38	0.5	0.41
14. MEDICAL LABORATORY TECHNOLOGY	1.227	0.746	0.595	0.874	0.44	0.4	0.46	0.43
15. MICROSCOPY	0.437	0.435	0.165	0.336	0.43	0.36	0.46	0.42
16. PHARMACOLOGY & PHARMACY	0.958	0.705	0.332	0.629	0.34	0.38	0.45	0.40
17. TOXICOLOGY	0.646	0.482	0.315	0.483	0.36	0.37	0.44	0.39
18. PHYSIOLOGY	0.279	0.182	0.124	0.201	0.29	0.4	0.47	0.38
<i>III. CLINICAL MEDICINE I (INTERNAL)</i>								
19. CARDIAC & CARDIOVASCULAR SYSTEMS	1.85	1.215	0.793	1.319	0.39	0.48	0.53	0.46
20. RESPIRATORY SYSTEM	0.595	0.422	0.326	0.455	0.36	0.43	0.45	0.41
21. ENDOCRINOLOGY & METABOLISM	0.85	0.468	0.402	0.569	0.31	0.4	0.44	0.39
22. ANESTHESIOLOGY	0.708	0.376	0.283	0.436	0.37	0.47	0.45	0.44
23. CRITICAL CARE MEDICINE	0.843	0.474	0.441	0.59	0.35	0.47	0.46	0.42
24. EMERGENCY MEDICINE	0.608	0.159	0.291	0.413	0.42	0.55	0.46	0.47
25. GASTROENTEROLOGY & HEPATOLOGY	1.495	0.919	0.57	0.933	0.36	0.42	0.49	0.43
26. MEDICINE, GENERAL & INTERNAL	33.7	15.55	11.04	19.15	0.42	0.58	0.67	0.56
27. TROPICAL MEDICINE	0.688	0.346	0.249	0.33	0.27	0.37	0.47	0.42
28. HEMATOLOGY	1.049	0.67	0.441	0.733	0.36	0.44	0.51	0.43
29. ONCOLOGY	1.967	0.592	0.586	1.058	0.33	0.43	0.45	0.40

30. ALLERGY	0.738	0.547	0.499	0.578	0.39	0.47	0.45	0.45
31. IMMUNOLOGY	1.314	0.771	0.723	0.947	0.34	0.42	0.49	0.41
32. INFECTIOUS DISEASES	0.574	0.336	0.304	0.417	0.35	0.42	0.43	0.40
IV. CLIN. MED. II (NON-INTERNAL)								
33. GERIATRICS & GERONTOLOGY	0.515	0.224	0.225	0.355	0.39	0.46	0.44	0.42
34. OBSTETRICS & GYNECOLOGY	0.501	0.408	0.274	0.397	0.39	0.45	0.47	0.44
35. ANDROLOGY	0.671	0.432	0.142	0.356	0.33	0.39	0.44	0.40
36. REPRODUCTIVE BIOLOGY	0.374	0.279	0.208	0.28	0.32	0.37	0.42	0.37
37. GERONTOLOGY	0.45	0.308	0.278	0.388	0.43	0.46	0.49	0.44
38. DENTISTRY, ORAL SURGERY	0.601	0.363	0.337	0.424	0.4	0.37	0.4	0.39
39. DERMATOLOGY	0.754	0.371	0.369	0.475	0.42	0.45	0.47	0.45
40. UROLOGY & NEPHROLOGY	0.989	0.63	0.387	0.676	0.36	0.48	0.51	0.45
41. OTORHINOLARYNGOLOGY	0.523	0.226	0.197	0.328	0.35	0.47	0.48	0.43
42. OPHTHALMOLOGY	1.089	0.461	0.399	0.669	0.37	0.47	0.47	0.43
43. INTEGRATIVE & COMPLEM. MEDICINE	0.236	0.518	0.221	0.302	0.43	0.46	0.37	0.41
44. CLINICAL NEUROLOGY	1.079	0.63	0.413	0.7	0.37	0.44	0.51	0.44
45. PSYCHIATRY	1.039	0.378	0.354	0.627	0.36	0.47	0.52	0.44
46. RADIOLOGY, NUCLEAR MED. & IMAGING	1.059	0.669	0.317	0.701	0.39	0.45	0.51	0.44
47. ORTHOPEDICS	0.741	0.364	0.361	0.516	0.37	0.47	0.45	0.43
48. RHEUMATOLOGY	1.41	0.751	0.705	0.892	0.38	0.42	0.42	0.41
49. SPORT SCIENCES	0.404	0.233	0.251	0.315	0.44	0.45	0.44	0.44
50. SURGERY	1.027	0.591	0.364	0.664	0.36	0.47	0.52	0.45
51. TRANSPLANTATION	1.313	0.727	0.559	0.845	0.36	0.44	0.54	0.45
52. PERIPHERAL VASCULAR DISEASE	1.095	0.757	0.758	0.876	0.36	0.46	0.48	0.43
53. PEDIATRICS	1.476	0.428	0.364	0.781	0.38	0.49	0.5	0.45
V. CL. MED. III (HEALTH & OTHER SCS.)								
54. HEALTH CARE SCIENCES & SERVICES	0.804	0.393	0.359	0.6	0.42	0.43	0.46	0.43
55. HEALTH POLICY & SERVICES	0.909	0.577	0.417	0.776	0.39	0.43	0.46	0.41
56. MEDICINE, LEGAL	0.589	0.546	0.354	0.503	0.4	0.42	0.45	0.42
57. NURSING	0.321	0.274	0.295	0.305	0.51	0.33	0.37	0.45
58. PUBLIC, ENVIRON. & OCCUP. HEALTH	0.799	0.473	0.307	0.556	0.37	0.41	0.47	0.41
59. REHABILITATION	0.393	0.333	0.298	0.359	0.47	0.41	0.44	0.45
60. SUBSTANCE ABUSE	0.32	0.204	0.144	0.261	0.36	0.42	0.43	0.39
61. EDUCATION, SCIENTIFIC DISCIPLINES	1.054	1.079	1.062	1.06	0.47	0.44	0.5	0.47
62. MEDICAL INFORMATICS	0.98	1.04	0.283	0.841	0.51	0.46	0.51	0.49
VI. NEUROSCIENCE & BEHAVIOR								
63. NEUROIMAGING	0.837	0.803	0.272	0.674	0.4	0.49	0.51	0.47
64. NEUROSCIENCES	0.925	0.444	0.298	0.568	0.32	0.41	0.48	0.40

65. BEHAVIORAL SCIENCES	0.296	0.298	0.165	0.263	0.32	0.3	0.36	0.33
66. PSYCHOLOGY, BIOLOGICAL	0.37	0.517	0.362	0.412	0.35	0.34	0.4	0.36
67. PSYCHOLOGY	0.444	0.298	0.252	0.354	0.36	0.42	0.44	0.39
68. PSYCHOLOGY, APPLIED	0.433	0.305	0.443	0.410	0.4	0.46	0.41	0.41
69. PSYCHOLOGY, CLINICAL	0.528	0.386	0.326	0.463	0.42	0.47	0.43	0.43
70. PSYCHOLOGY, DEVELOPMENTAL	0.493	0.423	0.302	0.442	0.4	0.44	0.43	0.41
71. PSYCHOLOGY, EDUCATIONAL	0.706	0.327	0.213	0.523	0.38	0.52	0.63	0.47
72. PSYCHOLOGY, EXPERIMENTAL	0.529	0.389	0.264	0.422	0.43	0.39	0.48	0.43
73. PSYCHOLOGY, MATHEMATICAL	0.531	0.315	0.394	0.459	0.46	0.41	0.42	0.44
74. PSYCHOLOGY, MULTIDISCIPLINARY	2.223	0.71	0.478	1.390	0.42	0.53	0.58	0.49
75. PSYCHOLOGY, PSYCHOANALYSIS	1.087	0.924	0.502	0.961	0.49	0.58	0.54	0.53
76. PSYCHOLOGY, SOCIAL	0.753	0.424	0.404	0.602	0.400	0.44	0.43	0.42
77. SOCIAL SCIENCES, BIOMEDICAL	0.63	0.828	0.421	0.610	0.44	0.36	0.44	0.42

B. PHYSICAL SCIENCES

VII. CHEMISTRY

78. CHEMISTRY, MULTIDISCIPLINARY	2.97	1.027	0.425	1.029	0.28	0.4	0.61	0.50
79. CHEMISTRY, INORGANIC & NUCLEAR	0.622	0.304	0.259	0.334	0.33	0.38	0.51	0.43
80. CHEMISTRY, ANALYTICAL	1.382	0.52	0.514	0.685	0.35	0.36	0.47	0.41
81. CHEMISTRY, APPLIED	0.582	0.556	0.225	0.392	0.38	0.36	0.51	0.44
82. ENGINEERING, CHEMICAL	0.827	0.732	0.33	0.551	0.45	0.44	0.52	0.48
83. CHEMISTRY, MEDICINAL	0.852	0.44	0.237	0.452	0.27	0.36	0.45	0.38
84. CHEMISTRY, ORGANIC	0.879	0.332	0.231	0.398	0.3	0.34	0.45	0.38
85. CHEMISTRY, PHYSICAL	1.253	0.532	0.291	0.547	0.32	0.38	0.48	0.42
86. ELECTROCHEMISTRY	0.66	0.31	0.247	0.333	0.33	0.35	0.46	0.41
87. POLYMER SCIENCE	1.662	0.78	0.441	0.733	0.34	0.39	0.47	0.43

VIII. PHYSICS

88. PHYSICS, MULTIDISCIPLINARY	8.779	2.897	1.472	3.174	0.36	0.47	0.59	0.51
89. SPECTROSCOPY	1.356	0.7	0.316	0.676	0.36	0.39	0.52	0.44
90. ACOUSTICS	0.654	0.681	0.238	0.507	0.38	0.4	0.5	0.43
91. OPTICS	1.706	1.023	0.518	0.952	0.39	0.39	0.52	0.45
92. PHYSICS, APPLIED	2.501	1.149	0.765	1.237	0.37	0.41	0.5	0.45
93. PHYSICS, ATOMIC, MOLECULAR & CHEMICAL	0.752	0.393	0.286	0.436	0.31	0.37	0.44	0.38
94. THERMODYNAMICS (CLASSICAL PHYSICS)	0.915	0.664	0.356	0.575	0.35	0.4	0.45	0.41
95. PHYSICS, MATHEMATICAL	1.342	0.897	0.48	0.811	0.38	0.4	0.5	0.44
96. PHYSICS, NUCLEAR	1.777	1.074	0.759	1.055	0.42	0.42	0.52	0.47
97. PHYSICS, PARTICLES & FIELDS	7.408	3.826	3.031	4.305	0.42	0.47	0.54	0.49
98. PHYSICS, CONDENSED MATTER	1.606	1.011	0.449	0.835	0.4	0.44	0.53	0.47

99. PHYSICS OF SOLIDS, FLUIDS & PLASMAS	0.587	0.452	0.236	0.409	0.36	0.36	0.45	0.39
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IX. SPACE SCIENCES

100. ASTRONOMY & ASTROPHYSICS	1.571	1.107	0.661	1.103	0.35	0.44	0.52	0.44
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X. MATHEMATICS

101. MATHEMATICS, APPLIED	1.569	0.885	0.521	0.891	0.43	0.45	0.54	0.48
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102. STATISTICS & PROBABILITY	33.03	12.24	21.59	22.44	0.45	0.46	0.56	0.49
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103. MATHEMATICS, INTERDISC. APPL.	1.212	0.671	0.505	0.759	0.39	0.43	0.48	0.44
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104. SOCIAL SCIENCES, MATH. METHODS	1.454	0.526	0.591	0.909	0.38	0.50	0.52	0.45
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105. PURE MATHEMATICS	1.33	0.940	0.526	0.849	0.43	0.46	0.56	0.50
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XI. COMPUTER SCIENCE

106. COMP. SC., ARTIFICIAL INTELLIGENCE	2.26	1.219	0.99	1.408	0.46	0.51	0.58	0.52
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107. COMPUTER SCIENCE, CYBERNETICS	2.429	0.984	0.419	1.048	0.38	0.44	0.65	0.53
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108. COMP. SC., HARDWARE & ARCHITECTURE	2.672	1.547	0.952	1.774	0.47	0.54	0.62	0.54
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109. COMP. SC., INFORMATION SYSTEMS	3.884	1.448	0.81	2.096	0.5	0.52	0.6	0.54
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110. COMP. SC., INTERDIS. APPLICATIONS	31.07	11.91	17.89	20.15	0.47	0.47	0.54	0.49
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111. COMP. SC., SOFTWARE ENGINEERING	1.733	1.024	0.668	1.168	0.49	0.49	0.57	0.52
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112. COMP. SC., THEORY & METHODS	2.193	1.01	1.464	1.48	0.51	0.57	0.6	0.56
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113. MATHEMATICAL & COMPUT. BIOLOGY	30.45	12.53	29.48	24.26	0.38	0.37	0.47	0.40
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C. OTHER NATURAL SCIENCES

XII. ENGINEERING

114. ENG., ELECTRICAL & ELECTRONIC	2.587	1.203	0.788	1.430	0.43	0.46	0.54	0.49
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115. TELECOMMUNICATIONS	4.358	1.326	0.818	2.082	0.47	0.52	0.63	0.55
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116. CONSTRUCTION & BUILDING TECH.	0.483	0.372	0.219	0.339	0.47	0.48	0.49	0.48
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117. ENGINEERING, CIVIL	0.621	0.608	0.542	0.586	0.56	0.5	0.51	0.52
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118. ENGINEERING, ENVIRONMENTAL	1.334	0.628	0.444	0.792	0.43	0.45	0.48	0.45
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119. ENGINEERING, MARINE	0.731	0.321	0.568	0.522	0.69	0.64	0.6	0.64
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120. TRANSPORTATION SC. & TECHNOLOGY	1.654	2.040	1.654	1.734	0.69	0.5	0.52	0.60
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121. ENGINEERING, INDUSTRIAL	0.449	0.362	0.233	0.332	0.54	0.46	0.52	0.51
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122. ENGINEERING, MANUFACTURING	0.512	0.377	0.23	0.336	0.45	0.46	0.5	0.48
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123. ENGINEERING, MECHANICAL	0.969	0.321	0.242	0.465	0.44	0.47	0.54	0.49
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124. MECHANICS	1.003	0.462	0.248	0.499	0.37	0.44	0.52	0.46
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125. ROBOTICS	0.901	0.35	0.439	0.54	0.41	0.46	0.53	0.48
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126. INSTRUMENTS & INSTRUMENTATION	1.098	0.803	0.55	0.761	0.46	0.42	0.53	0.48
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127. IMAGING SC. & PHOTOGRAPHIC TECH.	1.876	1.101	0.764	1.232	0.38	0.45	0.59	0.48
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128. ENERGY & FUELS	1.145	0.718	0.395	0.657	0.53	0.46	0.54	0.51
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129. NUCLEAR SCIENCE & TECHNOLOGY	1.492	1.239	0.721	1.044	0.42	0.43	0.5	0.46
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130. ENGINEERING, PETROLEUM	1.476	1.952	0.829	1.259	0.73	0.58	0.67	0.67
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131. UTOMATION & CONTROL SYSTEMS	0.828	1.011	0.507	0.741	0.47	0.48	0.58	0.52
132. ENGINEERING, MULTIDISCIPLINARY	2.246	1.066	0.606	1.219	0.52	0.42	0.58	0.52
133. ERGONOMICS	0.499	0.299	0.305	0.367	0.36	0.43	0.46	0.42
134. OPERATIONS RES. & MANAG. SCIENCE	0.62	0.311	0.271	0.395	0.46	0.5	0.52	0.49
XIII. MATERIALS SCIENCE								
135. MATERIALS SCIENCE, BIOMATERIALS	0.54	0.139	0.233	0.276	0.33	0.4	0.39	0.38
136. MATERIALS SCIENCE, CERAMICS	1.408	0.494	0.318	0.503	0.34	0.47	0.59	0.52
137. MAT. SC., CHARAC. & TESTING	4.03	1.616	0.983	1.778	0.58	0.48	0.65	0.59
138. MAT. SC., COATINGS & FILMS	0.568	0.315	0.314	0.364	0.41	0.43	0.45	0.43
139. MATERIALS SCIENCE, COMPOSITES	1.195	0.744	0.728	0.824	0.42	0.47	0.56	0.50
140. MATERIALS SCIENCE, PAPER & WOOD	0.461	0.827	0.415	0.565	0.51	0.51	0.5	0.51
141. MATERIALS SCIENCE, TEXTILES	0.979	1.401	0.797	0.953	0.44	0.42	0.56	0.51
142. METALLURGY & METALL. ENGIN.	2.976	1.084	1.018	1.3	0.39	0.44	0.56	0.51
143. NANOSCIENCE & NANOTECHNOLOGY	2.69	0.927	0.555	1.21	0.4	0.45	0.45	0.44
XIV. GEOSCIENCES								
144. GEOCHEMISTRY & GEOPHYSICS	1.218	0.889	0.24	0.742	0.34	0.4	0.5	0.42
145. GEOGRAPHY, PHYSICAL	0.359	0.311	0.248	0.301	0.37	0.39	0.45	0.40
146. GEOLOGY	0.458	0.248	0.256	0.304	0.36	0.42	0.5	0.44
147. ENGINEERING, GEOLOGICAL	0.602	0.604	0.528	0.566	0.43	0.45	0.44	0.44
148. PALEONTOLOGY	0.729	0.47	0.28	0.449	0.36	0.42	0.52	0.45
149. REMOTE SENSING	1.616	0.735	0.625	1.008	0.35	0.4	0.52	0.42
150. OCEANOGRAPHY	0.539	0.261	0.194	0.316	0.33	0.35	0.5	0.40
151. ENGINEERING, OCEAN	2.056	1.602	0.789	1.482	0.51	0.43	0.55	0.51
152. METEOROLOGY & ATMOSPH. SCS.	1.05	0.789	0.378	0.748	0.35	0.41	0.52	0.42
153 ENGINEERING, AEROSPACE	0.758	0.628	0.271	0.556	0.47	0.58	0.6	0.54
154. MINERALOGY	0.735	0.294	0.281	0.37	0.38	0.39	0.49	0.43
155. MINING & MINERAL PROCESSING	1.406	1.719	0.692	1.072	0.5	0.4	0.6	0.54
XV. AGRICULT. & ENVIRONMENT								
156. AGRICULTURAL ENGINEERING	0.245	0.519	0.444	0.39	0.44	0.35	0.45	0.42
157. AGRICULTURE, MULTIDISCIPLINARY	1.161	0.729	0.286	0.567	0.37	0.4	0.59	0.49
158. AGRONOMY	0.808	0.627	0.347	0.54	0.41	0.37	0.53	0.45
159. LIMNOLOGY	0.406	0.299	0.308	0.345	0.36	0.41	0.42	0.40
160. SOIL SCIENCE	0.459	0.331	0.155	0.285	0.39	0.34	0.49	0.42
161. BIODIVERSITY CONSERVATION	0.641	0.709	0.364	0.563	0.5	0.36	0.45	0.45
162. ENVIRONMENTAL SCIENCES	0.935	0.612	0.387	0.628	0.37	0.41	0.46	0.42
163. ENVIRONMENTAL STUDIES	0.365	0.474	0.252	0.373	0.45	0.41	0.49	0.44
164. FOOD SCIENCE & TECHNOLOGY	0.63	0.481	0.251	0.414	0.36	0.4	0.48	0.43
165. NUTRITION & DIETETICS	1.075	0.453	0.287	0.598	0.36	0.43	0.5	0.43

166. AGRIC., DAIRY & ANIMAL SCIENCE	0.889	0.656	0.223	0.506	0.33	0.39	0.61	0.48
167. HORTICULTURE	0.702	0.738	0.457	0.606	0.44	0.36	0.49	0.44

XVI. BIOLOGY

(ORGANISMIC AND SUPRAORG. LEVEL)

168. ORNITHOLOGY	3.243	0.443	0.33	1.399	0.4	0.37	0.44	0.40
169. ZOOLOGY	0.707	0.369	0.173	0.397	0.36	0.41	0.49	0.43
170. ENTOMOLOGY	0.329	0.312	0.198	0.274	0.45	0.42	0.49	0.46
171. WATER RESOURCES	0.38	0.386	0.321	0.358	0.39	0.42	0.47	0.43
172. FISHERIES	0.285	0.279	0.235	0.258	0.36	0.33	0.41	0.38
173. MARINE & FRESHWATER BIOLOGY	0.245	0.189	0.157	0.19	0.37	0.37	0.41	0.38
174. MICROBIOLOGY	0.761	0.369	0.216	0.419	0.31	0.36	0.48	0.39
175. PARASITOLOGY	0.628	0.306	0.162	0.301	0.35	0.35	0.47	0.41
176. VIROLOGY	0.4	0.26	0.244	0.309	0.31	0.37	0.43	0.36
177. FORESTRY	0.689	0.488	0.433	0.532	0.41	0.37	0.4	0.40
178. MYCOLOGY	2.546	0.779	0.832	1.138	0.36	0.41	0.53	0.45
179. PLANT SCIENCES	1.479	0.752	0.425	0.753	0.36	0.38	0.5	0.43
180. PURE AND APPLIED ECOLOGY	0.514	0.351	0.243	0.371	0.38	0.33	0.43	0.38
181. VETERINARY SCIENCES	0.895	0.78	0.39	0.655	0.42	0.47	0.55	0.49

XVII. MULTIDISCIPLINARY

182. MULTIDISCIPLINARY SCIENCES	5.633	2.543	0.829	2.31	0.41	0.44	0.62	0.53
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XVIII. RESIDUAL SUB-FIELDS

183. MATERIALS SCIENCE, MULT.	3.279	1.184	0.775	1.322	0.39	0.44	0.52	0.47
184. CRYSTALLOGRAPHY	64.8	41.79	14.4	30.25	0.4	0.46	0.5	0.47
185. GEOSCIENCES, MULT.	0.796	0.481	0.29	0.481	0.38	0.41	0.52	0.45
186. MED., RESEARCH & EXPERIMENTAL	4.156	2.446	1.67	2.778	0.39	0.49	0.59	0.49

D. SOCIAL SCIENCES

XIX. SOCIAL SCIENCES, GENERAL

187. CRIMINOLOGY & PENOLOGY	0.599	0.103	0.522	0.426	0.4	0.64	0.54	0.50
188. LAW	0.903	0.315	0.776	0.821	0.47	0.6	0.54	0.49
189. POLITICAL SCIENCE	1.424	0.542	0.473	1.001	0.5	0.59	0.64	0.55
190. PUBLIC ADMINISTRATION	0.578	0.579	0.165	0.482	0.51	0.41	0.58	0.49
191. ETHNIC STUDIES	1.291	1.079	0.493	1.131	0.61	0.48	0.52	0.56
192. FAMILY STUDIES	0.556	0.106	0.159	0.438	0.42	0.53	0.49	0.45
193. SOCIAL ISSUES	1.122	0.783	0.349	0.875	0.53	0.45	0.56	0.52
194. SOCIAL WORK	0.564	0.379	0.31	0.486	0.41	0.42	0.54	0.44
195. SOCIOLOGY	1.53	0.414	0.14	0.854	0.43	0.5	0.68	0.52
196. WOMEN'S STUDIES	0.569	0.444	0.375	0.511	0.45	0.62	0.61	0.51

197. EDUCATION & EDUCATIONAL RES.	0.994	0.398	0.316	0.743	0.5	0.49	0.55	0.51
198. EDUCATION, SPECIAL	0.372	0.484	0.323	0.384	0.46	0.36	0.48	0.45
199. AREA STUDIES	0.839	0.965	0.609	0.783	0.5	0.5	0.55	0.52
200. GEOGRAPHY	0.924	1.097	0.461	0.894	0.41	0.41	0.46	0.42
201. PLANNING & DEVELOPMENT	0.756	0.729	0.182	0.592	0.44	0.46	0.54	0.47
202. TRANSPORTATION	0.28	0.11	0.189	0.206	0.44	0.47	0.43	0.45
203 URBAN STUDIES	0.38	1.025	0.18	0.508	0.47	0.39	0.5	0.46
204. ETHICS	0.513	0.325	0.365	0.44	0.46	0.47	0.56	0.49
205. MEDICAL ETHICS	0.73	0.179	0.351	0.397	0.37	0.47	0.44	0.43
206. ANTHROPOLOGY	0.735	0.461	0.431	0.57	0.43	0.51	0.54	0.49
207. COMMUNICATION	0.402	0.525	0.108	0.381	0.45	0.49	0.5	0.47
208. DEMOGRAPHY	1.777	0.119	0.156	0.972	0.36	0.52	0.47	0.42
209. HISTORY OF SOCIAL SCIENCES	0.549	0.621	0.253	0.512	0.5	0.41	0.55	0.47
210. INFORMATION SC. & LIBRARY SC.	2.16	0.987	1.464	1.725	0.55	0.53	0.48	0.53
211. INTERNATIONAL RELATIONS	2.962	1.544	1.122	2.076	0.47	0.61	0.6	0.55
212. LINGUISTICS	0.497	0.613	0.146	0.45	0.44	0.45	0.52	0.46
213. SOCIAL SCIENCES, INTERD.	0.671	0.626	0.394	0.605	0.51	0.52	0.54	0.52
XX. ECONOMICS & BUSINESS								
214. AGRICULTURAL ECONOMICS & POLICY	0.347	0.423	0.364	0.367	0.42	0.39	0.5	0.44
215. ECONOMICS	1.868	0.931	0.664	1.281	0.41	0.49	0.55	0.47
216. INDUSTRIAL RELATIONS & LABOR	0.65	0.599	0.153	0.545	0.49	0.35	0.49	0.46
217. BUSINESS	0.796	0.274	0.307	0.594	0.45	0.51	0.52	0.48
218. BUSINESS, FINANCE	1.212	0.606	0.676	1.022	0.47	0.49	0.53	0.49
219. MANAGEMENT	1.311	0.376	0.359	0.796	0.41	0.52	0.54	0.47

Table D. The U.S./EU Gap at the Sub-field Level, Measured With High- and Low-impact Indicators, As Well As the Mean Citation Rate

	HIGH- IMPACT (1)	LOW- IMPACT (2)	MCR (3)	(4) = (1) – (3) In %
A. LIFE SCIENCES				
<i>I. BIOSCIENCES</i>				
1. BIOLOGY	0.88	1.067	0.95	-8.8
2. BIOLOGY, MISCELLANEOUS	0.84	1.371	0.71	15.1
3. EVOLUTIONARY BIOLOGY	1.70	0.860	1.16	31.5
4. BIOCHEMICAL RESEARCH METHODS	2.37	1.035	1.11	53.1
5. BIOCHEMISTRY & MOLECULAR BIOLOGY	1.75	0.791	1.33	24.2
6. BIOPHYSICS	1.29	0.883	1.19	7.7
7. CELL BIOLOGY	2.11	0.787	1.41	33.4
8. GENETICS & HEREDITY	1.87	0.852	1.30	30.4
9. DEVELOPMENTAL BIOLOGY	2.32	0.816	1.40	39.4
<i>II. BIOMEDICAL RESEARCH</i>				
10. PATHOLOGY	1.82	0.854	1.24	31.5
11. ANATOMY & MORPHOLOGY	1.48	0.736	1.38	6.6
12. ENGINEERING, BIOMEDICAL	1.98	0.927	1.19	39.8
13. BIOTECH. & APPLIED MICROBIOLOGY	3.57	0.896	1.34	62.3
14. MEDICAL LABORATORY TECHNOLOGY	1.64	1.113	0.96	41.4
15. MICROSCOPY	1.01	1.181	0.90	10.1
16. PHARMACOLOGY & PHARMACY	1.36	0.904	1.17	14.2
17. TOXICOLOGY	1.34	0.986	1.07	20.3
18. PHYSIOLOGY	1.53	0.722	1.31	14.6
<i>III. CLINICAL MEDICINE I (INTERNAL)</i>				
19. CARDIAC & CARDIOVASCULAR SYSTEMS	1.52	0.810	1.34	12.1
20. RESPIRATORY SYSTEM	1.41	0.854	1.17	16.7
21. ENDOCRINOLOGY & METABOLISM	1.82	0.782	1.30	28.2
22. ANESTHESIOLOGY	1.88	0.780	1.38	26.4
23. CRITICAL CARE MEDICINE	1.78	0.755	1.24	30.2
24. EMERGENCY MEDICINE	3.82	0.752	1.65	56.8
25. GASTROENTEROLOGY & HEPATOLOGY	1.63	0.842	1.27	22.1
26. MEDICINE, GENERAL & INTERNAL	2.17	0.721	1.67	22.8
27. TROPICAL MEDICINE	1.99	0.733	1.31	34.5
28. HEMATOLOGY	1.56	0.812	1.29	17.6
29. ONCOLOGY	3.32	0.763	1.44	56.5
30. ALLERGY	1.35	0.825	1.26	6.4

31. IMMUNOLOGY	1.70	0.811	1.30	23.6
32. INFECTIOUS DISEASES	1.71	0.844	1.21	29.0
IV. CLIN. MED. II (NON-INTERNAL)				
33. GERIATRICS & GERONTOLOGY	2.30	0.843	1.31	43.2
34. OBSTETRICS & GYNECOLOGY	1.23	0.856	1.15	6.7
35. ANDROLOGY	1.55	0.859	1.22	21.2
36. REPRODUCTIVE BIOLOGY	1.34	0.875	1.14	15.0
37. GERONTOLOGY	1.46	0.926	1.16	20.8
38. DENTISTRY, ORAL SURGERY	1.66	1.076	1.03	37.6
39. DERMATOLOGY	2.03	0.923	1.21	40.3
40. UROLOGY & NEPHROLOGY	1.57	0.745	1.42	9.3
41. OTORHINOLARYNGOLOGY	2.32	0.749	1.47	36.4
42. OPHTHALMOLOGY	2.36	0.781	1.42	39.8
43. INTEGRATIVE & COMPLEM. MEDICINE	0.46	0.924	1.04	-129.0
44. CLINICAL NEUROLOGY	1.71	0.827	1.25	27.3
45. PSYCHIATRY	2.75	0.772	1.45	47.3
46. RADIOLOGY, NUCLEAR MED. & IMAGING	1.58	0.866	1.25	20.9
47. ORTHOPEDICS	2.03	0.784	1.37	32.4
48. RHEUMATOLOGY	1.88	0.887	1.26	33.1
49. SPORT SCIENCES	1.73	0.969	1.13	34.9
50. SURGERY	1.74	0.766	1.39	19.8
51. TRANSPLANTATION	1.81	0.813	1.34	25.8
52. PERIPHERAL VASCULAR DISEASE	1.45	0.775	1.30	10.4
53. PEDIATRICS	3.45	0.780	1.53	55.5
V. CL. MED. III (HEALTH & OTHER SCS.)				
54. HEALTH CARE SCIENCES & SERVICES	2.05	0.967	1.22	40.2
55. HEALTH POLICY & SERVICES	1.57	0.917	1.26	20.1
56. MEDICINE, LEGAL	1.08	0.961	1.06	1.9
57. NURSING	1.17	1.536	0.75	36.1
58. PUBLIC, ENVIRON. & OCCUP. HEALTH	1.69	0.904	1.23	27.4
59. REHABILITATION	1.18	1.147	0.91	23.2
60. SUBSTANCE ABUSE	1.57	0.853	1.17	25.4
61. EDUCATION, SCIENTIFIC DISCIPLINES	0.98	1.056	0.89	8.8
62. MEDICAL INFORMATICS	0.94	1.119	1.05	-10.9
VI. NEUROSCIENCE & BEHAVIOR				
63. NEUROIMAGING	1.04	0.814	1.18	-13.2
64. NEUROSCIENCES	2.08	0.783	1.34	35.4
65. BEHAVIORAL SCIENCES	0.99	1.064	0.97	2.4

66. PSYCHOLOGY, BIOLOGICAL	0.72	1.015	0.95	-33.1
67. PSYCHOLOGY	1.49	0.857	1.15	22.7
68. PSYCHOLOGY, APPLIED	1.42	0.862	1.21	14.8
69. PSYCHOLOGY, CLINICAL	1.37	0.899	1.16	15.3
70. PSYCHOLOGY, DEVELOPMENTAL	1.17	0.910	1.12	3.8
71. PSYCHOLOGY, EDUCATIONAL	2.16	0.740	1.57	27.2
72. SYCHOLOGY, EXPERIMENTAL	1.36	1.099	0.95	30.1
73. PSYCHOLOGY, MATHEMATICAL	1.69	1.119	0.95	43.4
74. PSYCHOLOGY, MULTIDISCIPLINARY	3.13	0.803	1.48	52.7
75. PSYCHOLOGY, PSYCHOANALYSIS	1.18	0.844	1.08	8.0
76. PSYCHOLOGY, SOCIAL	1.78	0.918	1.18	33.6
77. SOCIAL SCIENCES, BIOMEDICAL	0.76	1.232	0.82	-7.8

B. PHYSICAL SCIENCES

VII. CHEMISTRY

78. CHEMISTRY, MULTIDISCIPLINARY	2.89	0.699	1.57	45.6
79. CHEMISTRY, INORGANIC & NUCLEAR	2.04	0.890	1.23	39.9
80. CHEMISTRY, ANALYTICAL	2.66	0.953	1.28	51.6
81. CHEMISTRY, APPLIED	1.05	1.063	0.98	6.5
82. ENGINEERING, CHEMICAL	1.13	1.043	1.00	11.3
83. CHEMISTRY, MEDICINAL	1.94	0.731	1.34	31.0
84. CHEMISTRY, ORGANIC	2.64	0.890	1.23	53.6
85. CHEMISTRY, PHYSICAL	2.36	0.836	1.34	43.2
86. ELECTROCHEMISTRY	2.13	0.961	1.17	44.9
87. POLYMER SCIENCE	2.13	0.873	1.32	38.2

VIII. PHYSICS

88. PHYSICS, MULTIDISCIPLINARY	3.03	0.759	1.57	48.3
89. SPECTROSCOPY	1.94	0.945	1.16	40.0
90. ACOUSTICS	0.96	0.953	1.07	-11.7
91. OPTICS	1.67	1.007	1.08	35.5
92. PHYSICS, APPLIED	2.18	0.901	1.32	39.2
93. PHYSICS, ATOMIC, MOLECULAR & CHEMICAL	1.91	0.852	1.22	36.5
94. THERMODYNAMICS (CLASSICAL PHYSICS)	1.38	0.872	1.21	12.4
95. PHYSICS, MATHEMATICAL	1.50	0.951	1.14	24.0
96. PHYSICS, NUCLEAR	1.66	0.988	1.14	31.1
97. PHYSICS, PARTICLES & FIELDS	1.94	0.882	1.37	29.0
98. PHYSICS, CONDENSED MATTER	1.59	0.921	1.25	21.0
99. PHYSICS OF SOLIDS, FLUIDS & PLASMAS	1.30	0.985	1.05	19.0

IX. SPACE SCIENCES

100. ASTRONOMY & ASTROPHYSICS	1.42	0.797	1.28	9.4
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X. MATHEMATICS

101. MATHEMATICS, APPLIED	1.77	0.955	1.17	34.0
102. STATISTICS & PROBABILITY	2.70	0.969	1.19	55.9
103. MATHEMATICS, INTERDISC. APPL.	1.81	0.918	1.22	32.3
104. SOCIAL SCIENCES, MATH. METHODS	2.76	0.758	1.54	44.3
105. PURE MATHEMATICS	1.41	0.950	1.13	20.5

XI. COMPUTER SCIENCE

106. COMP. SC., ARTIFICIAL INTELLIGENCE	1.85	0.895	1.25	32.3
107. COMPUTER SCIENCE, CYBERNETICS	2.47	0.870	1.22	50.7
108. COMP. SC., HARDWARE & ARCHITECTURE	1.73	0.878	1.38	20.2
109. COMP. SC., INFORMATION SYSTEMS	2.68	0.962	1.34	50.0
110. COMP. SC., INTERDIS. APPLICATIONS	2.61	1.013	1.18	54.6
111. COMP. SC., SOFTWARE ENGINEERING	1.69	1.003	1.14	32.7
112. COMP. SC., THEORY & METHODS	2.17	0.882	1.38	36.4
113. MATHEMATICAL & COMPUT. BIOLOGY	2.43	1.021	1.10	54.8

C. OTHER NATURAL SCIENCES**XII. ENGINEERING**

114. ENG., ELECTRICAL & ELECTRONIC	2.15	0.932	1.30	39.7
115. TELECOMMUNICATIONS	3.29	0.898	1.54	53.1
116. ONSTRUCTION & BUILDING TECH.	1.30	0.985	1.04	19.6
117. ENGINEERING, CIVIL	1.02	1.136	0.94	8.0
118. ENGINEERING, ENVIRONMENTAL	2.12	0.956	1.15	46.0
119. ENGINEERING, MARINE	2.28	1.079	1.03	54.8
120. TRANSPORTATION SC. & TECHNOLOGY	0.81	1.378	0.71	12.7
121. ENGINEERING, INDUSTRIAL	1.24	1.181	0.87	29.7
122. ENGINEERING, MANUFACTURING	1.36	0.980	1.08	20.3
123. ENGINEERING, MECHANICAL	3.02	0.943	1.22	59.5
124. MECHANICS	2.17	0.851	1.31	39.9
125. ROBOTICS	2.57	0.899	1.36	47.3
126. INSTRUMENTS & INSTRUMENTATION	1.37	1.118	0.99	27.7
127. IMAGING SC. & PHOTOGRAPHIC TECH.	1.70	0.859	1.37	19.8
128. ENERGY & FUELS	1.60	1.165	0.93	41.8
129. NUCLEAR SCIENCE & TECHNOLOGY	1.20	0.991	1.07	11.4
130. ENGINEERING, PETROLEUM	0.76	1.252	0.65	14.1

131. AUTOMATION & CONTROL SYSTEMS	0.82	0.976	1.05	-28.2
132. ENGINEERING, MULTIDISCIPLINARY	2.11	1.227	0.98	53.3
133. ERGONOMICS	1.67	0.843	1.24	25.9
134. OPERATIONS RES. & MANAG. SCIENCE	1.99	0.934	1.22	38.8
XIII. MATERIALS SCIENCE				
135. MATERIALS SCIENCE, BIOMATERIALS	3.89	0.831	1.36	65.1
136. MATERIALS SCIENCE, CERAMICS	2.85	0.726	1.52	46.9
137. MAT. SC., CHARAC. & TESTING	2.49	1.205	0.92	63.2
138. MAT. SC., COATINGS & FILMS	1.80	0.960	1.17	35.3
139. MATERIALS SCIENCE, COMPOSITES	1.61	0.910	1.14	29.2
140. MATERIALS SCIENCE, PAPER & WOOD	0.56	0.998	0.86	-54.3
141. MATERIALS SCIENCE, TEXTILES	0.70	1.037	0.94	-34.7
142. METALLURGY & METALL. ENGIN.	2.75	0.888	1.41	48.7
143. NANOSCIENCE & NANOTECHNOLOGY	2.90	0.894	1.40	51.7
XIV. GEOSCIENCES				
144. GEOCHEMISTRY & GEOPHYSICS	1.37	0.843	1.20	12.1
145. GEOGRAPHY, PHYSICAL	1.16	0.957	1.08	7.0
146. GEOLOGY	1.85	0.867	1.24	32.8
147. ENGINEERING, GEOLOGICAL	1.00	0.949	1.09	-9.2
148. PALEONTOLOGY	1.55	0.842	1.24	20.3
149. REMOTE SENSING	2.20	0.868	1.36	38.3
150. OCEANOGRAPHY	2.07	0.936	1.17	43.2
151. ENGINEERING, OCEAN	1.28	1.193	0.99	22.7
152. METEOROLOGY & ATMOSPH. SCS.	1.33	0.846	1.20	9.5
153. ENGINEERING, AEROSPACE	1.21	0.821	1.36	-12.9
154. MINERALOGY	2.50	0.970	1.17	53.2
155. MINING & MINERAL PROCESSING	0.82	1.234	0.82	0.1
XV. AGRICULT. & ENVIRONMENT				
156. AGRICULTURAL ENGINEERING	0.47	1.249	0.75	-59.3
157. AGRICULTURE, MULTIDISCIPLINARY	1.59	0.932	1.18	25.9
158. AGRONOMY	1.29	1.116	0.97	25.1
159. LIMNOLOGY	1.36	0.879	1.13	16.5
160. SOIL SCIENCE	1.39	1.150	0.98	29.4
161. BIODIVERSITY CONSERVATION	0.90	1.377	0.82	8.7
162. ENVIRONMENTAL SCIENCES	1.53	0.893	1.20	21.5
163. ENVIRONMENTAL STUDIES	0.77	1.095	0.92	-19.0
164. FOOD SCIENCE & TECHNOLOGY	1.31	0.909	1.10	15.8
165. NUTRITION & DIETETICS	2.38	0.841	1.31	44.9

166. AGRIC., DAIRY & ANIMAL SCIENCE	1.36	0.844	1.16	14.1
167. HORTICULTURE	0.95	1.227	0.81	15.4

XVI. BIOLOGY

(ORGANISMIC AND SUPRAORG. LEVEL)

168. ORNITHOLOGY	7.32	1.077	1.04	85.8
169. ZOOLOGY	1.92	0.883	1.15	39.9
170. ENTOMOLOGY	1.06	1.078	0.93	11.8
171. WATER RESOURCES	0.98	0.940	1.09	-11.0
172. FISHERIES	1.02	1.071	0.97	5.3
173. MARINE & FRESHWATER BIOLOGY	1.30	1.001	1.02	21.2
174. MICROBIOLOGY	2.06	0.855	1.23	40.3
175. PARASITOLOGY	2.05	0.988	1.11	46.1
176. VIROLOGY	1.54	0.829	1.21	21.4
177. FORESTRY	1.41	1.112	1.02	27.7
178. MYCOLOGY	3.27	0.867	1.30	60.2
179. PLANT SCIENCES	1.97	0.960	1.17	40.8
180. PURE AND APPLIED ECOLOGY	1.46	1.151	0.98	32.9
181. VETERINARY SCIENCES	1.15	0.892	1.12	2.2

XVII. MULTIDISCIPLINARY

182. MULTIDISCIPLINARY SCIENCES	2.22	0.917	1.35	39.0
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XVIII. RESIDUAL SUB-FIELDS

183. MATERIALS SCIENCE, MULT.	2.77	0.904	1.37	50.6
184. CRYSTALLOGRAPHY	1.55	0.879	1.32	15.0
185. GEOSCIENCES, MULT.	1.66	0.948	1.14	31.2
186. MED., RESEARCH & EXPERIMENTAL	1.70	0.798	1.48	12.6

D.SOCIAL SCIENCES

XIX. SOCIAL SCIENCES, GENERAL

187. CRIMINOLOGY & PENOLOGY	5.79	0.618	2.26	61.0
188. LAW	2.87	0.774	1.82	36.4
189. POLITICAL SCIENCE	2.63	0.841	1.47	43.8
190. PUBLIC ADMINISTRATION	1.00	1.227	0.80	19.9
191. ETHNIC STUDIES	1.20	1.254	0.73	38.9
192. FAMILY STUDIES	5.25	0.799	1.46	72.1
193. SOCIAL ISSUES	1.43	1.173	0.90	37.4
194. SOCIAL WORK	1.49	0.971	1.11	25.6
195. SOCIOLOGY	3.69	0.864	1.40	62.1
196. WOMEN'S STUDIES	1.28	0.727	1.46	-14.0

197. EDUCATION & EDUCATIONAL RES.	2.50	1.030	1.06	57.5
198. EDUCATION, SPECIAL	0.77	1.305	0.74	4.0
199. AREA STUDIES	0.87	1.009	0.90	-4.0
200. GEOGRAPHY	0.84	0.997	0.92	-9.4
201. PLANNING & DEVELOPMENT	1.04	0.956	1.07	-2.9
202. TRANSPORTATION	2.54	0.932	1.28	49.6
203 URBAN STUDIES	0.37	1.193	0.75	-101.4
204. ETHICS	1.58	0.980	1.06	32.9
205. MEDICAL ETHICS	4.07	0.780	1.54	62.2
206. ANTHROPOLOGY	1.59	0.842	1.24	22.0
207. COMMUNICATION	0.77	0.923	1.16	-51.0
208. DEMOGRAPHY	14.99	0.691	2.02	86.5
209. HISTORY OF SOCIAL SCIENCES	0.88	1.230	0.84	5.1
210. INFORMATION SC. & LIBRARY SC.	2.19	1.046	1.13	48.2
211. INTERNATIONAL RELATIONS	1.92	0.779	1.70	11.2
212. LINGUISTICS	0.81	0.987	0.95	-17.4
213. SOCIAL SCIENCES, INTERD.	1.07	0.985	1.08	-0.4
<i>XX. ECONOMICS & BUSINESS</i>				
214. AGRICULTURAL ECONOMICS & POLICY	0.82	1.075	0.95	-15.7
215. ECONOMICS	2.01	0.846	1.41	29.8
216. INDUSTRIAL RELATIONS & LABOR	1.09	1.407	0.81	25.0
217. BUSINESS	2.90	0.880	1.39	52.0
218. BUSINESS, FINANCE	2.00	0.962	1.26	37.3
219. MANAGEMENT	3.49	0.778	1.67	52.0

Table E. Average-based Indicators, and US/EU and RW/EU Gaps At the Sub-field Level According to the Multiplicative Strategy

	A^{US}	A^{EU}	A^{RW}	M^{US}/M^{EU}	M^{RW}/M^{EU}
	(1)	(2)	(3)	(4)	(5)
A. LIFE SCIENCES					
<i>I. BIOSCIENCES</i>					
BIOLOGY, MISCELLANEOUS	0.79	1.11	1.09	0.712	0.982
BIOLOGY	1.2	1.26	0.65	0.952	0.513
BIOCHEMICAL RESEARCH METHODS	1.14	1.03	0.84	1.114	0.818
EVOLUTIONARY BIOLOGY	1.15	0.98	0.85	1.165	0.862
BIOPHYSICS	1.22	1.03	0.82	1.189	0.794
GENETICS & HEREDITY	1.24	0.95	0.78	1.298	0.821
BIOCHEMISTRY & MOLEC. BIOLOGY	1.3	0.98	0.72	1.327	0.741
DEVELOPMENTAL BIOLOGY	1.26	0.9	0.74	1.404	0.818
CELL BIOLOGY	1.3	0.93	0.72	1.405	0.782
<i>II. BIOMEDICAL RESEARCH</i>					
MICROSCOPY	1.04	1.15	0.82	0.904	0.708
MEDICAL LABORATORY TECHNOLOGY	1.04	1.08	0.87	0.964	0.810
TOXICOLOGY	1.11	1.04	0.85	1.069	0.813
PHARMACOLOGY & PHARMACY	1.23	1.05	0.8	1.165	0.757
ENGINEERING, BIOMEDICAL	1.13	0.95	0.93	1.190	0.972
PATHOLOGY	1.26	1.01	0.76	1.244	0.748
PHYSIOLOGY	1.23	0.94	0.78	1.307	0.825
BIOTECH. & APPLIED MICROBIOLOGY	1.41	1.05	0.7	1.344	0.673
ANATOMY & MORPHOLOGY	1.37	0.99	0.76	1.381	0.765
<i>III. CLINICAL MED. I (INTERNAL)</i>					
RESPIRATORY SYSTEM	1.14	0.97	0.88	1.174	0.906
INFECTIOUS DISEASES	1.14	0.94	0.88	1.212	0.941
CRITICAL CARE MEDICINE	1.15	0.93	0.91	1.243	0.979
ALLERGY	1.2	0.95	0.93	1.263	0.984
GASTROENTEROLOGY & HEPATOLOGY	1.29	1.02	0.78	1.267	0.766
HEMATOLOGY	1.23	0.96	0.78	1.290	0.818
IMMUNOLOGY	1.23	0.94	0.8	1.302	0.854
ENDOCRINOLOGY & METABOLISM	1.23	0.94	0.83	1.304	0.885
TROPICAL MEDICINE	1.45	1.11	0.86	1.305	0.775
CARDIAC & CARDIOVASCULAR SYSTEMS	1.24	0.93	0.8	1.338	0.858
ANESTHESIOLOGY	1.27	0.92	0.89	1.383	0.969

ONCOLOGY	1.28	0.88	0.83	1.444	0.938
EMERGENCY MEDICINE	1.19	0.72	0.96	1.651	1.339
MEDICINE, GENERAL & INTERNAL	1.55	0.92	0.63	1.672	0.684
<i>IV. CL. MED. II (NON- INTERNAL)</i>					
DENTISTRY, ORAL SURGERY &	1.05	1.01	0.95	1.033	0.932
INTEGRATIVE & COMPLEM. MED.	0.98	0.94	1.04	1.045	1.113
SPORT SCIENCES	1.06	0.94	0.97	1.128	1.038
REPRODUCTIVE BIOLOGY	1.16	1.01	0.87	1.140	0.854
OBSTETRICS & GYNECOLOGY	1.14	1	0.86	1.147	0.863
GERONTOLOGY	1.07	0.93	0.84	1.157	0.902
DERMATOLOGY	1.18	0.97	0.88	1.214	0.909
ANDROLOGY	1.28	1.05	0.82	1.222	0.782
CLINICAL NEUROLOGY	1.24	1	0.76	1.247	0.763
RADIOLOGY, NUCLEAR MEDICINE &					
IMAGING	1.23	0.98	0.76	1.253	0.776
RHEUMATOLOGY	1.21	0.96	0.89	1.256	0.924
PERIPHERAL VASCULAR DISEASE	1.2	0.93	0.84	1.297	0.907
GERIATRICS & GERONTOLOGY	1.14	0.88	0.89	1.306	1.020
TRANSPLANTATION	1.31	0.98	0.74	1.340	0.754
ORTHOPEDICS	1.18	0.86	0.9	1.375	1.053
SURGERY	1.3	0.93	0.76	1.395	0.812
OPHTHALMOLOGY	1.24	0.87	0.86	1.423	0.987
UROLOGY & NEPHROLOGY	1.3	0.91	0.79	1.425	0.864
PSYCHIATRY	1.28	0.88	0.75	1.446	0.844
OTORHINOLARYNGOLOGY	1.26	0.86	0.83	1.473	0.972
PEDIATRICS	1.32	0.86	0.78	1.532	0.909
<i>V. CL. M. III (HEALTH SC. & OTHER)</i>					
NURSING	0.88	1.18	1.14	0.750	0.969
EDUCATION, SCIENTIFIC DISCIPLINES	1	1.12	0.91	0.890	0.811
REHABILITATION	0.97	1.07	0.99	0.906	0.925
MEDICAL INFORMATICS	1.07	1.03	0.83	1.046	0.808
MEDICINE, LEGAL	1.09	1.03	0.87	1.059	0.848
SUBSTANCE ABUSE	1.08	0.92	0.84	1.168	0.905
HEALTH CARE SCIENCES & SERVICES	1.11	0.91	0.84	1.225	0.928
PUBLIC, ENVIRON. & OCCUP. HEALTH	1.18	0.96	0.8	1.226	0.834
HEALTH POLICY & SERVICES	1.08	0.86	0.78	1.257	0.911
<i>VI. NEUROSC. & BEHAVIORAL</i>					
SOCIAL SCIENCES, BIOMEDICAL	0.96	1.17	0.91	0.820	0.773

PSYCHOLOGY, EXPERIMENTAL	1.03	1.08	0.83	0.952	0.771
PSYCHOLOGY, BIOLOGICAL	1.02	1.07	0.89	0.952	0.831
PSYCHOLOGY, MATHEMATICAL	0.98	1.03	1.04	0.954	1.013
BEHAVIORAL SCIENCES	1.02	1.06	0.89	0.970	0.847
PSYCHOLOGY, PSYCHOANALYSIS	1.04	0.96	0.93	1.081	0.969
PSYCHOLOGY, DEVELOPMENTAL	1.06	0.94	0.89	1.122	0.941
PSYCHOLOGY	1.1	0.95	0.86	1.153	0.906
PSYCHOLOGY, CLINICAL	1.05	0.91	0.95	1.156	1.052
PSYCHOLOGY, SOCIAL	1.07	0.91	0.91	1.181	0.997
NEUROIMAGING	1.19	1.01	0.76	1.181	0.757
PSYCHOLOGY, APPLIED	1.05	0.87	0.97	1.210	1.124
NEUROSCIENCES	1.27	0.95	0.75	1.345	0.796
PSYCHOLOGY, MULTIDISCIPLINARY	1.25	0.84	0.68	1.481	0.807
PSYCHOLOGY, EDUCATIONAL	1.22	0.78	0.61	1.572	0.784

B. PHYSICAL SCIENCES

VII. CHEMISTRY

CHEMISTRY, APPLIED	1.2	1.22	0.79	0.980	0.650
ENGINEERING, CHEMICAL	1.16	1.16	0.84	1.001	0.730
ELECTROCHEMISTRY	1.29	1.1	0.86	1.175	0.786
CHEMISTRY, INORGANIC & NUCLEAR	1.31	1.07	0.83	1.226	0.774
CHEMISTRY, ORGANIC	1.27	1.04	0.85	1.228	0.816
CHEMISTRY, ANALYTICAL	1.36	1.06	0.8	1.285	0.759
POLYMER SCIENCE	1.44	1.09	0.82	1.317	0.753
CHEMISTRY, MEDICINAL	1.38	1.03	0.77	1.336	0.747
CHEMISTRY, PHYSICAL	1.41	1.05	0.81	1.339	0.765
CHEMISTRY, MULTIDISCIPLINARY	1.91	1.22	0.63	1.574	0.516

VIII. PHYSICS

PHYSICS OF SOLIDS, FLUIDS & PLASMAS	1.14	1.08	0.82	1.052	0.758
ACOUSTICS	1.18	1.1	0.76	1.072	0.692
OPTICS	1.23	1.15	0.78	1.075	0.679
PHYSICS, MATHEMATICAL	1.24	1.09	0.81	1.137	0.745
PHYSICS, NUCLEAR	1.26	1.11	0.82	1.140	0.741
SPECTROSCOPY	1.3	1.12	0.75	1.163	0.672
THERMODYNAMICS	1.25	1.03	0.86	1.207	0.829
PHYSICS, ATOMIC, MOLEC. & CHEMICAL	1.24	1.02	0.83	1.216	0.816
PHYSICS, CONDENSED MATTER	1.37	1.09	0.81	1.255	0.736
PHYSICS, APPLIED	1.39	1.05	0.81	1.323	0.777

PHYSICS, PARTICLES & FIELDS	1.37	1	0.8	1.375	0.798
PHYSICS, MULTIDISCIPLINARY	1.75	1.12	0.68	1.566	0.608

IX. SPACE SCIENCE

ASTRONOMY & ASTROPHYSICS	1.27	0.99	0.76	1.285	0.772
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X. MATHEMATICS

MATHEMATICS	1.23	1.09	0.81	1.125	0.744
MATHEMATICS, APPLIED	1.24	1.06	0.82	1.170	0.767
STATISTICS & PROBABILITY	1.24	1.04	0.73	1.190	0.697
MATHEMATICS, INTERDIS. APPLICS.	1.23	1	0.83	1.223	0.826
SOCIAL SCIENCES, MATH. METHODS	1.28	0.83	0.79	1.539	0.952

XI. COMPUTER SCIENCE

MATH. & COMPUTATIONAL BIOLOGY	1.12	1.02	0.81	1.098	0.797
COMPUTER SC., SOFTWARE ENGIN.	1.16	1.02	0.8	1.139	0.781
COMPUTER SC., INTERDISC APPLCS.	1.23	1.04	0.76	1.184	0.727
COMPUTER SCIENCE, CYBERNETICS	1.46	1.2	0.65	1.216	0.544
COMPUTER SC., ARTIFICIAL INTELL.	1.27	1.01	0.8	1.255	0.791
COMPUTER SC., INFORMATION SYSTEMS	1.31	0.97	0.72	1.342	0.738
COMP. SC., HARDWARE & ARCHITECTURE	1.3	0.95	0.71	1.378	0.747
COMPUTER SC., THEORY & METHODS	1.27	0.92	0.88	1.381	0.957

C. OTHER NATURAL SCIENCI

XI. ENGINEERING

ENGINEERING, PETROLEUM	0.91	1.41	0.91	0.650	0.646
TRANSPORTATION SC. & TECHNOLOGY	0.83	1.17	1.15	0.707	0.984
ENGINEERING, INDUSTRIAL	0.99	1.14	0.93	0.871	0.818
ENERGY & FUELS	1.07	1.15	0.89	0.928	0.773
ENGINEERING, CIVIL	0.98	1.04	0.99	0.940	0.946
ENGINEERING, MULTIDISCIPLINARY	1.17	1.19	0.76	0.983	0.638
INSTRUMENTS & INSTRUMENTATION	1.11	1.12	0.85	0.988	0.762
ENGINEERING, MARINE	0.95	0.92	1.12	1.029	1.212
CONSTR. & BUILDING TECHNOLOGY	1.07	1.03	0.93	1.043	0.906
AUTOMATION & CONTROL SYSTEMS	1.17	1.12	0.82	1.050	0.736
NUCLEAR SCIENCE & TECHNOLOGY	1.18	1.1	0.85	1.066	0.776
ENGINEERING, MANUFACTURING	1.14	1.05	0.91	1.082	0.865
ENGINEERING, ENVIRONMENTAL	1.13	0.99	0.89	1.147	0.904
OPERATIONS RES. & MANAG. SC.	1.17	0.96	0.89	1.219	0.931
ENGINEERING, MECHANICAL	1.25	1.02	0.84	1.224	0.823
ERGONOMICS	1.15	0.93	0.91	1.238	0.976

ENG., ELECTRICAL & ELECTRONIC	1.31	1.01	0.79	1.297	0.778
MECHANICS	1.35	1.03	0.78	1.306	0.759
ROBOTICS	1.28	0.95	0.85	1.355	0.903
IMAGING SC. & PHOTOGR. TECH.	1.37	1	0.67	1.366	0.672
TELECOMMUNICATIONS	1.47	0.96	0.67	1.540	0.701
XIII. MATERIALS SCIENCE					
MATERIALS SC., PAPER & WOOD	0.96	1.12	0.93	0.860	0.827
MATERIALS SC., CHARACT. & TESTING	1.14	1.24	0.82	0.919	0.660
MATERIALS SCIENCE, TEXTILES	1.22	1.3	0.83	0.942	0.644
MATERIALS SCIENCE, COMPOSITES	1.24	1.09	0.86	1.138	0.783
MATERIALS SC., COATINGS & FILMS	1.17	1	0.93	1.166	0.934
MATERIALS SCIENCE, BIOMATERIALS	1.22	0.9	0.95	1.356	1.059
NANOSCIENCE & NANOTECHNOLOGY	1.3	0.93	0.87	1.401	0.940
METALLURGY & METALLUR. ENGIN.	1.61	1.14	0.81	1.410	0.713
MATERIALS SCIENCE, CERAMICS	1.68	1.11	0.8	1.515	0.724
XIV. GEOSCIENCES					
MINING & MINERAL PROCESSING	1.17	1.43	0.77	0.817	0.535
ENGINEERING, OCEAN	1.16	1.16	0.73	0.993	0.628
GEOGRAPHY, PHYSICAL	1.1	1.02	0.9	1.076	0.881
ENGINEERING, GEOLOGICAL	1.07	0.99	0.97	1.088	0.985
MINERALOGY	1.23	1.05	0.86	1.169	0.820
OCEANOGRAPHY	1.24	1.06	0.76	1.173	0.720
GEOCHEMISTRY & GEOPHYSICS	1.23	1.02	0.8	1.203	0.780
METEOROLOGY & ATMOSPHERIC SC.	1.22	1.01	0.74	1.205	0.731
PALEONTOLOGY	1.29	1.04	0.8	1.238	0.767
GEOLOGY	1.24	0.99	0.86	1.243	0.865
REMOTE SENSING	1.3	0.96	0.71	1.357	0.741
ENGINEERING, AEROSPACE	1.26	0.92	0.76	1.364	0.827
XV. AGRIC. & ENVIRONMENT					
AGRICULTURAL ENGINEERING	0.92	1.22	0.93	0.753	0.766
HORTICULTURE	0.98	1.22	0.87	0.805	0.717
BIODIVERSITY CONSERVATION	0.96	1.17	0.92	0.824	0.791
ENVIRONMENTAL STUDIES	1.01	1.1	0.85	0.918	0.766
AGRONOMY	1.16	1.2	0.8	0.965	0.670
SOIL SCIENCE	1.14	1.16	0.8	0.980	0.685
FOOD SCIENCE & TECHNOLOGY	1.2	1.09	0.82	1.104	0.755
LIMNOLOGY	1.1	0.97	0.89	1.134	0.920
AGRIC., DAIRY & ANIMAL SCIENCE	1.43	1.23	0.64	1.165	0.525

AGRICULTURE, MULTIDISCIPLINARY	1.45	1.23	0.72	1.180	0.585
ENVIRONMENTAL SCIENCES	1.18	0.99	0.86	1.199	0.867
NUTRITION & DIETETICS	1.27	0.97	0.77	1.308	0.799
XVI. BIOLOGY (ORGANISMIC & SUPRAORGANISMIC LEVEL)					
ENTOMOLOGY	1.05	1.13	0.88	0.930	0.779
FISHERIES	1.05	1.09	0.93	0.968	0.854
ECOLOGY	1.07	1.09	0.85	0.982	0.786
FORESTRY	1.04	1.02	0.95	1.021	0.927
MARINE & FRESHWATER BIOLOGY	1.06	1.04	0.92	1.024	0.890
ORNITHOLOGY	1.08	1.04	0.88	1.038	0.846
WATER RESOURCES	1.12	1.03	0.9	1.092	0.875
PARASITOLOGY	1.25	1.13	0.81	1.108	0.722
VETERINARY SCIENCES	1.21	1.08	0.79	1.122	0.729
ZOOLOGY	1.21	1.05	0.79	1.153	0.752
PLANT SCIENCES	1.31	1.12	0.77	1.165	0.688
VIROLOGY	1.16	0.96	0.82	1.212	0.857
MICROBIOLOGY	1.27	1.03	0.75	1.230	0.727
MYCOLOGY	1.4	1.08	0.76	1.301	0.707
XVII. MULTIDISCIPLINARY					
MULTIDISCIPLINARY SCIENCES	1.67	1.23	0.63	1.352	0.508
XVIII. RESIDUAL SUB-FIELDS					
GEOSCIENCES, MULTIDISCIPLINARY	1.23	1.08	0.79	1.139	0.734
CRYSTALLOGRAPHY	1.48	1.12	0.81	1.317	0.718
MATERIALS SCIENCE, MULTID.	1.45	1.06	0.82	1.367	0.774
MEDICINE, RESEARCH & EXPER.	1.38	0.93	0.68	1.485	0.730
D. SOCIAL SCIENCES					
XIX. SOCIAL SCIENCES, GENERAL					
ETHNIC STUDIES	0.9	1.23	1.05	0.730	0.849
EDUCATION, SPECIAL	0.95	1.29	0.9	0.738	0.693
URBAN STUDIES	0.94	1.26	0.81	0.747	0.639
PUBLIC ADMINISTRATION	0.99	1.24	0.71	0.800	0.575
HISTORY OF SOCIAL SCIENCES	0.97	1.16	0.78	0.838	0.677
SOCIAL ISSUES	1.01	1.13	0.82	0.896	0.720
AREA STUDIES	1.02	1.13	0.9	0.904	0.800
GEOGRAPHY	1	1.09	0.82	0.921	0.752
LINGUISTICS	1.05	1.1	0.77	0.951	0.695

ETHICS	1.07	1.01	0.83	1.057	0.826
EDUCATION & EDUC. RESEARCH	1.05	0.99	0.84	1.061	0.853
PLANNING & DEVELOPMENT	1.13	1.06	0.74	1.067	0.698
SOCIAL SCIENCES, INTERDIS.	1.05	0.98	0.89	1.076	0.910
SOCIAL WORK	1.08	0.98	0.74	1.107	0.761
INFORMATION SC. & LIBRARY SC.	1.03	0.91	1.03	1.134	1.135
COMMUNICATION	1.07	0.93	0.8	1.157	0.866
ANTHROPOLOGY	1.16	0.93	0.83	1.242	0.891
TRANSPORTATION	1.09	0.85	1.01	1.283	1.185
SOCIOLOGY	1.32	0.94	0.53	1.400	0.565
WOMEN'S STUDIES	1.14	0.78	0.73	1.461	0.946
FAMILY STUDIES	1.09	0.74	0.81	1.463	1.085
POLITICAL SCIENCE	1.21	0.82	0.66	1.475	0.796
MEDICAL ETHICS	1.29	0.84	0.9	1.541	1.077
INTERNATIONAL RELATIONS	1.32	0.77	0.71	1.703	0.914
LAW	1.08	0.59	0.8	1.823	1.355
DEMOGRAPHY	1.3	0.64	0.74	2.023	1.150
CRIMINOLOGY & PENOLOGY	1.31	0.58	0.93	2.260	1.608
<i>XX. ECONOMICS & BUSINESS</i>					
INDUSTRIAL RELATIONS & LABOR	0.99	1.22	0.78	0.815	0.642
AGRIC. ECONOMICS & POLICY	1.04	1.1	0.84	0.950	0.762
BUSINESS, FINANCE	1.09	0.87	0.78	1.256	0.904
BUSINESS	1.12	0.81	0.82	1.394	1.013
ECONOMICS	1.24	0.88	0.71	1.409	0.812
MANAGEMENT	1.29	0.77	0.75	1.674	0.967

Table F. Average-based Indicators, and US/EU and RW/EU Gaps At the Sub-field Level According to the Fractional Strategy

	$A^{US'}$	$A^{EU'}$	$A^{RW'}$	$M^{US'}/$	$M^{RW'}/$	$[(4)-(9)]/(4)$	In %
	(6)	(7)	(8)	(9)	(10)	(11)	
A. LIFE SCIENCES							
<i>I. BIOSCIENCES</i>							
BIOLOGY, MISCELLANEOUS	0.76	1.17	1.11	0.652	0.950	8.4	
BIOLOGY	1.27	1.33	0.6	0.952	0.450	0.0	
BIOCHEMICAL RESEARCH METHODS	1.13	1.04	0.85	1.088	0.819	2.4	
EVOLUTIONARY BIOLOGY	1.17	0.96	0.85	1.225	0.883	-5.2	
BIOPHYSICS	1.25	1.02	0.8	1.219	0.785	-2.4	
GENETICS & HEREDITY	1.24	0.98	0.76	1.264	0.773	2.7	
BIOCHEMISTRY & MOL. BIOLOGY	1.27	0.97	0.74	1.308	0.764	1.4	
DEVELOPMENTAL BIOLOGY	1.19	0.92	0.79	1.290	0.853	8.1	
CELL BIOLOGY	1.32	0.93	0.7	1.411	0.755	-0.4	
<i>II. BIOMEDICAL RESEARCH</i>							
MICROSCOPY	1.1	1.15	0.79	0.956	0.686	-5.7	
MEDICAL LABORATORY TECH.	1.05	1.06	0.87	0.990	0.818	-2.7	
TOXICOLOGY	1.13	1.03	0.84	1.088	0.810	-1.8	
PHARMACOLOGY & PHARMACY	1.23	1.04	0.8	1.181	0.769	-1.3	
ENGINEERING, BIOMEDICAL	1.11	0.96	0.93	1.159	0.972	2.6	
PATHOLOGY	1.28	0.97	0.77	1.319	0.798	-6.1	
PHYSIOLOGY	1.22	0.97	0.77	1.260	0.795	3.6	
BIOTECH. & APPLIED MICROBIOLOGY	1.46	1.02	0.7	1.425	0.687	-6.0	
ANATOMY & MORPHOLOGY	1.36	1	0.76	1.353	0.757	2.1	
<i>III. CLINICAL MEDICINE I (INTER.)</i>							
RESPIRATORY SYSTEM	1.12	0.97	0.9	1.155	0.928	1.6	
INFECTIOUS DISEASES	1.17	0.91	0.89	1.290	0.979	-6.4	
CRITICAL CARE MEDICINE	1.11	0.95	0.93	1.176	0.988	5.3	
ALLERGY	1.24	0.91	0.97	1.365	1.073	-8.0	
GASTROENTEROLOGY & HEPATOLOGY	1.3	1.02	0.79	1.276	0.773	-0.7	
HEMATOLOGY	1.27	0.97	0.76	1.311	0.784	-1.6	
IMMUNOLOGY	1.21	0.93	0.82	1.309	0.884	-0.5	
ENDOCRINOLOGY & METABOLISM	1.22	0.94	0.84	1.303	0.893	0.1	
TROPICAL MEDICINE	1.44	1.12	0.86	1.286	0.769	1.5	
CARDIAC & CARDIOVASCULAR SYSTEMS	1.23	0.95	0.8	1.292	0.839	3.4	
ANESTHESIOLOGY	1.26	0.92	0.9	1.370	0.981	0.9	
ONCOLOGY	1.3	0.87	0.82	1.492	0.935	-3.3	

EMERGENCY MEDICINE	1.13	0.68	1.01	1.672	1.492	-1.3
MEDICINE, GENERAL & INTERNAL	1.62	0.91	0.62	1.782	0.687	-6.6
<i>IV. CLINICAL MED. (NON-INTERNAL)</i>						
DENTISTRY, ORAL SURGERY & INTEGRATIVE & COMPLEM. MED.	1.05	1.02	0.94	1.031	0.925	0.3
SPORT SCIENCES	1.14	0.86	1.03	1.329	1.205	-27.2
REPRODUCTIVE BIOLOGY	1.05	0.92	1	1.134	1.085	-0.5
OBSTETRICS & GYNECOLOGY	1.14	1	0.88	1.139	0.883	0.1
GERONTOLOGY	1.17	0.97	0.85	1.200	0.880	-4.6
DERMATOLOGY	1.07	0.94	0.81	1.147	0.866	0.9
ANDROLOGY	1.18	0.96	0.89	1.227	0.919	-1.1
CLINICAL NEUROLOGY	1.27	1.04	0.82	1.221	0.785	0.1
RADIO., NUCL. MED. & MEDICAL IMAG.	1.27	0.96	0.77	1.326	0.800	-6.4
RHEUMATOLOGY	1.21	0.97	0.77	1.255	0.800	-0.2
PERIPHERAL VASCULAR DISEASE	1.22	0.96	0.89	1.265	0.921	-0.7
GERIATRICS & GERONTOLOGY	1.23	0.92	0.86	1.343	0.939	-3.6
TRANSPLANTATION	1.16	0.86	0.92	1.348	1.066	-3.2
ORTHOPEDICS	1.3	0.99	0.74	1.311	0.748	2.2
SURGERY	1.18	0.85	0.91	1.385	1.073	-0.7
OPHTHALMOLOGY	1.31	0.92	0.76	1.435	0.832	-2.9
UROLOGY & NEPHROLOGY	1.27	0.85	0.86	1.507	1.017	-5.9
PSYCHIATRY	1.3	0.91	0.78	1.434	0.861	-0.7
OTORHINOLARYNGOLOGY	1.32	0.85	0.74	1.545	0.875	-6.8
PEDIATRICS	1.31	0.86	0.84	1.521	0.971	-3.3
<i>V. CL. M. III (HEALTH SC. & OTHER)</i>						
NURSING	1.37	0.83	0.78	1.659	0.949	-8.3
EDUCATION, SC. DISCIPLINES	0.88	1.17	1.13	0.749	0.966	0.1
REHABILITATION	0.99	1.12	0.92	0.882	0.815	0.9
MEDICAL INFORMATICS	0.97	1.08	0.99	0.902	0.924	0.4
MEDICINE, LEGAL	1.1	0.99	0.85	1.108	0.861	-6.0
SUBSTANCE ABUSE	1.05	1.06	0.88	0.993	0.829	6.2
HEALTH CARE SC. & SERVICES	1.09	0.93	0.82	1.170	0.884	-0.2
PUBLIC, ENVIRON. & OCCUP. HEALTH	1.12	0.9	0.85	1.236	0.938	-0.9
HEALTH POLICY & SERVICES	1.21	0.95	0.78	1.270	0.818	-3.6
<i>VI. NEUROSC. & BEHAVIORAL</i>						
SOCIAL SCIENCES, BIOMEDICAL	1.09	0.86	0.79	1.260	0.909	-0.2
PSYCHOLOGY, EXPERIMENTAL	0.93	1.24	0.9	0.756	0.727	7.8
PSYCHOLOGY, BIOLOGICAL	1.04	1.06	0.83	0.982	0.780	-3.1
	1.03	1.06	0.87	0.969	0.824	-1.8

PSYCHOLOGY, MATHEMATICAL	0.97	1.06	1.03	0.919	0.972	3.6
BEHAVIORAL SCIENCES	1.03	1.04	0.9	0.995	0.863	-2.6
PSYCHOLOGY, PSYCHOANALYSIS	1.23	0.77	0.9	1.587	1.166	-46.7
PSYCHOLOGY, DEVELOPMENTAL	1.06	0.96	0.88	1.106	0.916	1.5
PSYCHOLOGY	1.12	0.95	0.82	1.176	0.857	-2.0
PSYCHOLOGY, CLINICAL	1.07	0.85	0.97	1.251	1.131	-8.2
PSYCHOLOGY, SOCIAL	1.09	0.89	0.9	1.226	1.009	-3.8
NEUROIMAGING	1.19	1.01	0.76	1.181	0.757	0.0
PSYCHOLOGY, APPLIED	1.07	0.8	0.97	1.347	1.224	-11.3
NEUROSCIENCES	1.29	0.93	0.75	1.380	0.801	-2.7
PSYCHOLOGY, MULTIDISCIPLINARY	1.34	0.8	0.62	1.675	0.781	-13.1
PSYCHOLOGY, EDUCATIONAL	1.28	0.76	0.57	1.675	0.746	-6.6

B. PHYSICAL SCIENCES

VII. CHEMISTRY

CHEMISTRY, APPLIED	1.28	1.36	0.72	0.937	0.527	4.4
ENGINEERING, CHEMICAL	1.17	1.13	0.85	1.030	0.747	-2.9
ELECTROCHEMISTRY	1.37	1.16	0.83	1.183	0.716	-0.7
CHEMISTRY, INORGANIC & NUCLEAR	1.33	1.07	0.82	1.249	0.774	-1.9
CHEMISTRY, ORGANIC	1.3	1.05	0.83	1.239	0.794	-1.0
CHEMISTRY, ANALYTICAL	1.5	1.04	0.78	1.439	0.748	-12.0
POLYMER SCIENCE	1.49	1.12	0.81	1.327	0.719	-0.7
CHEMISTRY, MEDICINAL	1.34	1.04	0.73	1.290	0.709	3.5
CHEMISTRY, PHYSICAL	1.44	1.07	0.79	1.351	0.737	-0.9
CHEMISTRY, MULTIDISCIPLINARY	2.04	1.26	0.61	1.616	0.481	-2.7

VIII. PHYSICS

PHYSICS OF SOLIDS, FLUIDS & PLASMAS	1.16	1.09	0.8	1.056	0.733	-0.4
ACOUSTICS	1.27	1.08	0.71	1.176	0.654	-9.7
OPTICS	1.22	1.17	0.77	1.044	0.663	2.9
PHYSICS, MATHEMATICAL	1.24	1.07	0.82	1.159	0.768	-2.0
PHYSICS, NUCLEAR	1.2	1.08	0.84	1.115	0.778	2.2
SPECTROSCOPY	1.32	1.19	0.74	1.114	0.626	4.2
THERMODYNAMICS	1.22	1.03	0.88	1.189	0.855	1.6
PHYSICS, ATOMIC, MOL. & CHEMICAL	1.22	1.02	0.84	1.195	0.820	1.7
PHYSICS, CONDENSED MATTER	1.38	1.09	0.8	1.269	0.730	-1.1
PHYSICS, APPLIED	1.45	1.07	0.79	1.357	0.740	-2.6
PHYSICS, PARTICLES & FIELDS	1.36	0.97	0.82	1.406	0.847	-2.3
PHYSICS, MULTIDISCIPLINARY	1.77	1.13	0.67	1.573	0.595	-0.5

IX. SPACE SCIENCES

ASTRONOMY & ASTROPHYSICS	1.25	0.99	0.76	1.265	0.775	1.5
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X. MATHEMATICS

MATHEMATICS	1.24	1.09	0.81	1.141	0.740	-1.4
MATHEMATICS, APPLIED	1.24	1.06	0.81	1.179	0.770	-0.8
STATISTICS & PROBABILITY	1.24	1.03	0.74	1.207	0.721	-1.4
MATHEMATICS, INTERDIS. APPLS.	1.24	0.98	0.83	1.265	0.848	-3.4
SOCIAL SCIENCES, MATH. METHODS	1.28	0.82	0.79	1.550	0.962	-0.7

XI. COMPUTER SCIENCE

MATH. & COMPUTATIONAL BIOLOGY	1.12	1.03	0.8	1.089	0.781	0.8
COMPUTER SC., SOFTWARE ENGIN.	1.13	1.02	0.82	1.109	0.804	2.6
COMPUTER SC., INTRER. APPLS.	1.21	1.06	0.77	1.150	0.734	2.9
COMPUTER SCIENCE, CYBERNETICS	1.59	1.15	0.64	1.386	0.554	-14.0
COMP. SC., ARTIFICIAL INTELLIGENCE	1.31	0.97	0.81	1.347	0.829	-7.4
COMPUTER SC., INFORMATION SYSTEMS	1.29	0.97	0.75	1.332	0.773	0.8
COMP. SC., HARDWARE & ARCH.	1.31	0.95	0.7	1.379	0.741	-0.1
COMPUTER SC., THEORY & METHODS	1.24	0.94	0.89	1.312	0.943	5.0

C. OTHER NATURAL SCIENCES**XII. ENGINEERING**

ENGINEERING, PETROLEUM	0.86	1.38	0.97	0.623	0.699	4.2
TRANSPORTATION SC. & TECHNOLOGY	0.82	1.2	1.16	0.689	0.971	2.7
ENGINEERING, INDUSTRIAL	0.96	1.16	0.94	0.828	0.813	5.0
ENERGY & FUELS	1	1.15	0.92	0.873	0.802	6.0
ENGINEERING, CIVIL	0.96	1.06	1	0.905	0.950	3.7
ENGINEERING, MULTIDISCIPLINARY	1.14	1.2	0.79	0.949	0.658	3.5
INSTRUMENTS & INSTRUMENTATION	1.14	1.11	0.83	1.029	0.750	-4.1
ENGINEERING, MARINE	1.06	0.89	1.07	1.188	1.193	-15.5
CONSTR. & BUILDING TECHNOLOGY	1.06	1.04	0.93	1.015	0.895	2.6
AUTOMATION & CONTROL SYSTEMS	1.22	1.06	0.83	1.155	0.787	-10.1
NUCLEAR SCIENCE & TECHNOLOGY	1.2	1.1	0.86	1.098	0.780	-2.9
ENGINEERING, MANUFACTURING	1.11	1.07	0.91	1.041	0.849	3.8
ENGINEERING, ENVIRONMENTAL	1.15	0.98	0.87	1.175	0.890	-2.4
OPERATIONS RES. & MANAG. SC.	1.16	0.97	0.89	1.196	0.911	1.9
ENGINEERING, MECHANICAL	1.26	1.05	0.82	1.200	0.784	1.9
ERGONOMICS	1.13	0.96	0.91	1.174	0.942	5.1
ENGIN., ELECTRICAL & ELECTRONIC	1.33	1.01	0.78	1.316	0.771	-1.5
MECHANICS	1.35	1.03	0.78	1.310	0.760	-0.3

ROBOTICS	1.37	0.99	0.8	1.383	0.805	-2.0
IMAGING SC. & PHOTO. TECHNOLOGY	1.5	1.04	0.64	1.449	0.621	-6.1
TELECOMMUNICATIONS	1.45	0.96	0.7	1.512	0.724	1.9
XIII. MATERIALS SCIENCE						
MATERIALS SCIENCE, PAPER & WOOD	0.97	1.09	0.94	0.889	0.861	-3.3
MATERIALS SC., CHARACTERIZATION & T	1.09	1.31	0.81	0.835	0.620	9.1
MATERIALS SCIENCE, TEXTILES	1.35	1.19	0.84	1.129	0.703	-19.8
MATERIALS SCIENCE, COMPOSITES	1.16	1.07	0.89	1.083	0.826	4.8
MATERIALS SC., COATINGS & FILMS	1.14	0.99	0.94	1.154	0.951	1.1
MATERIALS SCIENCE, BIOMATERIALS	1.21	0.89	0.96	1.358	1.082	-0.1
NANOSCIENCE & NANOTECHNOLOGY	1.33	0.92	0.88	1.447	0.957	-3.3
METALLURGY & METALL. ENGIN.	1.79	1.16	0.81	1.543	0.695	-9.4
MATERIALS SCIENCE, CERAMICS	1.67	1.11	0.81	1.504	0.724	0.8
XIV. GEOSCIENCES						
MINING & MINERAL PROCESSING	1.16	1.6	0.74	0.725	0.467	11.3
ENGINEERING, OCEAN	1.03	1.17	0.82	0.882	0.698	11.2
GEOGRAPHY, PHYSICAL	1.12	1.01	0.91	1.107	0.895	-2.9
ENGINEERING, GEOLOGICAL	1.1	0.97	0.97	1.131	0.993	-3.9
MINERALOGY	1.31	1.01	0.88	1.299	0.872	-11.1
OCEANOGRAPHY	1.26	1.05	0.73	1.206	0.702	-2.8
GEOCHEMISTRY & GEOPHYSICS	1.26	1.03	0.78	1.219	0.758	-1.3
METEO. & ATMOSPHERIC SCIENCES	1.17	1.01	0.75	1.158	0.743	3.9
PALEONTOLOGY	1.24	1.08	0.81	1.149	0.757	7.2
GEOLOGY	1.21	0.99	0.87	1.220	0.870	1.9
REMOTE SENSING	1.34	0.95	0.72	1.415	0.764	-4.3
ENGINEERING, AEROSPACE	1.31	0.82	0.74	1.602	0.910	-17.5
XV. AGRIC. & ENVIRONMENT						
AGRICULTURAL ENGINEERING	0.98	1.2	0.89	0.816	0.741	-8.4
HORTICULTURE	0.98	1.25	0.88	0.784	0.702	2.6
BIODIVERSITY CONSERVATION	0.91	1.22	0.95	0.747	0.773	9.3
ENVIRONMENTAL STUDIES	1.02	1.11	0.83	0.914	0.742	0.5
AGRONOMY	1.19	1.21	0.79	0.985	0.657	-2.0
SOIL SCIENCE	1.21	1.17	0.76	1.028	0.652	-5.0
FOOD SCIENCE & TECHNOLOGY	1.21	1.09	0.81	1.116	0.748	-1.1
LIMNOLOGY	1.13	0.94	0.89	1.202	0.942	-5.9
AGRIC., DAIRY & ANIMAL SCIENCE	1.47	1.26	0.63	1.166	0.500	-0.1
AGRICULTURE, MULTIDISCIPLINARY	1.54	1.38	0.72	1.114	0.526	5.6
ENVIRONMENTAL SCIENCES	1.18	1.01	0.85	1.176	0.843	1.9

NUTRITION & DIETETICS	1.25	0.97	0.76	1.295	0.786	1.0
XVI. BIOLOGY (ORGANISMIC & SUPRAORGANISMIC LEVEL)						
ENTOMOLOGY	1.05	1.13	0.88	0.934	0.779	-0.4
FISHERIES	1.1	1.1	0.91	0.995	0.822	-2.8
ECOLOGY	1.11	1.08	0.83	1.022	0.763	-4.0
FORESTRY	1.06	0.99	0.95	1.065	0.961	-4.3
MARINE & FRESHWATER BIOLOGY	1.11	1.02	0.92	1.085	0.904	-5.9
ORNITHOLOGY	1.08	1.04	0.88	1.043	0.846	-0.5
WATER RESOURCES	1.13	1.03	0.89	1.100	0.867	-0.7
PARASITOLOGY	1.23	1.11	0.82	1.104	0.741	0.3
VETERINARY SCIENCES	1.25	1.07	0.77	1.173	0.721	-4.5
ZOOLOGY	1.28	1.03	0.79	1.235	0.761	-7.1
PLANT SCIENCES	1.29	1.13	0.76	1.134	0.673	2.6
VIROLOGY	1.17	0.95	0.8	1.233	0.844	-1.7
MICROBIOLOGY	1.26	1.04	0.76	1.209	0.730	1.7
MYCOLOGY	1.4	1.1	0.76	1.270	0.689	2.4
XVII. MULTIDISCIPLINARY SCIENCE						
MULTIDISCIPLINARY SCIENCES	1.74	1.26	0.61	1.382	0.483	-2.3
XVIII. RESIDUAL SUB-FIELDS						
GEOSCIENCES, MULTIDISCIPLINARY	1.31	1.07	0.78	1.220	0.724	-7.1
CRYSTALLOGRAPHY	1.35	1.12	0.85	1.205	0.753	8.6
MATERIALS SC., MULTIDISCIPLINARY	1.45	1.06	0.83	1.367	0.782	0.0
MEDICINE, RES. & EXPERIMENTAL	1.51	0.9	0.63	1.681	0.698	-13.2
D. SOCIAL SCIENCES						
XIX. SOCIAL SCIENCES, GENERAL						
ETHNIC STUDIES	0.9	1.18	1.14	0.763	0.960	-4.5
EDUCATION, SPECIAL	0.97	1.28	0.91	0.759	0.709	-2.9
URBAN STUDIES	0.96	1.25	0.79	0.770	0.629	-3.1
PUBLIC ADMINISTRATION	1.04	1.23	0.68	0.851	0.555	-6.5
HISTORY OF SOCIAL SCIENCES	0.96	1.17	0.78	0.824	0.671	1.7
SOCIAL ISSUES	1.05	1.11	0.75	0.946	0.679	-5.6
AREA STUDIES	1.02	1.13	0.92	0.901	0.814	0.3
GEOGRAPHY	1.03	1.09	0.79	0.946	0.727	-2.6
LINGUISTICS	1.06	1.08	0.77	0.987	0.716	-3.8
ETHICS	1.15	1.01	0.7	1.131	0.685	-7.0
EDUCATION & EDUC. RESEARCH	1.06	0.98	0.85	1.085	0.865	-2.2

PLANNING & DEVELOPMENT	1.15	1.08	0.72	1.059	0.662	0.8
SOCIAL SCIENCES, INTERDISCIPLINARY	1.06	1	0.82	1.057	0.812	1.8
SOCIAL WORK	1.1	0.99	0.69	1.117	0.698	-0.9
INFORMATION SC. & LIBRARY SCIENCE	1.02	0.92	1.07	1.105	1.165	2.6
COMMUNICATION	1.07	0.91	0.81	1.181	0.889	-2.0
ANTHROPOLOGY	1.23	0.88	0.81	1.390	0.915	-11.9
TRANSPORTATION	1.03	0.9	1.04	1.142	1.155	11.0
SOCIOLOGY	1.41	0.88	0.47	1.595	0.529	-13.9
WOMEN'S STUDIES	1.22	0.74	0.67	1.636	0.895	-12.0
FAMILY STUDIES	1.1	0.71	0.76	1.550	1.067	-5.9
POLITICAL SCIENCE	1.25	0.75	0.64	1.655	0.851	-12.2
MEDICAL ETHICS	1.3	0.84	0.9	1.553	1.069	-0.8
INTERNATIONAL RELATIONS	1.39	0.71	0.63	1.944	0.880	-14.1
LAW	1.06	0.58	0.75	1.818	1.286	0.3
DEMOGRAPHY	1.31	0.63	0.72	2.059	1.134	-1.8
CRIMINOLOGY & PENOLOGY	1.36	0.56	0.79	2.443	1.424	-8.1
<i>XX. ECONOMICS & BUSINESS</i>						
INDUSTRIAL RELATIONS & LABOR	1	1.23	0.75	0.819	0.613	-0.6
AGRICULTURAL ECONOMICS & POLICY	1.05	1.1	0.84	0.952	0.762	-0.2
BUSINESS, FINANCE	1.11	0.81	0.74	1.360	0.911	-8.3
BUSINESS	1.12	0.81	0.8	1.380	0.989	1.0
ECONOMICS	1.29	0.86	0.68	1.510	0.791	-7.2
MANAGEMENT	1.32	0.78	0.72	1.685	0.926	-0.7

Appendix II. A Family of High- and Low-impact Indicators

Consider a discrete citation distribution of papers published in a given year, that is, consider an ordered, non-negative vector $\mathbf{c} = (c_1, \dots, c_i, \dots, c_n)$ where $c_1 \leq c_2 \leq \dots \leq c_n$, and $c_i \geq 0$ is the number of citations received by the i -th article. Given a distribution \mathbf{c} and a positive CCL, classify as low- or high-impact articles all papers with citation $c_i \leq \text{CCL}$, or $c_i > \text{CCL}$. In this paper, the CCL is always fixed at the 80th percentile of the world citation distribution. To simplify the notation, we will omit in the sequel a reference for such fixed CCL. Thus, denote by $n(\mathbf{c})$ the total number of articles in the distribution, and by $l(\mathbf{c})$ and $h(\mathbf{c}) = n(\mathbf{c}) - l(\mathbf{c})$ the number of low- and high-impact articles. A *low-impact index* is a real valued function L whose typical value $L(\mathbf{c})$ indicates the low-impact level associated with distribution \mathbf{c} , while a *high-impact index* is a real valued function H whose typical value $H(\mathbf{c})$ indicates the high-impact level associated with that distribution.

Given a citation distribution \mathbf{c} and a CCL, the Foster, Greer, and Thorbeke (FGT hereafter) family of low-impact indicators, originally introduced in Foster *et al.* (1984) for the measurement of economic poverty, is defined by:

$$L_\beta(\mathbf{c}) = [1/n(\mathbf{c})] \sum_{i=1}^{l(\mathbf{c})} (\Gamma_i)^\beta, \quad 0 \leq \beta,$$

where β is a parameter identifying the members of the family, and $\Gamma_i = \max \{(\text{CCL} - c_i)/\text{CCL}, 0\}$ is the *normalized low-impact gap* for any article with c_i citations. Note that $\Gamma_i \geq 0$ for low-impact articles, while $\Gamma_i = 0$ for high-impact articles. The class of FGT high-impact indicators is defined by

$$H_\beta(\mathbf{c}) = [1/n(\mathbf{c})] \sum_{i=l(\mathbf{c})+1}^{n(\mathbf{c})} (\Gamma_i^*)^\beta, \quad 0 \leq \beta,$$

where b is again a parameter identifying the members of the family, and $\Gamma_i^* = \max \{(c_i - \text{CCL})/\text{CCL}, 0\}$ is the *normalized high-impact gap*. Now $\Gamma_i^* > 0$ for high-impact articles, while $\Gamma_i^* = 0$ for low-impact articles. As explained in Albarrán *et al.* (2011b), both families are size- and scale-invariant.

It will be sufficient to understand the differences involved in these indicators for parameter values $\beta = 0, 1$, and 2. Firstly, note that the high- and low-impact indices obtained when $b = 0$ coincide with the proportion of high- and low-impact papers: $H_0(\mathbf{c}) = h(\mathbf{c})/n(\mathbf{c})$, and $L_0(\mathbf{c}) = l(\mathbf{c})/n(\mathbf{c})$. It should be noted that the mere percentage of articles satisfying some interesting condition only captures what can be referred to as the *incidence* aspect of the phenomenon in question. In this sense, it can be said that H_0 and L_0 only capture the incidence aspect of the high- and low-impact phenomenon. Secondly, consider the high-impact index corresponding to $b = 1$, or the *per-article high-impact gap ratio*:

$$H_1(\mathbf{c}) = [1/n(\mathbf{c})] \sum_{i=l(\mathbf{c})+1}^{n(\mathbf{c})} \Gamma_i^*.$$

Similarly, the member of the FGT family of low-impact indicators for $b = 1$, or the *per-article low-impact gap ratio*, is equal to:

$$L_1(\mathbf{c}) = [1/n(\mathbf{c})] [\sum_{i=1}^{l(\mathbf{c})} \Gamma_i].$$

The normalized high- and low-impact gaps of two articles, Γ_i^* and Γ_i , respectively, reflect how far are both articles from the CCL. Consequently, it can be said that H_1 and L_1 capture both the incidence and the *intensity* of the corresponding phenomena. Thirdly, the high- and low-impact members of the FGT families obtained when $b = 2$ can be expressed as:

$$H_2(\mathbf{c}) = H_0(\mathbf{c}) \{ [H_1(\mathbf{c})]^2 + [1 - H_1(\mathbf{c})]^2 (C_H)^2 \}, \quad (1)$$

$$L_2(\mathbf{c}) = L_0(\mathbf{c}) \{ [L_1(\mathbf{c})]^2 + [1 - L_1(\mathbf{c})]^2 (C_L)^2 \}, \quad (2)$$

where C_H and C_L are the coefficients of variation (that is, the ratio of the standard deviation over the mean) among the high- and low-impact articles, respectively. In so far as the coefficient of variation is a measure of citation inequality, the FGT indicators H_2 and L_2 defined in equations (1) and (2) simultaneously capture the incidence, the intensity, and the *citation inequality* aspects of the high- and low-impact phenomenon they measure (see Albarrán *et al.*, 2011b, for a full discussion of the properties possessed by the above indicators).

Since in this paper only indicators for parameter value $\beta = 2$ will be computed, we will omit any further subscript in what follows. Thus, in the text the high- and low-impact indicators for $\beta = 2$ are simply denoted as H and L , respectively.

