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ABSTRACT

Average-Based Indicators at Different Aggregation Levels*

This paper investigates the citation impact of three large geographical areas--the U.S., the European Union (EU), and the rest of the world (RW)--at different aggregation levels in two scenarios: (i) when each article published in 1998-2002 is assigned to a single broad field, and (ii) when it is recognized that 42% of these articles are assigned to several sub-fields among a set of 219 Web of Science categories. The study focuses on the consequences of using the crown indicator, the Mean Normalized Citation Score (MNCS), and a third average-based indicator that does not correct for differences across sub-fields. It is found that: (1) Using either of the two normalized indicators, and following a multiplicative or a fractional strategy at the sub-field level in the second scenario is of little consequence. (2) The U.S. outperforms the EU in 179 of the 219 sub-fields, and 71 of 80 disciplines in the second scenario, as well as at all higher aggregate levels in both scenarios. (3) The US/EU and EU/RW gaps for all sciences as a whole according to both normalized indicators are 25-28% and 23%, respectively. Without normalization, these gaps increase by 4.5 and 5.6 percentage points--a non-negligible difference.

JEL Classification: O31, Y80 and Z00
Keywords: citation analysis, crown indicator, European Paradox and normalization

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I. INTRODUCTION

From the methodological point of view, this paper contributes to recent discussions about the evaluation of the citation performance of research units that publish articles in several disciplines when one uses commonly proposed average-based indicators at different aggregate levels. The problem, of course, is that for evaluations at the level of broad, aggregate scientific *fields*, it is crucial that one carefully controls for wide differences in the average number of citations per publication at the lowest level of aggregation in what we call *sub-fields*. As is well known, there are two main normalization mechanisms in contention: the *crown indicator*, previously recommended by the Center for Science and Technological Studies (CWTS) at Leiden University (De Bruin *et al.*, 1993, and Moed *et al.*, 1995), and an alternative normalization mechanism sometimes referred to as the *item-oriented field-normalized citation score average* (Lunberg, 2007), or as the *mean normalized citation score*. Apparently, because of its better theoretical properties the CWTS is currently moving towards a new crown indicator that relies on the second mechanism (see Waltman *et al.*, 2011 for a clear rendition of the issues, as well as for relevant references about the polemic involving the two mechanisms).

This paper emphasizes the distinction between an *ideal world* in which all papers are assigned to a single sub-field, and the *real world* in which papers are assigned to sub-fields through the journals in which they have been published, and journals are often assigned to two, three, or more sub-fields.[1]

(i). In the ideal world, both average-based indicators coincide at the sub-field level. At the aggregate level, we suggest a third indicator that serves a useful purpose in spite of the fact that, contrary to the previous ones, does not correct for differences in mean citation rates across sub-fields.

(ii). Naturally, in the real world the issues are more complex. What is to be done with the publications assigned to two or more sub-fields? Section 6 in Waltman *et al.* (2011a) solves the problem by adopting a fractional strategy according to which if a paper is assigned, for example, to three sub-fields, the paper is broken down into three pieces, one third of the citations originally received are assigned to each piece, and the result is assigned to each of the three sub-fields in question. We partially disagree. At the sub-field level we recommend a multiplicative strategy according to which if, as in the previous example, 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. At the aggregate level, if in the previous example the three sub-fields belong to the same field, then the paper should be counted once. This means that the number of papers at the field and sub-field levels will be different, so that the link between the two levels will be broken. In this situation, we can always compute our third indicator that only uses aggregate data. However, this is accomplished at a high cost: ignoring differences across sub-fields. Alternatively, to correct for these differences in the presence of multiple assignments we agree with Waltman *et al.* (2011a) that a fractional strategy is appropriate. Interestingly enough, at the maximum aggregate level the third indicator computed from the sub-field level through a fractional strategy coincides with the one already referred to directly computed with aggregate data. Thus, in the real world we recommend a multiplicative strategy at the sub-field level and a fractional strategy at any aggregate level.

So far it has been implicitly assumed that each paper has been written by one or more authors belonging to the same research unit. Empirically, this will always be the case only when research units are journals, but in an international context and many other situations it is likely that there is some cooperation between research units. From a methodological point of view, we must confront

[1] For example, only about 41% of the total number of articles published in 1998-2002 in all sciences in our dataset acquired from Thomson Scientific is assigned to a single Web of Science category.

a formally identical problem to the one just discussed: what should be done with papers written by authors belonging to two or more research units? Although this old problem admits different solutions (see *inter alia* Anderson *et al.*, 1988, for a discussion in the international case), we side with many other authors in recommending a multiplicative strategy at all aggregation levels that is analogous to the one already recommended at the sub-field level for the treatment of multiple assignment publications (see the influential contributions by May, 1997, and King, 2004, as well as the references in Section II in Albarrán *et al.*, 2010).

Normalization procedures can and should be evaluated in terms of the properties they satisfy. However, quite apart from the *a priori* advantages that may make a normalization scheme preferable to another one, it is important to empirically verify the order of magnitude of the differences that the alternative methods may bring. For that purpose, this paper uses a large data set acquired from Thomson Scientific consisting of more than 3,6 million articles published in 1998-2002, and the 28 million citations they have received during a five year citation window. The database offers two ways to classify all articles at different aggregation levels. Firstly, each article is assigned to a single broad field among a set of 20 natural sciences and two social sciences. This provides a unique opportunity to compare the three average-based indicators in a version of what we call the ideal world where the lowest aggregation level –the sub-fields– are identified with these 22 fields. The comparison is done at two aggregate levels: (i) four grand fields including the Life Sciences, the Physical Sciences, Other Natural Sciences, and the Social Sciences, and (ii) all 22 fields as a whole. Secondly, Thomson Scientific assigns each article to one, two, three, and up to six Web of Science (WoS hereafter) categories. Therefore, in what we call the real world sub-fields are identified with 219 WoS categories. Here we compare the three indicators at three aggregate levels: 20 broad fields, the four grand fields, and all sciences as a whole.

From the empirical point of view, this paper complements previous contributions that study aggregation issues for different types of research units: individual scientists in Van Raan *et al.* (2010), as well as 158 research groups, 365 universities, 58 countries, and 8,423 journals for only seven WoS categories in Waltman *et al.* (2011b). For the 22 and 219 sub-fields in our two situations, we partition the entire world into three large geographical areas: the U.S., the EU, namely, the 15 countries forming the European Union before the 2004 accession, and any other country of the rest of the world (RW hereafter).

It is true that, judging from the results in Waltman *et al.* (2011b), for these large research units the differences between the three indicators are expected to be small. However, there are three reasons to justify our effort. Firstly, the verification of this conjecture is interesting in itself. Note, however, that the mere ranking of only three wide geographical areas is of secondary interest: what matters here is the cardinal measure of their relative positions. Secondly, normalization procedures in previous studies take as reference sub-field mean citation rates computed for all papers published in the world over a certain period but consider a set of research units that do not constitute a partition of the world. Consequently, the connection between the research units' means citation rates and the world reference standard is never clear-cut. Instead, in this paper the consistency between the magnitudes for the geographical areas and the world as a whole is always explicit. Thirdly, the comparison of the relative performance of the U.S. and the EU at all aggregation levels is an important empirical issue in view of the so-called "European Paradox", popularized in the *First European Report on Science and Technology Indicators* (EC, 1994), 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 it into innovation, growth, and jobs. This paradox is exclusively based on a mere counting of the number of publications. As soon as one takes into account the citation impact that these publications achieve, Albarrán *et al.* (2010, 2011a, 2011b) *inter alia* provides ample evidence against this view, and in favor of a dramatic dominance of the U.S. over the EU (and the RW) in all of the 22 fields already mentioned. Admittedly, however, these fields are much too broad, and hence too heterogeneous. Thus, as pointed out by a referee: "*the results of*

the paper [Albarrán et al. (2011b)] could be translated as that the U.S. is disproportionally active in the highest impact subject category/-ies in all 22 fields". The present paper nails down this important issue from the point of view of average-based indicators.

The rest of the paper is organized into three Sections and a statistical Appendix. Section II presents the notation, introduces the average-based indicators, and discusses the aggregation issues in an ideal and a real world. Section III presents the data and the comparison of the three geographical areas according to the three indicators when sub-fields are identified with (i) the 22 broad fields distinguished by Thomson Scientific, and (ii) the 219 WoS categories. Descriptive statistics and other individual information is relegated to the Appendix. Section IV offers some concluding comments and suggestions for extensions.

II. THE AGGREGATION PROBLEM

II.1. Notation

Assume that there are S sub-fields, indexed by $s = 1,\ldots, S$, as well as K research units indexed by $k = 1,\ldots, K$. Assume that each article is written by one or more authors belonging to a single research unit, and that it is assigned to a single sub-field. Research unit k has a set $\boldsymbol{x}^{\boldsymbol{k}}_{\boldsymbol{s}} = \{c^k_{si}\}$ of n^k_s distinct articles in sub-field s, indexed by $i = 1,\ldots, n^k_s$, where c^k_{si} is the number of citations received by article i. The total number of articles for research unit k is $n^k = \Sigma_s\, n^k_s$. The mean citation rate (MCR hereafter) of unit k at the sub-field level s, m^k_s, is defined as

$$m^k_s = \Sigma_i\, c^k_{si}/n^k_s.$$

The corresponding MCR at the aggregate level, m^k, is defined as

$$m^k = \Sigma_s\, \Sigma_i\, c^k_{si}/n^k.$$

Note that this MCR can also be written as the weighted average of the m^k_s with weights α^k_s equal to the area's publication effort in each sub-field s:

$$m^k = \Sigma_s\, \alpha^k_s\, m^k_s,$$

where $\alpha^k_s = n^k_s/n^k$, and $\Sigma_s\, \alpha^k_s = 1$.

We are aware that most empirical work in bibliometrics is typically concerned with a relatively small subset of research units that do not constitute a partition of the world. This is the case, for example, of the empirical studies on aggregation issues mentioned in the Introduction. Quite independently of the fact that the empirical part of this paper does involve a world partition into three geographical areas, we proceed to develop the general case in order to clearly establish the inter-relationship between what happens in all members of a world partition and what happens in the world as a whole. Even if one is solely interested in investigating a certain subset of research units, normalization procedures should be defined –and understood– at the general level. Thus, under the assumption that the K research units form a partition of the world, and that there is no article written in cooperation between research units, the total number of articles in sub-field s and at the aggregate world level are, respectively, $n_s = \Sigma_k\, n^k_s$ and $n = \Sigma_s\, n_s = \Sigma_k\, n^k$. What is the connection between the research units MCRs and the corresponding measures at the world level? In the first place, the world sub-field s MCR, m_s, is defined as

$$m_s = (\Sigma_k \Sigma_i c^k_{si})/n_s = \Sigma_k v^k_s m^k_s,$$

where $v^k_s = n^k_s/n_s$ is the publication share of research unit k in sub-field s, and $\Sigma_k v^k_s = 1$. In the second place, the world aggregate MCR, m, is defined as

$$m = (\Sigma_k \Sigma_s \Sigma_i c^k_{si})/n = \Sigma_s \alpha_s m_s = \Sigma_k V^k m^k = \Sigma_s \Sigma_k z^k_s m^k_s,$$

where $\alpha_s = n_s/n$, $V^k = n^k/n$, $z^k_s = n^k_s/n$, and $\Sigma_s \alpha_s = \Sigma_k W^k = \Sigma_s \Sigma_k z^k_s = 1$.

II.2. Average-based Indicators at the Aggregate Level

Let e^k_{si}, $i = 1,\ldots, n^k_s$, denote the expected number of citations of article i published by research unit k in sub-field s. Consider the following two well-known indicators. Firstly, the so-called *crown indicator* for research unit k, C^k, is the ratio CPP/FCSm where CPP and FCSm stand for, respectively, the research unit's MCR and the mean sub-field citation score. Therefore, C^k is defined as

$$C^k = \text{CPP}^k/\text{FCSm}^k = (\Sigma_s \Sigma_i c^k_{si}/n^k)/(\Sigma_s \Sigma_i e^k_{si}/n^k) = (\Sigma_s \Sigma_i c^k_{si})/(\Sigma_s \Sigma_i e^k_{si}),$$

which is equation (1) in Waltman *et al.* (2011a). The rationale is that the articles of a research unit are seen as a single integrated *ouvre* rather than as a number of independent works. Since the distribution of citations over the individual articles is not considered important, normalization is performed at the level of the research unit's *ouvre* as a whole rather than at the level of the research unit's individual publications. Secondly, the *mean normalized citation score, MNCS*^{k}, is defined as

$$MNCS^k = (1/n^k)(\Sigma_s \Sigma_i c^k_{si}/e^k_{si}),$$

which is equation (2) in Waltman *et al.* (2011a). The $MNCS^k$ indicator first performs a normalization at the level of individual articles, and then obtains the average of the normalized articles. The idea is that once the number of citations received by an article has been normalized for differences among sub-fields, all articles should be treated equally.

It is natural to take e^k_{si} equal to the sub-field's MCR, m_s, for all i in s. In this case

$$C^k = (\Sigma_s \Sigma_i c^k_{si})/(\Sigma_s \Sigma_i m_s) = (\Sigma_s \Sigma_i c^k_{si})/\Sigma_s n^k_s m_s = (\Sigma_s \Sigma_i c^k_{si})/n^k)/(\Sigma_s (n^k_s/n^k) m_s = m^k/m^{k\#}, \qquad (1)$$

where $m^{k\#} = \Sigma_s \alpha^k_s m_s$ is the field MCR that unit k would obtain if each of its publications in a given sub-field s were to receive m_s citations, that is, if $c^k_{si} = m_s$ for all $i = 1,\ldots, n^k_s$, and $s = 1,\ldots, S$. Similarly, we have

$$MNCS^k = (1/n^k)(\Sigma_s \Sigma_i (c^k_{is}/m_s)). \qquad (2)$$

It is easy to observe that, for any s, the sub-field indicators C^k_s and M^k_s are equal:

$$C^k_s = MNCS^k_s = m^k_s/m_s. \qquad (3)$$

The relationship between the indicators at the sub-field and field levels is the following:

$$MNCS^k = \Sigma_s \alpha^k_s M^k_s, \ \Sigma_s \alpha^k_s = 1.$$

$$C^k = \Sigma_s \beta^k_s M^k_s, \ \beta^k_s = (\alpha^k_s m_s)/\Sigma_s \alpha^k_s m_s, \ \Sigma_s \beta^k_s = 1. \qquad (4)$$

On the other hand, the following indicators are all equal to one:

$$C_s = (\Sigma_k \Sigma_i\, c^k_{si})/(\Sigma_k \Sigma_i\, m_s) = (\Sigma_k \Sigma_i\, c^k_{si})/n_s\, m_s = m_s/m_s = 1.$$

$$MNCS_s = (1/n_s)\ (\Sigma_k \Sigma_i\ (c^k_{si}/m_s)) = m_s/m_s = 1.$$

$$MNCS = (1/n)\ \Sigma_s\, (\Sigma_k \Sigma_i\, c^k_{si})/m_s) = (1/n)\ (\Sigma_s\, n_s) = n/n = 1.$$

$$C = (\Sigma_s \Sigma_k \Sigma_i\, c^k_{si})/(\Sigma_s \Sigma_k \Sigma_i\, m_s) = (\Sigma_s \Sigma_k \Sigma_i\, c^k_{si})/(\Sigma_s\, n_s\, m_s) = (\Sigma_s \Sigma_k \Sigma_i\, c^k_{si})/\ (\Sigma_s \Sigma_k \Sigma_i\, c^k_{si}) = 1.$$

It is easy to show that $MNCS_s = \Sigma_k\, w^k_s\, MNCS^k_s$. Hence, $C_s = \Sigma_k\, w^k_s\, C^k_s$.

II.3. A New Type of Indicator at the Aggregate Level

It might be argued that it is not obvious why we should evaluate a research unit's *ouvre* independently of the differences between its publication effort across sub-fields, α^k_s, and the world publication effort, W_s. This is exactly what is done in C^k, where the normalization process is tailored to the research unit publication effort, as well as in M^k, where all sub-fields count the same regardless of their relative importance at the world level. Alternatively, we can take $e^k_{si} = m$ for all $i = 1,\ldots, n^k_s$, and all $s = 1,\ldots, S$, normalize each article so that c^k_{si}/m, and find the MCR over all articles published by unit k. In this case we have a new indicator, I^k, defined as

$$I^k = (1/n^k)\ (\Sigma_s\, \Sigma_i\ (c^k_{si}/m)) = m^k/m. \qquad (5)$$

This indicator can also be seen as the result of a normalization at the level of the research unit's *ouvre* as a whole, where the expected number of citations of the *ouvre* is taken to be the aggregate world MCR, m, in which case

$$I^k = (\Sigma_s\, \Sigma_i\, c^k_{si})/(\Sigma_s\, \Sigma_i\, m) = m^k/m.$$

Finally, note that if we were to take the entire field as a homogeneous field, then

$$I^k = MNCS^k = C^k = m^k/m.$$

This provides a third interpretation of indicator I^k: it is the natural measure to take when the entire field itself is taken to be homogeneous. However, this shows that I^k does not correct for differences across sub-fields.

Remark. Observe that if we define $C^{k\#} = m^{k\#}/m$, then we have that

$$C^k\, C^{k\#} = I^k.$$

Therefore, I^k penalizes (rewards) a research unit when $C^{k\#} < 1$ ($C^{k\#} > 1$), that is, when the research unit publication share α^k_s is smaller than the world publication share W_s for sub-fields with high m_s. Another interpretation is that I^k can be broken down in a useful way into two components, C^k and $C^{k\#}$. For any pair k and v of research units we have

$$I^k/I^v = m^k/m^v = (C^k/C^v)(m^{k\#}/m^{v\#}).$$

Finally, we could define the following indicators:

$$I_s = (1/n_s)\ (\Sigma_k \Sigma_i\ (c^k_{si}/m)) = m_s/m,$$

$$I = \Sigma_s\ W_s\ I_s = \Sigma_k\ W^k\ I^k = (1/n)\ (\Sigma_k \Sigma_s \Sigma_i\ (c^k_{si}/m)) = m/m = 1.$$

II.4. A Comparison of the Alternatives In the Ideal World

Of course, in the case in which all mean citation rates are close to each other at the sub-field level, aggregation will not be problematic regardless of the differences in the MCRs across geographical areas. In other words, if m_s is close to m for every s, then the three indicators C^k, $MNCS^k$, and I^k would be close to each other. Otherwise, any attempt to aggregate sub-fields with rather different m_s is bound to be problematic.

Clearly, sub-fields with a high m_s have more weight in the calculation of C^k (see equation 4). In view of the fact that $I^k = C^k\ C^{k\#}$, this criticism can be equally raised for I^k. According to the critics of the original crown indicator, there is no reason to treat normalized articles from different sub-fields differently. After normalization, articles from different sub-fields should be treated equally, which is what $MNCS^k$ does. Waltman *et al.* (2011a) are of the same opinion. Moreover, they establish that $MNCS^k$ is the only indicator that has both the properties of homogeneous normalization and consistency. Consequently, as indicated in the Introduction the CWTS is currently moving towards a new crown indicator that relies on the second normalization mechanism.

In a different vein, recent results indicate that citation distributions share a common shape at all aggregate levels (Radicchi *et al.*, 2008, Glänzel, 2010, and Albarrán *et al.*, 2010b). Since these distributions appear to be separated by a mere difference of scale, Radicchi *et al.* (2008) recommend the evaluation of the citation performance of a single publication by a relative indicator in which the citations received are normalized by the MCR of the sub-field to which it belongs. This essentially leads to the *MNCS* indicator for the evaluation of citation impact independently of the scientific discipline.

On the other hand, disregarding differences in publication efforts provides incentives to specialize in sub-fields with a small m_s. Indeed, one way to raise $MNCS^k$ is to achieve a few high c^k_{si}/m_s ratios. The greater is the publication effort in that sub-field, α^k_s, the greater will be the impact of this strategy on $MNCS^k$. In so far as high c^k_{si}/m_s ratios might lead to a high m^k_s, with $m^k_s > m_s$, C^k will also be high. At the same time, $m^k_s > m_s$ implies that $C^{k\#} = m^{k\#}/m < 1$, so that I^k will be low and immune to this strategy. A final difficulty with the *MNCS* has been pointed out by Van Raan *et al.* (2010) and Waltman *et al.* (2011b). Because recent publications have low citation counts their long-run impact cannot be predicted very well. Since the *MNCS* gives the same weight to all publications regardless of their age, recent publications may introduce a significant amount of noise in this indicator.

In spite of the fact that different *a priori* arguments appear to tilt the balance towards the *MNCS*, it seems reasonable to study the robustness of any evaluation exercise to the different indicators.

II.5. Average-based Indicators When There Is Cooperation Between Research Units

Let us take a step towards the real world by introducing the possibility that some publications are written by authors from two research units. For example, consider our own case in which the

world is partitioned into three geographical areas. The assignment of internationally co-authored papers among areas is problematic. 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 from a U.S. and a European university. Thus, as indicated in the Introduction, in this paper in every internationally co-authored article a whole count is credited to each contributing area. 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 in what we call the *geographical extended count*.

Let us denote by N^k_s, $N^k = \Sigma_s\, N^k_s$, $N_s = \Sigma_k\, N^k_s$, and $N = \Sigma_s\, N_s = \Sigma_k\, N^k$ the number of publications of unit k in sub-field s, the total number of publications of unit k, the total number of publications in sub-field s, and the total number of publications at the aggregate level, respectively, in the geographical extended count. Of course, $N^k_s \geq n^k_s$ for all $k = 1,\ldots, K$, and $s = 1,\ldots, S$, with some strict inequality for some k and s, so that $N_s \geq n_s$ with strict inequality for some s, and $N > n$. As long as internationally co-authored publications are typically found in the upper tail of citation distributions, we expect that the MCRs in the geographically extended count, M, M_s, M^k, and M^k_s, will be greater than in the ideal world, that is, $M > m$; $M_s > m_s$ for some s; $M^k > m^k$ for some k, and $M^k_s > m^k_s$ for some k and s.

Normalized indicators at the sub-field level are defined as before:

$$C^k_s(\text{GEC}) = MNCS^k_s(\text{GEC}) = M^k_s/M_s. \tag{6}$$

On the other hand, denote the publication effort by $a^k_s = N^k_s/N^k$, and the publication share $b^k_s = (a^k_s\, M_s)/\Sigma_s\, a^k_s\, M_s$ with $\Sigma_s\, a^k_s = \Sigma_s\, b^k_s = 1$. At the aggregate level we have:

$$MNCS^k(\text{GEC}) = (1/N^k)\,(\Sigma_s\, \Sigma_i\, (c^k_{is}/M_s)) = \Sigma_s\, a^k_s\, MNCS^k_s(\text{GEC}), \tag{7}$$

$$C^k(\text{GEC}) = (\Sigma_s\, \Sigma_i\, c^k_{si})/(\,\Sigma_s\, \Sigma_i\, M_s) = \Sigma_s\, b^k_s\, C^k_s = M^k/M^{k\#},\ M^{k\#} = \Sigma_s\, a^k_s\, M_s, \tag{8}$$

$$I^k(\text{GEC}) = M^k/M, \tag{9}$$

Finally, consider an intermediate level we call *fields*, indexed by $f = 1,\ldots, F$. If we let $N^k_f = \Sigma_{s\in f} N^k_s$ be the total number of articles in field f, we have:

$$MNCS^k_f(\text{GEC}) = (1/N^k_f)\,(\Sigma_{s\in f}\, \Sigma_i\, (c^k_{is}/M_s)) = \Sigma_{s\in f}\,(N^k_s/N^k_f)\, MNCS^k_s(\text{GEC}), \tag{10}$$

$$C^k_f(\text{GEC}) = (\Sigma_{s\in f}\, \Sigma_i\, c^k_{si})/(\Sigma_{s\in f}\, \Sigma_i\, M_s) = M^k_f/M^{k\#}_f, \tag{11}$$

where $M^{k\#}_f = \Sigma_{s\in f}\,(N^k_s/N^k_f)\, M_s$, and

$$I^k_f(\text{GEC}) = M^k_f/M_f. \tag{12}$$

II.6. Average-based Indicators In the Real World: A Multiplicative Strategy

Next, let us recognize that in the real world some publications are assigned to several sub-fields. At the sub-field level we recommend taking a multiplicative strategy for two reasons. Firstly, as indicated in Albarrán *et al.* (2011c) where sub-fields are identified with WoS categories, "*A crucial requirement is that all articles within a sub-field should count the same. Otherwise, if an*

article assigned to several WoS categories were fractionally assigned to them, then its place in the various citation distributions would be dramatically affected. In particular, fractionally assigned articles would have a much smaller chance of occupying the upper tail of citation distributions than articles assigned to a single WoS category." Secondly, a fractional assignment would affect research units' citation distributions in a normatively undesirable manner, hurting relatively more those units with overlapping articles that receive a larger number of citations. Therefore, we opt for classifying multiple assignment articles into as many WoS categories as necessary. An article assigned to three WoS categories, for instance, is classified into the three corresponding sub-fields; this means that this article –and the citations it originally received– would be counted three times. In this way, as before, the space of articles is expanded as much as necessary beyond the initial size. This artificially large number in what we call the *double extended count* is not that worrisome in the sense that, since the multiplicative 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.

Let us denote by P^k_s, $P^k = \Sigma_s P^k_s$, and $P_s = \Sigma_k P^k_s$, the number of publications of unit k in sub-field s, the total number of publications of unit k, the total number of publications in sub-field s, respectively, in the double extended count at the sub-field level. Of course, the total number of articles in this case, $P = \Sigma_s P_s = \Sigma_k P^k$, is strictly greater than the total in the geographical extended count, N. Let us denote the MCRs in the double extended count by μ^k_s, and μ_s. Normalized indicators at the sub-field level are defined as before:

$$C^k_s(\text{DEC}) = MNCS^k_s(\text{DEC}) = \mu^k_s/\mu_s, \tag{13}$$

A key question is that as soon as we attempt to aggregate from the sub-field to the field and other aggregate levels the multiplicative strategy runs into difficulties. At the field level we do not want to count the papers that were assigned to two sub-fields twice when both sub-fields belong to the same field. If we were to do this, we would arbitrarily favor research units whose multiple assigned papers are highly cited. One alternative is to count such papers at the field level only once, maintaining a multiplicative strategy whenever a paper is assigned to two or more sub-fields and these sub-fields belong to two (or more fields). Denote by Q^k_f the number of papers of unit k in field f, $f = 1,\ldots, F$, and let $Q^k = \Sigma_f Q^k_f$, and $Q_f = \Sigma_k Q^k_f$ be the total number of papers in unit k and field f, respectively. Clearly, the total number of papers in this new double extended count, $Q = \Sigma_k Q^k = \Sigma_f Q_f$, will be smaller than P, but still greater than N. Denote the MCRs in this extended count by μ^{k*}_f, and μ^*_f. The connection between the field and sub-field levels is broken in the sense that

$$\mu^{k*}_f \neq \Sigma_{s\in f}(P^k_s/P^k_f)\,\mu^k_s,$$

and

$$\mu^*_f \neq \Sigma_{s\in f}(P_s/P_f)\,\mu_s.$$

However, for each k we can always compute the field indicators

$$I^k_f = \mu^{k*}_f/\mu^*_f, f = 1,\ldots F. \tag{14}$$

It is important to note that at the maximum aggregate level all papers would count only once, regardless of whether some of them were originally assigned to two or more sub-fields. Consequently, the MCRs at this level for all units and for the world as a whole, μ^{k*} and μ^*, are equal to the corresponding ones at the geographical extended count. Thus, at this level the indicator $I^k = \mu^{k*}/\mu^*$ coincides with the indicator defined in equation 9, $I^k(\text{GEC}) = M^k/M$.

II.7. Average-based Indicators in the Real World: A Fractional Strategy

The problem with the previous strategy, of course, is that it amounts to taking fields and all sciences as a whole at the maximum or an intermediate aggregate level as if they were homogeneous, something that we know is not the case. Moreover, moving away from the double extended count at the sub-field level means that we are no longer able to compute MCRs at that level. This implies declining to compute sub-field indicators C^k_s and $MNCS^k_s$ and, hence, aggregate indicators C^k_f, C^k, as well as $MNCS^k_f$ and $MNCS^k$. An alternative is to pursue the following fractional strategy.

Consider a paper i, written in research unit k, receiving c^k_i citations, which had been assigned to, say $x \geq 1$ sub-fields indexed by $s = j + 1, \ldots, j + x$. If we define weights $w^k_i = (1/x)$ in all such cases, then in the fractional strategy we compute the weighted mean for each area k in each sub-field s, $\mu^{k'}_s$, as:

$$\mu^{k'}_s = \Sigma_i w^k_i c^k_i / \Sigma_i w^k_i. \quad (15)$$

Let $N^{k'}_s = \Sigma_i w^k_i$ be the number of papers of unit k in sub-field s according to the fractional strategy, and let $N^{k'} = \Sigma_s N^{k'}_s$. Let us denote by $\mu^{k'}$, μ'_s and μ' the remaining MCRs computed following the fractional strategy, where

$$\mu^{k'} = \Sigma_s a^{k'}_s \mu^{k'}_s,$$

$a^{k'}_s = N^{k'}_s / N^{k'}$, and $\Sigma_s a^{k'}_s = 1$,

$$\mu'_s = (\Sigma_k \Sigma_i c^{k'}_{si}) / N'_s = \Sigma_k w^{k'}_s \mu^{k'}_s,$$

$N'_s = \Sigma_k N^{k'}_s$, $w^{k'}_s = N^{k'}_s / N'_s$, and $\Sigma_k w^k_s = 1$, and

$$\mu' = (\Sigma_k \Sigma_s \Sigma_i c^{k'}_{si}) / N',$$

where $N^{k'} = N^k$ for all k, and $N' = N$.

At the sub-field level we can now compute the indicators

$$C^{k'}_s = MNCS^{k'}_s = \mu^{k'}_s / \mu'_s. \quad (16)$$

At the intermediate level we have:

$$MNCS^{k'}_f = (1/N^{k'}_f) (\Sigma_{s \in f} \Sigma_i (c^{k'}_{is} / \mu'_s)) = \Sigma_{s \in f} (N^{k'}_s / N^{k'}_f) MNCS^{k'}_s, \quad (17)$$

$$C^{k'}_f = (\Sigma_{s \in f} \Sigma_i c^{k'}_{si}) / (\Sigma_{s \in f} N^{k'}_s \mu'_s) = \mu^{k'}_f / \mu^{k\#'}_f, \quad (18)$$

where $N^{k'}_f = \Sigma_{s \in f} N^{k'}_s$, and $\mu^{k\#'}_f = \Sigma_{s \in f} (N^{k'}_s / N^{k'}_f) \mu'_s$. Finally, at the aggregate level we have

$$MNCS^{k'} = (1/N^k) (\Sigma_s \Sigma_i (c^{k'}_{is} / \mu'_s)) = \Sigma_s a^{k'}_s MNCS^{k'}_s, \quad (19)$$

$$C^{k'} = (\Sigma_s \Sigma_i c^{k'}_{si}) / (\Sigma_s \Sigma_i \mu'_s) = \Sigma_s b^{k'}_s C^{k'}_s = \mu^{k'} / \mu^{k\#}, \quad (20)$$

where $\mu^{k\#'} = \Sigma_s a^{k'}_s \mu'_s$, $b^{k'}_s = (a^{k'}_s \mu'_s) / \Sigma_s a^{k'}_s \mu'_s$, $\Sigma_s b^{k'}_s = 1$.

Remark. For each unit, counting a paper assigned to x sub-fields only once is equivalent to the sum of $(1/x)$ fractional papers x times. Consequently, $N^{k'} = N^k$ for all k, so that the total number of papers in the fractional strategy $N' = \Sigma_k N^{k'}$ coincides with N, the total number of papers in the geographical extended count. Similarly, the number of citations received by this paper, c^k_i, is equal to the sum of (c^k_i/x) citations x times. Consequently, $\mu^{k'} = M^k$ for all k, and $\mu' = M$, so that, as anticipated in the Introduction, at the maximum aggregation level we have:

$$I^k = \mu^{k*}/\mu^* = I^k(\text{GEC}) = M^k/M = \mu^{k'}/\mu'.$$

III. EMPIRICAL RESULTS

III.1. The Data

In this paper, only research articles or, simply, articles are studied. We begin with a large sample acquired from Thomson Scientific, consisting of about 3.6 million articles published in 1998-2002, as well as more than 28 million citations these fields receive using a five-year citation window for each one. This relatively wide citation window for all articles avoids the problem that recent publications with low citation counts may cause to the indicator *MNCS*.

As indicated in the Introduction, Thomson Scientific distinguishes 22 broad scientific areas –20 natural sciences and two social sciences–, and assigns each article to a single area among these 22. Therefore, given the illustrative nature of our work we identify the ideal world with this dataset and each of the 22 scientific areas with the sub-field notion. To facilitate the reading of the text, descriptive statistics are relegated to the Appendix, where Table A presents the percentage distribution and the MCR by sub-field in the ideal world. The 20 fields in the natural sciences are organized in three large aggregates or *grand fields*: Life Sciences, Physical Sciences, and Other Natural Sciences, including the Multidisciplinary field that, as Tijssen and van Leeuwen (2003) explain, includes the prestigious general journals with broad multidisciplinary scopes, such as *Nature*, and *Science*. The last two in the ideal world (column 1 in Table A) represent, approximately, 28.5% and 25.5% of the total, while Life Sciences represent about 41%. The remaining 5% correspond to the fourth grand field including two Social Sciences. Note also that there are important differences in the range of variation of the MCRs (column 3): in particular, the MCR for Molecular Biology it is 8.5 times greater than for Mathematics.

Next, 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. As indicated in the Introduction, in this paper in every internationally co-authored article a whole count is credited to each contributing area. 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 we arrive at the geographical extended count, whose distribution and MCRs by sub-field are in columns 4 to 6 in Table A. The total extended number of 4.1 million articles is 13.5% larger than in the ideal world. However, the comparison of columns 2 and 5 indicates that the distribution of articles by sub-fields is practically the same in both cases. On the other hand, it is known that international cooperation generally leads to a greater number of citations. This is the reason why the MCRs in column 6 are always slightly greater than in column 3. In Space Science, where international cooperation is extraordinarily important, the MCR in the geographical extended count is 1.2 citations greater than in the original dataset. In four other cases (Clinical Medicine, Neurosciences, Immunology, and Physics) the MCR increases by 0.7-0.5 citations, but otherwise the differences are minimal. For all sub-fields taken as a whole the MCR in the geographical extended count and the ideal world are 8.2 and 7.7, respectively. All this implies that working with the geographical extended count does not distort much the features that characterize the ideal world.

Before we begin the comparison of the three geographical areas, it is important to learn how different or similar they are. Table B presents the distribution of articles by sub-field in each area in the geographical extended count. Since the U.S. and the EU belong to the so-called "Western model" (see *inter alia* Glänzel, 2000, 2001), their publication efforts in columns 4 and 5 are rather close to each other with the exception of the two Social Sciences and Psychology and Psychiatry, where the U.S. publication effort is greater than that of the EU, and Chemistry, Physics, and Materials Science where the opposite is the case. The correlation coefficient between the U.S. and the EU is 0.96. In turn, the RW publication effort in column 6 is considerably smaller in Life and Social Sciences, and greater in the other two grand fields. Correlation coefficients between the U.S. and the RW, and between the EU and the RW are 0.91 and 0.79, respectively. Publication shares tell a similar story from another point of view (see columns 7 to 10). The EU publishes almost a third of all articles, while the U.S. is four percentage points short of that, and the RW is responsible for almost 39% of the total number of articles. The publication share of the RW is above 44% in Engineering, Physics, Chemistry, Materials Science and the Multidisciplinary sub-field. The EU is well above its average in Microbiology and Clinical Medicine, and the U.S. in the Social Sciences and Psychology and Psychiatry.

III. 2. Empirical Results for the Geographical Extended Count

Table 1 presents the MCRs M^k_s for all geographical areas k and all sub-fields s in the geographical extended count introduced in equation (6), as well as the measures of the U.S./EU gap and the RW/EU gap, $M^{US}{}_s/M^{EU}{}_s$ and $M^{RW}{}_s/M^{EU}{}_s$, respectively. The results are very eloquent. Firstly, the ranking is the same in all sub-fields: U.S., EU, and RW. This, of course, coincides with the results obtained in Albarrán *et al.* (2010a, 2011b). Secondly, the U.S. dominance is below 20% in eight cases, between 20% and 40% in twelve cases, and above 40% in two cases (Computer Science and Economics and Business). Thirdly, the RW performance is between 10% and 20% below the EU in seven cases, between 20% and 40% in 14 cases, and 51% in one case: the important Multidisciplinary sub-field where the RW publication share is particularly large.

Table 1 around here

The results for grand fields, indexed by g = A, B, C, and D, at the intermediate level (see equations 10 to 12), and at the maximum aggregate level (see equations 7 to 9), are in Table 2. The following four comments seem pertinent. Firstly, at the grand field level differences between the two contending indicators C^k_g and $MNCS^k_g$ are negligible. Consequently, the US/EU gap varies across grand fields but not across normalized average-based indicators. The gap is smaller for Other Natural Sciences and the Social Sciences (around 13.1%-14.1% and 27%, respectively, in favor of the U.S.) than for the Life and Physical Sciences (about 32% in both cases). Secondly, there are cases in which $C^k_g > I^k_g$, including Physical Sciences in the U.S., as well as Other Natural Sciences and, above all, all fields in the RW. In all these cases, the indicator C^{k*}_g introduced in the Remark in Section II.3 is less than one, meaning that the area's publication shares in sub-fields with a low MCR within the aggregate level in question is greater than in the world as a whole. On the contrary, the fact that at the maximum aggregate level $C^k > I^k$ for k = EU and, above all, for k = U.S., indicates that the proportion of articles in sub-fields with a high MCR in the geographical area in question is greater than in the world as a whole.[2] Thirdly, at the aggregate level there is a non-negligible difference between the US/EU gap when no allowance is made for differences in MCRs across sub-fields –in which case the gap is 29.2%– and when normalization is performed –with gaps of 28.5% and 25.7% when the crown and the *MNCS* indicators are used. Fourthly, at the grand field level the RW/EU gap ranges from 17% for Social Sciences to 30% for Physical Sciences in favor of

[2] As a matter of fact, the correlation coefficient between MCRs (column 6 in Table A) and publication efforts in these areas (columns 4 and 5 in Table B) are 0.070 and 0.089 for the EU and the U.S., respectively.

the EU. For all fields as a whole, differences according to the several indicators are as follows: the overall performance of the RW is 28.3% below the European one according to the I^k indicator, but only about 23% according to the C^k and $MNCS^k$ indicators.

Table 2 around here

III. 3. Empirical Results for the Double Extended Count

As indicated in the Introduction, in our version of the real world sub-fields are identified with the 219 WoS categories distinguished by Thomson Scientific. In the original dataset there are only 2,144,620 articles assigned to a single sub-field. On the other hand, 1,036,139 articles are assigned to two sub-fields; 365,004 to three; 92,894 to four; 9,176 to five, and 691 to six. Thus, the multiple assigned articles represent about 42% of the total. Following a multiplicative strategy, we arrive to a double extended count of more than 6.5 million articles and 38 million citations. These amounts represent, respectively, 57.7% and 53% more than the number of articles and citations in the geographical extended count used in the previous Sub-section.

It is also convenient to work at other aggregate levels. However, there is no generally agreed upon Map of Science or aggregation scheme that allows us to climb from the sub-field up to other aggregate levels. Among the many alternatives, Albarrán *et al.* (2011c) 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. The resulting scheme consists of 80 intermediate categories, called *disciplines*, and 19 broad fields, or simply *fields*.[3] For our purposes, we separate Computer Sciences from Engineering to work with a total of 20 fields. Finally, we also distinguish the four grand fields already analyzed.

Tables C, D, and E in the Appendix presents the percentage distribution, the MCR, and the geographical areas' publication effort for the 219 sub-fields, the 80 disciplines, the 20 fields, and the four grand fields. The following five points might be noted. Firstly, the total number of articles and citations in these double extended counts are compared in Table 3 with those of the geographical extended count. As expected, the double extended count at the discipline, field and grand field levels include successively fewer articles and citations. Secondly, we will omit a detailed comparison of percentage distributions at the different aggregate levels. It suffices to say that, at the grand field level, Other Natural Sciences now represent 28.8% of all articles versus 25.4% in the geographical extended count. The percentage represented by Physical Sciences also increases by one point. Correspondingly, Life and Social Sciences now represent three and one percentage points fewer than before. Thirdly, as far as MCRs are concerned, the main difference is that the MCR of Other Natural Sciences increases from 4.8 to 5.7 citations, while it slightly decreases for the remaining three grand fields. For all sciences as a whole, the MCR diminishes from 8.2 to 8 citations. These constitute relatively minor changes. Fourthly, for later reference, the correlation coefficients between the geographical areas' publication efforts at the sub-field level are the following: between the U.S and the EU it is 0.92, while between the RW and the U.S. and the RW and the EU they are 0.81 and 0.93. This means, of course, that there is little difference in the way all areas allocate their publication effort among sub-fields. Fifthly, for reasons of space publication shares by geographical areas in the different double extended counts are available only on request. However, it should be noted that at all aggregate levels 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 116 of 219 sub-fields, 52 of 80 disciplines, and 14 of 20 fields.

[3] The existence of a power law cannot be rejected in 59 of 80 disciplines and 16 of 19 fields, accounting for 71.8% and 75.5% of all articles in the respective extended samples.

Table 3 around here

Table F.1 in the Appendix presents the MCRs μ^{k}_{s} for all geographical areas and all sub-fields according to the multiplicative strategy in the double extended count introduced in equation 13, as well as the measures of the U.S./EU and RW/EU gaps, $\mu^{US}{}_{s}/\mu^{EU}{}_{s}$ and $\mu^{RW}{}_{s}/\mu^{EU}{}_{s}$, respectively. Sub-fields are ordered by the size of the U.S/EU gap within each field. These massive results are appropriately summarized in Table 4. The resulting picture is quite dramatic: the U.S. MCR is greater than that of European 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 4): 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%. In brief, as we aggregate from the sub-field to the discipline level the dominance of the U.S. over the EU and that of the EU over the RW increases.

Table 4 around here

A fractional strategy would penalize geographical areas with more articles and/or more highly-cited articles among those assigned to multiple sub-fields. Table F.2 in the Appendix presents the MCRs introduced in equation 15 in Section II.7, $\mu^{k'}{}_{s}$, as well as the measures of the U.S./EU and the RW/EU gaps and the difference between the U.S./EU gaps according to the multiplicative and the fractional strategies. The evidence about the U.S./EU gap can be summarized as follows: the gap is strictly greater with a 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.

The next question is: what is the evolution of the relative situation among geographical areas as we climb from the sub-field to higher aggregate levels? The value of the three indicators and the ratios measuring the gaps between geographical areas at the discipline level are in Table G in the Appendix. The results are summarized in Table 5. The main message is that, according to the *MNCS* indicator, only in six out of 80 disciplines, representing 4% of all articles in the corresponding double extended count, the EU is still ahead of the U.S. These include two disciplines among the Life Sciences (Experimental and Laboratory Medicine, and Other Clinical Medicine), one among the Physical Sciences (Applied Chemistry and Chemical Engineering), two among the Other Natural Sciences (Agricultural Science and Technology, and Fuel and Energy), and one among the Social Sciences (Geography, Planning, and Urban Studies). In contrast, in 60% of all disciplines the US/EU gap is greater than 20%, and in 11 disciplines, representing about 16% of all articles, that gap is greater than 40%. On the other hand, only in two disciplines among the Life Sciences (Paramedicine, Ophthalmology and Otorhinolaryngology) and one among the Social Sciences (Law and Criminology) –representing less than 2% of all articles– the RW is still ahead of the EU, while in 50 out of 80 disciplines representing more than 65% of all articles the EU/RW gap is greater than 20%.

Table 5 around here

Finally, the value of the three indicators and the gaps between geographical areas at the remaining aggregate levels –fields, grand fields, and all sciences as a whole– are in Table 6. In regard to the methodological issues in contention, these results deserve the following three comments.

1. For every area, differences between the indicators *C* and *MNCS* at any aggregate level reflect the fact that the first weights articles in proportion to the mean of the sub-field to which they belong, while the second weights equally all normalized articles. Qualitatively, geographical areas behave quite differently. On the one hand, for the U.S. the crown indicator is greater than the *MNCS* in 14 fields, all grand fields, and all sciences as a whole. This means that in all these cases the U.S. tend to specialize in sub-fields with larger means. The opposite is the case for the EU and the RW in 13 and 15 fields, respectively, all grand fields in both areas, and all sciences as a whole. However, the quantitative differences one way or another are always of a small order of magnitude below five percentage points.

The above results for the first two geographical areas imply that the US/EU gap is slightly smaller according to the *MNCS* indicator in 16 out of 20 fields, the four grand fields, and all sciences as a whole. Differences are of some importance only for two minor fields (Clinical Medicine III and the Residual Sub-fields where differences are of 6 and 15.4 percentage points). In turn, the RW/EU gap is slightly greater according to the *MNCS* indicator in 13 fields, Life and Physical Sciences, and all sciences as a whole. Quantitative differences are, again, negligible.

2. For any geographical area, differences between the crown and the un-normalized indicator *I* are due to differences between the area publication shares and the ones at the world level. If the area publication shares are greater for sub-fields with a high MCR, then *I* will be greater than *C*. This is what happens in the U.S for 11 fields, including differences of some importance for Mathematics and the Residual Sub-fields.[4] In the remaining nine cases, only for Chemistry and the Multidisciplinary field are differences above five percentage points. Differences are also small for the grand fields but in favor of the crown indicator in three cases. For all sciences as a whole, $C^{US} = 1.283 < I^{US} = 1.324$, a 4.1 percentage points difference. In the EU the crown indicator is slightly greater for 15 fields, all grand fields, and all sciences as a whole, while the opposite is the case for the RW in 13 fields. For all sciences as a whole, $C^{EU} = 0.995 < I^{EU} = 1.025$, while $C^{RW} = 0.773 > I^{RW} = 0.735$, a 3 and 3.8 percentage points difference, respectively.[5]

The US/EU gap is greater according to the crown indicator for 12 fields and three grand fields, but for all sciences as a whole it is only 0.3 percentage points smaller than according to the *I* indicator. The RW/EU gap is in most cases slightly greater according to the crown indicator. Differences are of a small order of magnitude.

3. For the importance of normalization, we compare the two gaps according to the *MNCS* and the *I* indicators. For the US/EU gap the results are rather mixed: the gap is greater (smaller) according to the *MNCS* indicator in 11 (9) fields and half of the grand fields. Differences are generally small with the exception of Biosciences, Mathematics, Agriculture and the Environment, and Residual Sub-fields at the field level, as well as Other Natural Sciences at the grand field level when the gap is greater without normalization. The exceptions in the opposite direction take place in two fields: Neurosciences and Behavior, and Social Sciences, General. For all sciences as a whole, the difference is not negligible: 29.2% and 24.7% according to the *I* and *MNCS* indicators. The RW/EU gap is most of the time smaller according to the normalized indicator, namely, in 14 fields and three grand fields. For all sciences as a whole the gap is 0.773 and 0.717 according to the *MNCS* and the un-normalized indicator, respectively, a 5.6 percentage-point difference.[6]

[4] It is instructive to check in Table D in the Appendix that, relative to the EU and the RW, the U.S. actually devote a greater effort to sub-fields with a higher mean, namely, Statistics and Probability, and Mathematical Methods for the Social Sciences within Mathematics, as well as Medicine, Research and Experimental within Residual Sub-fields.

[5] In line with these differences, the correlation coefficients of publication efforts with MCRs at the sub-field level are 0.55, 0.51, and 0.33 for the U.S., the EU, and the RW, respectively.

[6] The results for all sciences as a whole are consistent with the differences in correlation coefficients reported in the previous note.

Once the methodological issues have been discussed, it only remains to summarize the substantive results about the citation performance of the three geographical areas at all higher aggregate levels. Table 6 inspires the following three comments, illustrated at the field level in Figures 1 and 2.

Figures 1 and 2 around here

4. For all indicators and all aggregate levels the ranking of geographical areas is always the same: U.S., EU, and RW. This is, of course, the same ranking always obtained when all articles were assigned to a single sub-field in Sub-section III.2.

5. The fundamental result at the field level regardless of the normalized indicator used is that the US/EU gap is less than 20% in six fields, and between 20% and 40% for the remaining 14. The minimum gap, below 10%, is in Agriculture and Environment, Biology (Organismic and Supraorganismic Levels), and Clinical Medicine III (Health and Other Sciences). The maximum gap, above 34%, is in Economics and Business, the Multidisciplinary category, Clinical Medicine I and II (Internal and Non-internal Medicine), Chemistry, and the Residual Sub-fields. Life and Social Sciences present the maximum gap at the grand field level.

6. The RW performance according to both normalized indicators is between 10% and 20% below the EU in seven fields, and between 20% and 50% in the remaining 13 cases that represent about 69% of all articles. The smallest gap is in Clinical Medicine I, II, and III, Neuroscience and Behavioral, and Economics and Business. The largest gap is in the Multidisciplinary category, Chemistry, Physics, and Agriculture and Environment. The smallest gap at the grand field level is in Life and Social Sciences.

III. 4. Discussion

How can these results be explained? The first key element is that publication efforts at all levels are rather similar across geographical areas, and hence between them and the world as a whole. This is the case both in the geographical extended count and in all versions of the double extended count. This fact explains why differences between the crown and the un-normalized indicator in the previous two Sub-sections are not that large. In the second place, the U.S. appears to devote relatively more –and the RW less– effort to sub-fields with a high MCR, which explains why there is a non-negligible difference in favor of the un-normalized versus the normalized US/EU gap in both Sub-sections, as well as a non-negligible difference in the opposite direction for the RW/EU gap. However, this is not the case within all categories at all other aggregate levels, so that there are instances in which the US/EU gap, for example, is greater according to the normalized indicators. Since in most cases these differences are of a small order of magnitude, we can conclude that there is no systematic bias on the part of any geographical area towards sub-fields with systematically higher or lower MCRs within most aggregate categories, a fact that explains why differences between the two normalized indicators, and between them and the un-normalized one, are generally small.

Furthermore, the correlation coefficients between the ratio α^k_s/W_s and μ^k_s/μ_s for the three areas in the double extended count are – 0.52, - 0.08, and – 0.13 for the U.S., the EU, and the RW, respectively, and – 0.58, – 0.40, and – 0.26, respectively, in the geographical extended count. This interesting result indicates that geographical areas do not seem to specialize in these sub-fields where they enjoy a comparative advantage measured by the μ^k_s/μ_s ratio. Forces explaining publication efforts are different from the ones explaining relative successes. In this scenario, it should be recalled that 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 at all higher aggregate levels with some minor exceptions at the discipline and sub-field levels. Likewise, although the RW usually is the area with more publications, it exhibits the worst citation performance in almost all cases.

The multiple assignment problem makes the two scenarios studied in Sub-sections III.2 and III.3 essentially non-comparable at the field and grand field level. Nevertheless, if we compare the results in Tables 2 and 6 at the latter level, the main difference for the US/EU gap according to the two normalized indicators, for example, seems to be the decrease of the gap in Life and Physical Sciences, and the increase in the Social Sciences and, above, in Other Natural Sciences when we go from 22 to 219 sub-fields. For all sciences as a whole, however, comparability is possible. For the finer normalization, the US/EU gap is about the same according to the crown indicator, and only one percentage point less according to the *MNCS*. Differences for the RW/EU gap are even smaller. In brief, interestingly enough, taking into account ten times more sub-fields does not lead to dramatic changes in the gaps measured with normalized indicators.

IV. CONCLUSIONS AND EXTENSIONS

IV. 1. Conclusions

This paper has investigated the citation impact of three large geographical areas –the U.S., the EU, and the RW– at different aggregation levels in two scenarios (i) when all articles published in the 1998-2002 period are assigned to a single broad field among a set of 22 natural and social sciences distinguished by Thomson Scientific, and (ii) when it is recognized that more than half of these articles are assigned to several sub-fields among a set of 219 WoS categories. The study has focused on the consequences of following alternative normalization procedures when using average-based indicators of citation impact.

From a methodological point of view, the main conclusions are the following five.

1. Using the crown or the *MNCS* indicator gives rise in both scenarios to some differences in the measurement of citation impact in all areas, as well as in the measurement of the US/EU and the RW/EU gaps. However, these differences are of a small order of magnitude generally below a few percentage points.

2. Since the publication shares of both the U.S. and the EU are rather close to the world ones, there is not much of a difference between the crown and the un-normalized indicator in spite of the fact that the latter does not account for differences in MCRs across sub-fields. In both scenarios there are many cases in which, for each geographical area, the crown indicator is smaller than the un-normalized one. But the opposite is also the case in many other cases at all aggregation levels. However, these differences have small consequences for the US/EU and RW/EU gaps.

3. The results about the impact of normalization on the size of the two gaps are interesting. In the second with 219 sub-fields, the US/EU gap at the field and grand field levels is greater in half of the cases when the *MNCS* indicator is used, while the RW/EU gap is most of the time smaller when this normalized indicator is used. For all sciences as a whole, normalization implies that the US/EU and the RW/EU gap decrease by 4.5 and 5.6 percentage points –a non-negligible difference.

4. At the sub-field level both normalized indicators coincide. The issue is about the consequences of solving the multiple assignments of articles to sub-fields by means of a multiplicative or a fractional strategy in the second scenario. We recommend the first, in which case the dominance of the U.S. over the EU reaches 174 of the 219 cases. When a fractional strategy is followed, the US/EU gap increases in 137 cases, or 63% of the total. However, this gap varies by more than 10% in only 20 cases (of which 17 represent a worsening of the European position).

5. The results when all articles are assigned to a single or multiple sub-fields are hardly comparable, except at the maximum aggregate level. When we go from 22 to 219 sub-fields, the only change in the two gaps between geographical areas according to both normalized indicators for

all sciences as a whole is a decrease of one percentage point in the US/EU gap according to the *MNCS* indicator.

From a substantive point of view, the main conclusions are the following two.

6. As soon as we climb from the sub-field to higher aggregate levels in the second scenario, all indicators agree that the few cases in which the EU ranks higher than the U.S. yield to the ranking that obtains at all levels in the first scenario and previous research: the U.S., the EU, and the RW.

7. From a quantitative point of view at the field level in the second scenario, the two normalized indicators agree that the US/EU gap is less than 20% in six fields, and between 20% and 40% for the remaining 14, while the RW/EU gap is between 10% and 20% in seven cases, and between 20% and 50% in the remaining 13. For all sciences as a whole, the normalized US/EU and RW/EU gaps are 25-28% and 23%, respectively.

IV. 2. Extensions

The present analysis might be extended in the rather obvious directions 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.

As it is well known, references made by articles in any sub-field give rise to a highly skewed distribution of citations received in which a large proportion of articles gets none or few citations while a small percentage of them account for a disproportionate amount of all citations (Schubert *et al.*, 1987, Radicchi *et al.*, 2008, and Albarrán *et al.*, 2011c). An important consequence is that average-based indicators may not adequately summarize these distributions for which the upper and the lower part are typically very different. This leads to 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 critical citation level (see Albarrán *et al.*, 2011c, for a discussion of technical properties). While average-based measures are silent about the distributive characteristics on either side of the mean, the high- and low-impact measures used for the evaluation of the U.S, the EU, and the RW in Albarrán *et al.* (2011a) are sensitive to the citation inequality in the sense that an increase in the coefficient of variation increases both of them. Previous results –Albarrán *et al.* (2011a, b) – are restricted to the scenario in which articles are assigned to only one of the 22 broad fields distinguished by Thomson Scientific. It remains to investigate how to apply this approach in what we have called the real world, including aggregation procedures capable of correcting for differences in citation practices across sub-fields.

We have stressed the difficulties created by the multi-assignment of articles to sub-fields. As emphasized already in Albarrán *et al.* (2011c), to ameliorate this problem it is crucial to construct schemes in which each article is directly assigned to a sub-field (see *inter alia*, Glänzel and Schubert, 2003, and Waltman *et al.*, 2010) on the basis of its references, its key words, and other techniques that may include the testing for the existence of a power law. The obvious difficulty of truly interdisciplinary research belonging to several very closely related sub-fields might be solved by creating new mixed sub-fields containing them. In turn, each sub-field should be assigned to a single discipline, and each discipline to a single field, on the basis of experts' opinions, as well as bibliometric techniques that may include the preservation, or generation as the case may be, of power law behavior.

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Table 1. Average-based Indicators At the Sub-field Level In the Geographical Extended Count

		M^{US}	M^{EU}	M^{RW}	M^{US}/M^{E}	M^{RW}/M^{EU}
		(1)	(2)	(3)	(4)	(5)
LIFE SCIENCES						
I	**Clinical Medicine**	13.0	9.6	8.1	1.356	0.847
II	**Biology & Biochemistry**	17.1	12.5	9.5	1.365	0.758
III	**Neuroscience & Behavioral Science**	17.6	13.4	10.9	1.307	0.814
IV	**Molecular Biology & Genetics**	27.0	20.7	15.9	1.303	0.766
V	**Psychiatry & Psychology**	7.8	6.6	5.8	1.196	0.881
VI	**Pharmacology & Toxicology**	10.4	8.4	6.4	1.233	0.767
VII	**Microbiology**	15.4	12.0	8.6	1.281	0.719
VIII	**Immunology**	19.7	15.6	14.0	1.268	0.899
PHYSICAL SCIENCES						
IX	**Chemistry**	11.4	8.3	5.7	1.373	0.684
X	**Physics**	10.5	8.0	5.6	1.316	0.699
XI	**Computer Science**	4.2	2.9	2.4	1.445	0.830
XII	**Mathematics**	3.2	2.7	2.0	1.180	0.738
XIII	**Space Science**	15.4	11.8	9.1	1.311	0.774
OTHER NATURAL SCIENCES						
XIV	**Engineering**	3.9	3.5	2.7	1.097	0.766
XV	**Plant & Animal Science**	6.2	5.9	4.2	1.046	0.711
XVI	**Materials Science**	6.2	4.7	3.7	1.323	0.779
XVII	**Geosciences**	9.1	7.4	5.3	1.230	0.717
XVIII	**Environment & Ecology**	8.2	7.5	5.9	1.099	0.795
XIX	**Agricultural Sciences**	6.0	5.5	3.6	1.099	0.646
XX	**Multidisciplinary**	5.9	3.9	1.9	1.539	0.491
SOCIAL SCIENCES						
XXI	**Social Sciences, General**	3.7	3.2	2.6	1.173	0.823
XXII	**Economics & Business**	5.0	3.3	2.8	1.498	0.851

Table 2. Average-based Indicators At High Aggregation Levels In the Geographical Extended Count

	$MNCS^{US}$	$MNCS^{EU}$	$MNCS^{RW}$	C^{US}	C^{EU}	C^{RW}	I^{US}	I^{EU}	I^{RW}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. LIFE SCIENCES	1.257	0.950	0.777	1.260	0.951	0.772	1.263	0.948	0.774
B. PHYSICAL SCIENCES	1.416	1.070	0.758	1.426	1.073	0.756	1.408	1.071	0.761
C. OTHER NATURAL SCS.	1.237	1.090	0.805	1.233	1.087	0.802	1.256	1.101	0.787
D. SOCIAL SCIENCES	1.147	0.909	0.759	1.152	0.904	0.756	1.147	0.913	0.757
ALL FIELDS	1.278	1.016	0.778	1.282	0.998	0.772	1.324	1.025	0.735

	MNCS US/EU	MNCS RW/EU	C US/EU	C RW/EU	I US/EU	I RW/EU
	(1)	(2)	(3)	(4)	(5)	(6)
A. LIFE SCIENCES	1.323	0.817	1.325	0.812	1.332	0.817
B. PHYSICAL SCIENCES	1.323	0.708	1.329	0.704	1.314	0.710
C. OTHER NATURAL SCS.	1.134	0.738	1.134	0.738	1.141	0.715
D. SOCIAL SCIENCES	1.262	0.835	1.274	0.836	1.256	0.830
ALL FIELDS	1.257	0.765	1.285	0.774	1.292	0.717

Table 3. Number of Articles and Citations In the Double Extended Count At Different Aggregate Levels

	Number of Articles		Number of Citations	
Geographical Extended Count	**4,142,281**	**-**	**33,974,915**	**-**
Double Extended Counts:				
Grand Field Level	4,771,792	15.2%	38,136,598	12.2%
Field Level	5,538,760	33.7%	44,068,093	29.7%
Discipline Level	6,107,509	47.4%	49,226,503	44.9%
Sub-field Level	6,512,031	57.2%	52,088,387	53.3%

Table 4. Comparison Between Geographical Areas At the Sub-field Level

The U.S versus the EU

Number of Sub-fields in which:	EU Ahead	U.S. Ahead:			TOTAL
		< 20%	≥ 20%	Total	
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (1) + (4)
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**

The RW versus the EU

Number of Sub-fields in which:	RW Ahead	EU Ahead:			TOTAL
		< 20%	≥ 20%	Total	
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (1) + (4)
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**

Table 5. Comparison Between Geographical Areas At the Discipline Level

U. S. versus EU
U.S

Number of Disciplines in which:	EU Ahead	U.S. Ahead:			TOTAL
		< 20%	≥ 20%	Total	
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (1) + (4)
1. Life Sciences	2	6	20	26	28
2. Physical Sciences	1	4	12	16	17
3. Other Natural Sciences	2	15	9	24	26
4. NATURAL SCIENCES = 1 + 2 + 3	5	25	41	66	**71**
5. Social Sciences = 4 + 5	1	1	7	8	9
ALL SCIENCES	**6**	26	48	**74**	**80**

RW versus EU
U.S

Number of Disciplines in which:	RW Ahead	EU Ahead:			TOTAL
		< 20%	≥ 20%	Total	
	(1)	(2)	(3)	(4) = (2) + (3)	(5) = (1) + (4)
1. Life Sciences	2	16	10	26	28
2. Physical Sciences	0	4	13	17	17
3. Other Natural Sciences	0	4	22	26	26
4. NATURAL SCIENCES = 1 + 2 + 3	2	24	45	69	**71**
5. Social Sciences = 4 + 5	1	3	5	8	9
ALL SCIENCES	**3**	27	50	**77**	**80**

Table 6. Average-based Indicators At Higher Aggregate Levels In the Double Extended Count

FIELDS	$MNCS^{US}$ (1)	$MNCS^{EU}$ (2)	$MNCS^{RW}$ (3)	C^{US} (4)	C^{EU} (5)	C^{RW} (6)	I^{US} (7)	I^{EU} (8)	I^{RW} (9)
1. BIOSCIENCES	1.259	0.989	0.741	1.264	0.973	0.741	1.299	0.974	0.73
2. BIOMEDICAL RESEARCH	1.240	1.016	0.785	1.248	1.013	0.781	1.265	1.011	0.77
3. CLINICAL MEDICINE I	1.284	0.930	0.792	1.295	0.928	0.783	1.289	0.93	0.79
4. CLINICAL MEDICINE II	1.243	0.922	0.820	1.247	0.924	0.816	1.232	0.943	0.8
5. CLINICAL MEDICINE III	1.087	0.991	0.845	1.123	0.970	0.819	1.075	0.991	0.87
6. NEUROS. AND BEHAVIORAL	1.190	0.930	0.775	1.217	0.936	0.767	1.126	0.987	0.82
7. CHEMISTRY	1.491	1.111	0.760	1.527	1.111	0.749	1.472	1.094	0.77
8. PHYSICS	1.386	1.085	0.771	1.408	1.079	0.765	1.38	1.08	0.77
9. SPACE SCIENCE	1.248	0.987	0.765	1.248	0.987	0.765	1.268	0.987	0.76
10. MATHEMATICS	1.243	1.058	0.801	1.244	1.049	0.799	1.298	1.043	0.77
11. COMPUTER SCIENCE	1.245	0.981	0.804	1.240	0.990	0.798	1.256	0.983	0.79
12 ENGINEERING	1.221	1.052	0.829	1.239	1.045	0.822	1.229	1.063	0.81
13. MATERIALS SCIENCES	1.375	1.082	0.843	1.355	1.039	0.856	1.398	1.065	0.83
14. GEOSCIENCE	1.226	1.023	0.791	1.220	1.025	0.786	1.228	1.052	0.77
15. AGRIC. AND ENVIRONMENT	1.203	1.108	0.785	1.205	1.076	0.793	1.224	1.08	0.78
16. PLANT AND ANIMAL SC.	1.193	1.063	0.812	1.197	1.053	0.804	1.218	1.086	0.77
17. MULTIDICIPLINARY	1.739	1.258	0.608	1.739	1.258	0.608	1.665	1.232	0.63
18. RESIDUAL SUB-FIELDS	1.423	1.048	0.797	1.450	1.012	0.762	1.615	1.014	0.72
19. SOCIAL SCIENCES, GENERAL	1.131	0.930	0.747	1.133	0.926	0.738	1.112	0.96	0.76
20. ECONOMIC AND BUSSINESS	1.227	0.847	0.709	1.219	0.841	0.714	1.223	0.847	0.73
A. LIFE SCIENCES	1.238	0.952	0.788	1.258	0.949	0.775	1.241	0.959	0.782
B. PHYSICAL SCIENCES	1.374	1.077	0.771	1.407	1.076	0.760	1.372	1.07	0.774
C. OTHER NATURAL SCIENCES	1.253	1.065	0.805	1.258	1.046	0.795	1.323	1.08	0.752
D. SOCIAL SCIENCES	1.160	0.899	0.734	1.167	0.887	0.728	1.149	0.914	0.741
ALL FIELDS	**1.267**	**1.016**	**0.786**	**1.283**	**0.995**	**0.773**	**1.324**	**1.025**	**0.735**

	$MNCS^{US}/MNCS^{EU}$ (1)	$MNCS^{RW}/MNCS^{EU}$ (2)	C^{US}/C^{EU} (3)	C^{RW}/C^{EU} (4)	I^{US}/I^{EU} (5)	I^{RW}/I^{EU} (6)
1. BIOSCIENCES	1.272	0.749	1.299	0.761	1.334	0.750
2. BIOMEDICAL RESEARCH	1.221	0.772	1.232	0.771	1.251	0.765
3. CLINICAL MEDICINE I	1.381	0.852	1.396	0.844	1.386	0.844
4. CLINICAL MEDICINE II	1.348	0.889	1.350	0.884	1.307	0.852
5. CLINICAL MEDICINE III	1.097	0.853	1.157	0.844	1.085	0.879
6. NEUROS. AND BEHAVIORAL	1.280	0.833	1.300	0.819	1.141	0.827
7. CHEMISTRY	1.342	0.684	1.375	0.675	1.346	0.702
8. PHYSICS	1.278	0.711	1.305	0.709	1.277	0.715
9. SPACE SCIENCE	1.265	0.775	1.265	0.775	1.285	0.772
10. MATHEMATICS	1.174	0.757	1.186	0.762	1.245	0.739
11. COMPUTER SCIENCE	1.269	0.820	1.253	0.806	1.278	0.803
12 ENGINEERING	1.161	0.788	1.186	0.787	1.157	0.766
13. MATERIALS SCIENCES	1.271	0.779	1.304	0.824	1.312	0.777
14. GEOSCIENCE	1.199	0.773	1.190	0.767	1.167	0.735
15. AGRIC. AND ENVIRONMENT	1.086	0.708	1.120	0.737	1.134	0.727
16. PLANT AND ANIMAL SC.	1.123	0.764	1.137	0.763	1.121	0.713
17. MULTIDICIPLINARY	1.382	0.483	1.382	0.483	1.352	0.508
18. RESIDUAL SUB-FIELDS	1.359	0.761	1.433	0.753	1.593	0.708
19. SOCIAL SCIENCES, GENERAL	1.216	0.803	1.223	0.797	1.159	0.794
20. ECONOMIC AND BUSSINESS	1.448	0.837	1.450	0.849	1.444	0.858
A. LIFE SCIENCES	1.301	0.828	1.326	0.816	1.294	0.815
B. PHYSICAL SCIENCES	1.276	0.716	1.307	0.707	1.283	0.723
C. OTHER NATURAL SCIENCES	1.176	0.755	1.202	0.760	1.226	0.696
D. SOCIAL SCIENCES	1.291	0.816	1.316	0.821	1.258	0.814
ALL FIELDS	**1.247**	**0.773**	**1.289**	**0.777**	**1.292**	**0.717**

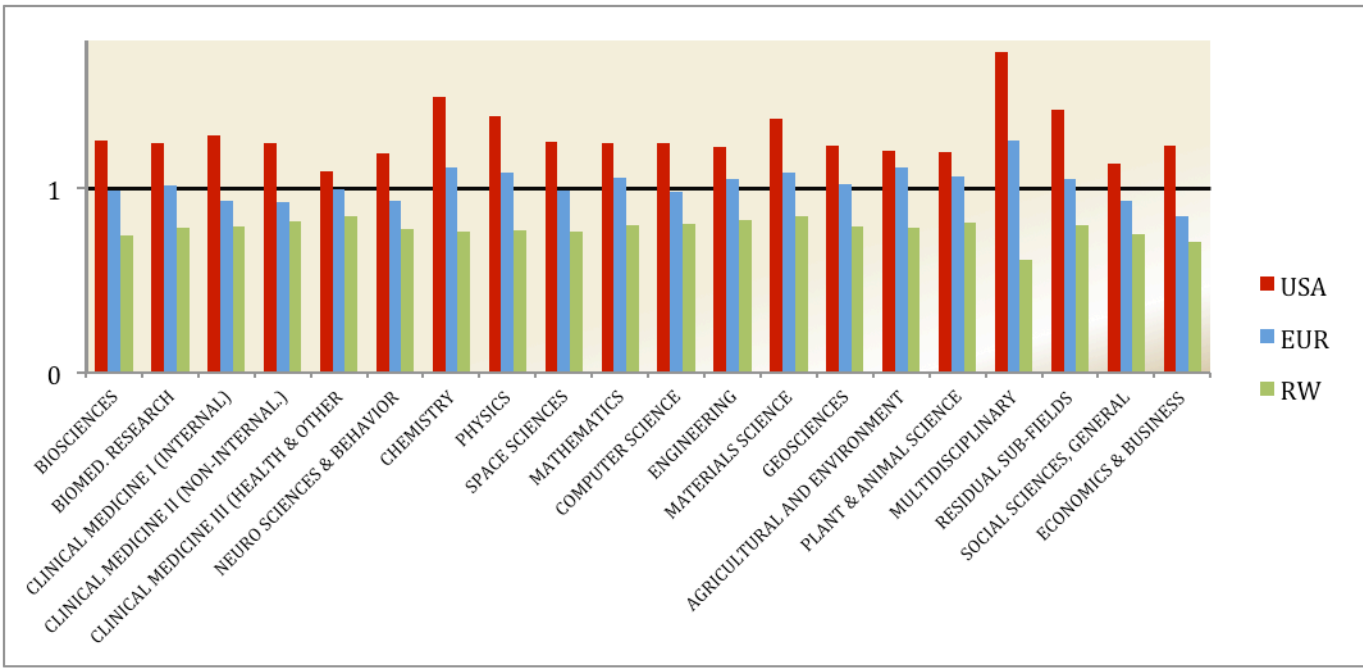

Figure 1. Mean Normalized Citation Score Indicators At the Field Level For the Three Geographical Areas ($MNCS^{k}_{f}$). Articles Published In 1998-2002 With a Five-Year Citation Window

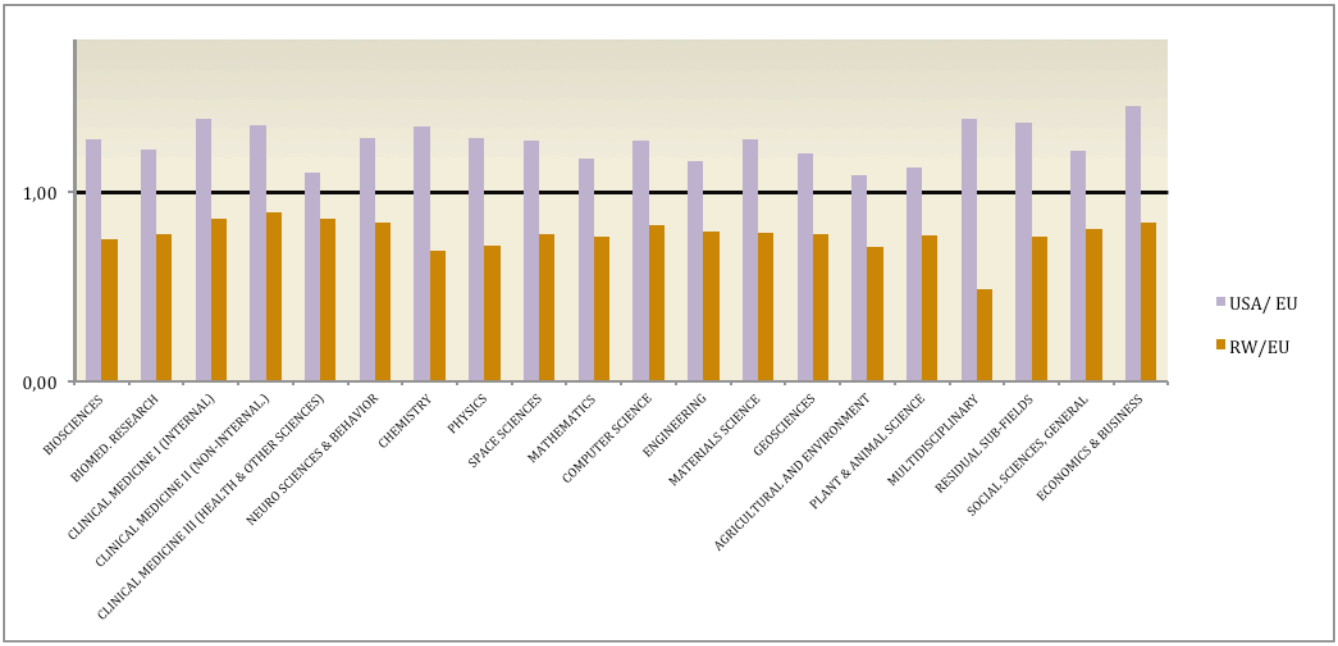

Figure 2. US/EU and RW/EU Gaps According To the Mean Normalized Citation Score Indicators At the Field Level. Articles Published In 1998-2002 With a Five-Year Citation Window

APPENDIX

Table A. Number of Articles and Mean Citation Rates In the Original Distribution and the Geographical Extended Count, 1998-2002

		Original Distribution			Geographical Extended Count		
		Number of Articles	%	Mean Citation Rate	Number of Articles	%	Mean Citation Rate
		(1)	(2)	(3)	(4)	(5)	(6)
LIFE SCIENCES		**1,487,094**	**40.8**	**11.1**	**1,670,608**	**40.3**	**11.8**
I	**Clinical Medicine**	778,938	21.3	9.5	857,870	20.7	10.2
II	**Biology & Biochemistry**	226,836	6.2	12.4	261,204	6.3	12.8
III	**Neuroscience & Behavioral Science**	115,124	3.2	13.6	131,683	3.2	14.2
IV	**Molecular Biology & Genetics**	101,212	2.8	20.5	120,951	2.9	21.6
V	**Psychiatry & Psychology**	90,619	2.5	6.8	98,386	2.4	7.0
VI	**Pharmacology & Toxicology**	63,090	1.7	7.9	69,970	1.7	8.1
VII	**Microbiology**	60,250	1.7	11.4	69,620	1.7	11.8
VIII	**Immunology**	51,025	1.4	16.0	60,924	1.5	16.6
PHYSICAL SCIENCES		**1,039,476**	**28.5**	**6.6**	**1,215,233**	**29.3**	**7.0**
IX	**Chemistry**	450,245	12.3	7.4	500,719	12.1	7.6
X	**Physics**	373,221	10.2	6.8	452,921	10.9	7.3
XI	**Computer Science**	71,368	2.0	3.0	80,551	1.9	3.1
XII	**Mathematics**	95,426	2.6	2.4	112,961	2.7	2.5
XIII	**Space Science**	49,216	1.3	10.9	68,081	1.6	12.1
OTHER NATURAL SCIENCES		**933,780**	**25.6**	**4.6**	**1,053,850**	**25.4**	**4.8**
XIV	**Engineering**	286,561	7.9	3.1	318,945	7.7	3.2
XV	**Plant & Animal Science**	215,056	5.9	5.0	243,348	5.9	5.2
XVI	**Materials Science**	162,143	4.4	4.3	180,110	4.3	4.4
XVII	**Geosciences**	96,772	2.7	6.6	117,927	2.8	7.0
XVIII	**Environment & Ecology**	88,567	2.4	6.9	100,926	2.4	7.1
XIX	**Agricultural Sciences**	67,102	1.8	4.6	73,374	1.8	4.8
XX	**Multidisciplinary**	17,579	0.5	3.0	19,220	0.5	3.1
SOCIAL SCIENCES		**188,174**	**5.2**	**3.4**	**202,590**	**4.9**	**3.5**
XXI	**Social Sciences, General**	136,737	3.7	3.3	144,309	3.5	3.3
XXII	**Economics & Business**	51,437	1.4	3.8	58,281	1.4	4.0
ALL TS FIELDS		**3,648,524**	**100.0**	**7.7**	**4,142,281**	**100.0**	**8.2**

Table B. Number of Articles In the Geographical Areas In the Geographical Extended Count

		Number of Articles			Publication Effort			Publication Shares			
		U.S.	EU	RW	US	EU	RW	US	EU	RW	All
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LIFE SCIENCES		**565,250**	**584,908**	**520,450**	**47.1**	**43.5**	**32.6**	**33.8**	**35.0**	**31.2**	**100.0**
I	Clinical Medicine	279,707	317,947	260,216	23.3	23.7	16.3	32.6	37.1	30.3	100.0
II	Biology & Biochemistry	82,557	84,130	94,517	6.9	6.3	5.9	31.6	32.2	36.2	100.0
III	Neuroscience & Behavioral Science	47,366	45,440	38,877	3.9	3.4	2.4	36.0	34.5	29.5	100.0
IV	Molecular Biology & Genetics	45,541	39,762	35,648	3.8	3.0	2.2	37.7	32.9	29.5	100.0
V	Psychiatry & Psychology	49,490	27,875	21,021	4.1	2.1	1.3	50.3	28.3	21.4	100.0
VI	Pharmacology & Toxicology	18,479	22,724	28,767	1.5	1.7	1.8	26.4	32.5	41.1	100.0
VII	Microbiology	19,967	25,665	23,988	1.7	1.9	1.5	28.7	36.9	34.5	100.0
VIII	Immunology	22,143	21,365	17,416	1.8	1.6	1.1	36.3	35.1	28.6	100.0
PHYSICAL SCIENCES		**262,303**	**389,820**	**563,110**	**21.9**	**29.0**	**35.2**	**21.6**	**32.1**	**46.3**	**100.0**
IX	Chemistry	93,631	156,182	250,906	7.8	11.6	15.7	18.7	31.2	50.1	100.0
X	Physics	92,384	143,764	216,773	7.7	10.7	13.6	20.4	31.7	47.9	100.0
XI	Computer Science	25,108	27,405	28,038	2.1	2.0	1.8	31.2	34.0	34.8	100.0
XII	Mathematics	29,077	38,043	45,841	2.4	2.8	2.9	25.7	33.7	40.6	100.0
XIII	Space Science	22,103	24,426	21,552	1.8	1.8	1.3	32.5	35.9	31.7	100.0
OTHER NATURAL SCIENCES		**267,162**	**316,413**	**470,275**	**22.3**	**23.6**	**29.4**	**25.4**	**30.0**	**44.6**	**100.0**
XIV	Engineering	85,378	91,653	141,914	7.1	6.8	8.9	26.8	28.7	44.5	100.0
XV	Plant & Animal Science	64,330	74,046	104,972	5.4	5.5	6.6	26.4	30.4	43.1	100.0
XVI	Materials Science	31,211	52,791	96,108	2.6	3.9	6.0	17.3	29.3	53.4	100.0
XVII	Geosciences	33,350	37,644	46,933	2.8	2.8	2.9	28.3	31.9	39.8	100.0
XVIII	Environment & Ecology	32,118	31,817	36,991	2.7	2.4	2.3	31.8	31.5	36.7	100.0
XIX	Agricultural Sciences	16,556	24,989	31,829	1.4	1.9	2.0	22.6	34.1	43.4	100.0
XX	Multidisciplinary	4,219	3,473	11,528	0.4	0.3	0.7	22.0	18.1	60.0	100.0
SOCIAL SCIENCES		**105,476**	**52,350**	**44,764**	**8.8**	**3.9**	**2.8**	**52.1**	**25.8**	**22.1**	**100.0**
XXI	Social Sciences, General	77,852	34,770	31,687	6.5	2.6	2.0	53.9	24.1	22.0	100.0
XXII	Economics & Business	27,624	17,580	13,077	2.3	1.3	0.8	47.4	30.2	22.4	100.0
ALL SUB-FIELDS		**1,200,191**	**1,343,491**	**1,598,599**	**100.0**	**100.0**	**100.0**	**29.0**	**32.4**	**38.6**	**100.0**

Table C. Number of Articles and Mean Citation Rates In the Double Extended Counts For Sub-fields, Disciplines, and Fields

	SUB-FIELDS			DISCIPLINES			FIELDS		
	Number Of Articles	%	MCR	Number Of Articles	%	MCR	Number Of Articles	%	MCR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I. BIOSCIENCES							*429,332*	*7.8*	*15.4*
D1. Multidisciplinary Biology				**42,034**	**0.69**	**9.5**			
1. BIOLOGY	28,017	0.43	7.9						
2. BIOLOGY, MISCELLANEOUS	475	0.01	3.6						
3. EVOLUTIONARY BIOLOGY	13,542	0.21	12.9						
D2. Biochemistry, Biophysics, Mol. Biology				**287,797**	**4.71**	**16.0**			
4. BIOCHEMICAL RESEARCH METHODS	37,350	0.57	9.5						
5. BIOCHEMISTRY & MOLECULAR BIOLOGY	248,933	3.82	17						
6. BIOPHYSICS	56,436	0.87	11.1						
D3 = 7. **Cell Biology**	97,545	1.5	22.5	**97,545**	**1.60**	**22.5**			
D4. Genetics & Development Biology				**91,943**	**1.51**	**16.7**			
8. GENETICS & HEREDITY	74,782	1.15	16.9						
9. DEVELOPMENTAL BIOLOGY	19,590	0.3	20.2						
II. BIOMEDICAL RESEARCH							*317,909*	*5.7*	*8.8*
D5. Anatomy & Pathology				**39,021**	**0.64**	**8.9**			
10. PATHOLOGY	32,518	0.5	9.6						
11. ANATOMY & MORPHOLOGY	6,756	0.1	5.8						
D6. Biomaterials & Bioengineering				**91,185**	**1.49**	**8.9**			
12. ENGINEERING, BIOMEDICAL	21,597	0.33	6.9						
13. BIOTECH. & APPLIED MICROBIOLOGY	69,781	1.07	9.5						
D7. Experimental & Laboratory Medicine				**15,423**	**0.25**	**6.4**			
14. MEDICAL LABORATORY TECHNOLOGY	10,927	0.17	6.4						
15. MICROSCOPY	4,496	0.07	6.3						
D8 Pharmacology & Toxicology				**136,684**	**2.24**	**8.1**			
16. PHARMACOLOGY & PHARMACY	111,320	1.71	8.3						
17. TOXICOLOGY	34,066	0.52	7.3						
D9 = 18. **Physiology**	49,225	0.76	10.7	**49,225**	**0.81**	**10.7**			
III. CLINICAL MEDICINE I (INTERNAL)							*509,541*	*9.2*	*13.2*
D10. Cardiovascular & Respiratory Medicine				**79,780**	**1.31**	**12.2**			
19. CARDIAC & CARDIOVASCULAR SYSTEMS	60,300	0.93	12.2						
20. RESPIRATORY SYSTEM	30,928	0.47	10.5						
D11 = 21. **Endocrinology & Metabolism**	55,583	0.85	13.3	**55,583**	**0.91**	**13.3**			
D12. General & Internal Medicine				**149,527**	**2.45**	**11.9**			
22. ANESTHESIOLOGY	18,037	0.28	7						
23. CRITICAL CARE MEDICINE	14,301	0.22	11.4						
24. EMERGENCY MEDICINE	6,864	0.11	4.1						
25. GASTROENTEROLOGY & HEPATOLOGY	37,885	0.58	11.2						
26. MEDICINE, GENERAL & INTERNAL	66,266	1.02	15.1						

27. TROPICAL MEDICINE	9,193	0.14	5.7						
D13. Hematology & Oncology				**131,133**	**2.15**	**16.1**			
28. HEMATOLOGY	47,323	0.73	17.5						
29. ONCOLOGY	91,359	1.4	14.8						
D14. Immunology				**115,554**	**1.89**	**13.8**			
30. ALLERGY	9,706	0.15	9.2						
31. IMMUNOLOGY	94,351	1.45	14.9						
32. INFECTIOUS DISEASES	37,806	0.58	12.3						
IV. CLIN. MED. II (NON-INTERNAL)							*549,174*	*9.9*	*8.3*
D15. Age & Gender Related Medicine				**59,716**	**0.98**	**7.4**			
33. GERIATRICS & GERONTOLOGY	10,141	0.16	8.2						
34. OBSTETRICS & GYNECOLOGY	34,907	0.54	6.9						
35. ANDROLOGY	1,605	0.02	5.7						
36. REPRODUCTIVE BIOLOGY	18,956	0.29	9.7						
37. GERONTOLOGY	7,334	0.11	7.4						
D16 = 38. **Dentistry, Oral Surgery**	23,294	0.36	5.5	**23,294**	**0.38**	**5.5**			
D17. Dermatology & Urogenital System				**59,102**	**0.97**	**8.3**			
39. DERMATOLOGY	22,848	0.35	6.2						
40. UROLOGY & NEPHROLOGY	36,254	0.56	9.6						
D18. Ophthalmology & Otorhinolaryngology				**47,410**	**0.78**	**6.1**			
41. OTORHINOLARYNGOLOGY	18,492	0.28	4.4						
42. OPHTHALMOLOGY	28,918	0.44	7.2						
D19 = 43 **Integrative & Complementary Medicine**	2,633	0.04	4.4	**2,633**	**0.04**	**4.4**			
D20. Psychiatry & Neurology				**110,370**	**1.81**	**10.1**			
44. CLINICAL NEUROLOGY	73,322	1.13	9.8						
45. PSYCHIATRY	47,038	0.72	9.9						
D21 = 46. **Radiology, Nuclear Med. & Imaging**	58,950	0.91	7.9	**58,950**	**0.97**	**7.9**			
D22. Rheumatology & Orthopedics				**55,519**	**0.91**	**7.1**			
47. ORTHOPEDICS	25,624	0.39	5.9						
48. RHEUMATOLOGY	11,821	0.18	11.5						
49. SPORT SCIENCES	22,548	0.35	6						
D23. Surgery				**155,182**	**2.54**	**9.1**			
50. SURGERY	109,354	1.68	6.5						
51. TRANSPLANTATION	22,663	0.35	7						
P52. ERIPHERAL VASCULAR DISEASE	40,847	0.63	16.4						
D24 = 53. **Pediatrics**	45,506	0.7	5.9	**45,506**	**0.75**	**5.9**			
V. CL. MED. III (HEALTH & OTHER SCS.)							*114,753*	*2.1*	*5.9*
D25. Health Sciences				**105,469**	**1.73**	**6.2**			
54. HEALTH CARE SCIENCES & SERVICES	15,058	0.23	5.9						
55. HEALTH POLICY & SERVICES	9,388	0.14	6.3						
56. MEDICINE, LEGAL	4,565	0.07	4.5						
57. NURSING	9,105	0.14	3						
58. PUBLIC, ENVIRON. & OCCUP. HEALTH	56,693	0.87	7.4						
59. REHABILITATION	14,513	0.22	4.3						
60. SUBSTANCE ABUSE	8,382	0.13	7.6						
D26. Other Clinical Medicine				**15,378**	**0.25**	**3.5**			
61. EDUCATION, SCIENTIFIC DISCIPLINES	8,371	0.13	2.9						
62. MEDICAL INFORMATICS	7,007	0.11	4.3						

VI. NEUROSCIENCE & BEHAVIOR							*231,219*	*4.2*	*10.2*
D27. Neurosciences & Psychopharmacology				**129,562**	**2.12**	**13.4**			
63. NEUROIMAGING	6,826	0.1	10.9						
64. NEUROSCIENCES	125,782	1.93	13.6						
D28. Psychology & Behavioral Sciences				**113,029**	**1.85**	**6.5**			
65. BEHAVIORAL SCIENCES	16,450	0.25	8.9						
66. PSYCHOLOGY, BIOLOGICAL	4,429	0.07	7.5						
67. PSYCHOLOGY	17,977	0.28	7.9						
68. PSYCHOLOGY, APPLIED	8,732	0.13	4.7						
69. PSYCHOLOGY, CLINICAL	18,978	0.29	7.5						
70. PSYCHOLOGY, DEVELOPMENTAL	10,994	0.17	7.8						
71. PSYCHOLOGY, EDUCATIONAL	5,601	0.09	5.2						
72. SYCHOLOGY, EXPERIMENTAL	17,565	0.27	7.6						
73. PSYCHOLOGY, MATHEMATICAL	1,930	0.03	5.1						
74. PSYCHOLOGY, MULTIDISCIPLINARY	19,785	0.3	4.9						
75. PSYCHOLOGY, PSYCHOANALYSIS	2,504	0.04	2.7						
76. PSYCHOLOGY, SOCIAL	10,717	0.16	6.3						
77. SOCIAL SCIENCES, BIOMEDICAL	6,669	0.1	5.4						
VII. CHEMISTRY							*580,050*	*10.5*	*7.3*
D29 = 78. **Chemistry, Multidisciplinary**	107,816	1.66	8.9	**107,816**	**1.77**	**8.9**			
D30. Analytical, Inorganic & Nuclear Chemistry				**125,780**	**2.06**	**7.3**			
79. CHEMISTRY, INORGANIC & NUCLEAR	55,337	0.85	6.7						
80. CHEMISTRY, ANALYTICAL	73,439	1.13	7.5						
D31. Applied Chemistry & Chemical Engineering				**95,175**	**1.56**	**4.7**			
81. CHEMISTRY, APPLIED	37,068	0.57	5.6						
82. ENGINEERING, CHEMICAL	64,146	0.99	4.3						
D32. Organic & Medicinal Chemistry ,				**105,557**	**1.73**	**7.8**			
83. CHEMISTRY, MEDICINAL	27,721	0.43	7.5						
84. CHEMISTRY, ORGANIC	84,274	1.29	7.9						
D33. Physical Chemistry				**165,622**	**2.71**	**7.8**			
85. CHEMISTRY, PHYSICAL	143,582	2.2	7.8						
86. ELECTROCHEMISTRY	22,040	0.34	7.6						
D34 = 87. **Polymer Science**	61,649	0.95	6.2	**61,649**	**1.01**	**6.2**			
VIII. PHYSICS							*610,826*	*11.0*	*7.1*
D35. Multidisciplinary Physics				**136,906**	**2.24**	**8.4**			
88. PHYSICS, MULTIDISCIPLINARY	101,780	1.56	9.3						
89. PECTROSCOPY	35,126	0.54	5.8						
D36. Applied Physics				**208,980**	**3.42**	**5.7**			
90. ACOUSTICS	15,991	0.25	4						
91. OPTICS	61,373	0.94	5.6						
92. PHYSICS, APPLIED	143,531	2.2	5.8						
D37 = 93. **Physics, Atomic, Molecular & Chemical**	74,351	1.14	8.6	**74,351**	**1.22**	**8.6**			
D38 = 94. **Thermodynamics (Classical Physics)**	19,276	0.3	3.5	**19,276**	**0.32**	**3.5**			
D39 = 95. **Physics, Mathematical**	41,061	0.63	5.9	**41,061**	**0.67**	**5.9**			
D40. Particle & Nuclear Physics				**74,155**	**1.21**	**8.8**			
96. PHYSICS, NUCLEAR	33,146	0.51	5.6						
97. PHYSICS, PARTICLES & SUB-FIELDS	50,532	0.78	10						
D41. Physics of Solids, Fluids & Plasmas				**160,097**	**2.62**	**6.0**			
98. PHYSICS, CONDENSED MATTER	130,377	2	5.7						

99. PHYSICS OF SOLIDS, FLUIDS & PLASMAS	29,720	0.46	7.3						
IX. SPACE SCIENCES							*82,073*	*1.5*	*12.5*
D42 = 100. **Astronomy & Astrophysics ,**	82,073	1.26	12.5	**82,073**	**1.34**	**12.5**			
X. MATHEMATICS							*163,098*	*2.9*	*3.0*
D43. Applied Mathematics				**106,187**	**1.74**	**3.5**			
101. MATHEMATICS, APPLIED	61,964	0.95	2.8						
102. STATISTICS & PROBABILITY	27,188	0.42	4.7						
103. MATHEMATICS,INTERDISC. APPL.	19,976	0.31	4.2						
104. SOCIAL SCIENCES, MATH. METHODS	6,078	0.09	4.3						
D44 = 105. **Pure Mathematics**	76,078	1.17	2.1	**76,078**	**1.25**	**2.1**			
XI. COMPUTER SCIENCE							*132,264*	*2.4*	*3.5*
D45. Computer Science & Information Tech.				**132,264**	**2.17**	**3.5**			
106. COMP. SC., ARTIFICIAL INTELLIGENCE	26,462	0.41	4						
107. COMPUTER SCIENCE, CYBERNETICS	4,865	0.07	2.7						
108. COMP. SC., HARDWARE & ARCHITECTURE	14,163	0.22	3.2						
109. COMP. SC., INFORMATION SYSTEMS	22,925	0.35	3.5						
110. COMP. SC., INTERDIS. APPLICATIONS	30,920	0.47	4.8						
111. COMP. SC., SOFTWARE ENGINEERING	19,570	0.3	2.8						
112. COMP. SC., THEORY & METHODS	37,783	0.58	2.5						
113. MATHEMATICAL & COMPUT. BIOLOGY	8,621	0.13	9						
XII. ENGINEERING							*392,455*	*7.1*	*3.5*
D46. Electrical & Electronic Engineering				**135,308**	**2.22**	**3.6**			
114. ENG., ELECTRICAL & ELECTRONIC	131,115	2.01	3.6						
115. TELECOMMUNICATIONS	21,591	0.33	2.9						
D47. Civil Engineering				**49,282**	**0.81**	**4.2**			
116. ONSTRUCTION & BUILDING TECH.	9,010	0.14	2.4						
117. ENGINEERING, CIVIL	23,183	0.36	2.4						
118. ENGINEERING, ENVIRONMENTAL	22,096	0.34	6.6						
119. ENGINEERING, MARINE	417	0.01	1						
120. TRANSPORTATION SC. & TECHNOLOGY	6,365	0.1	1.5						
D48. Mechanical Engineering				**99,768**	**1.63**	**3.1**			
121. ENGINEERING, INDUSTRIAL	13,858	0.21	2.2						
122. ENGINEERING, MANUFACTURING	14,516	0.22	2.4						
123. ENGINEERING, MECHANICAL	40,995	0.63	2.9						
124. MECHANICS	48,002	0.74	3.8						
125. ROBOTICS	3,231	0.05	2.6						
D49. Instruments & Instrumentation				**48,605**	**0.80**	**4.1**			
126. INSTRUMENTS & INSTRUMENTATION	43,348	0.67	3.9						
127. IMAGING SC. & PHOTOGRAPHIC TECH.	5,449	0.08	5.6						
D50. Fuel & Energy				**69,897**	**1.14**	**3.4**			
128. ENERGY & FUELS	26,298	0.4	3.5						
129. NUCLEAR SCIENCE & TECHNOLOGY	42,406	0.65	3.4						
130. ENGINEERING, PETROLEUM	6,974	0.11	1.2						
D51. Other Engineering				**60,713**	**0.99**	**3.0**			
131. UTOMATION & CONTROL SYSTEMS	18,140	0.28	3						
132. ENGINEERING, MULTIDISCIPLINARY	22,062	0.34	2.8						
133. ERGONOMICS	3,299	0.05	3.3						

134. OPERATIONS RES. & MANAG. SCIENCE	20,897	0.32	2.8						
XIII. MATERIALS SCIENCE							*138,254*	*2.5*	*4.3*
D52. Materials Science				**138,254**	**2.26**	**4.3**			
135. MATERIALS SCIENCE, BIOMATERIALS	7,382	0.11	9.6						
136. MATERIALS SCIENCE, CERAMICS	21,255	0.33	3.5						
137. MAT. SC., CHARAC. & TESTING	6,606	0.1	1.5						
138. MAT. SC., COATINGS & FILMS	24,592	0.38	5.5						
139. MATERIALS SCIENCE, COMPOSITES	10,368	0.16	2.5						
140. MATERIALS SCIENCE, PAPER & WOOD	6,577	0.1	2						
141. MATERIALS SCIENCE, TEXTILES	4,923	0.08	2						
142. METALLURGY & METALL. ENGIN.	42,534	0.65	3.5						
143. NANOSCIENCE & NANOTECHNOLOGY	22,069	0.34	5.8						
XIV. GEOSCIENCES							*137,187*	*2.5*	*6.6*
D53. Geosciences & Technology				**64,682**	**1.06**	**6.6**			
144. GEOCHEMISTRY & GEOPHYSICS	32,728	0.5	7.6						
145. GEOGRAPHY, PHYSICAL	10,440	0.16	6.9						
146. GEOLOGY	9,447	0.15	6.1						
147. ENGINEERING, GEOLOGICAL	5,253	0.08	2.7						
148. PALEONTOLOGY	8,039	0.12	4.9						
149. REMOTE SENSING	5,869	0.09	5.6						
D54. Hydrology & Oceanography				**24,878**	**0.41**	**7.2**			
150. OCEANOGRAPHY	22,387	0.34	7.7						
151. ENGINEERING, OCEAN	3,725	0.06	2.9						
D55 Meteo., Atmosph., Aero., Sc. & Tech.				**42,560**	**0.70**	**6.7**			
152. METEOROLOGY & ATMOSPH. SCS.	33,043	0.51	8.2						
153 ENGINEERING, AEROSPACE	12,910	0.2	1.8						
D56. Mineralogy & Petrology				**14,782**	**0.24**	**4.7**			
154. MINERALOGY	9,038	0.14	5.5						
155. MINING & MINERAL PROCESSING	7,333	0.11	3.1						
XV. AGRICULT. & ENVIRONMENT							*235,573*	*4.3*	*5.6*
D57. Agricultural Science & Technology				**46,943**	**0.77**	**4.5**			
156. AGRICULTURAL ENGINEERING	4,880	0.07	3.3						
157. AGRICULTURE, MULTIDISCIPLINARY	15,859	0.24	4.8						
158. AGRONOMY	26,490	0.41	4.5						
D58. Plant & Animal Science & Tech,				**22,045**	**0.36**	**5.7**			
159. LIMNOLOGY	6,362	0.1	7.2						
160. SOIL SCIENCE	15,683	0.24	5.1						
D59. Environmental Science & Technology				**91,032**	**1.49**	**6.2**			
161. BIODIVERSITY CONSERVATION	7,186	0.11	6.5						
162. ENVIRONMENTAL SCIENCES	78,593	1.21	6.7						
163. ENVIRONMENTAL STUDIES	10,681	0.16	3.6						
D60. Food & Animal Science & Technology				**98,654**	**1.62**	**5.6**			
164. FOOD SCIENCE & TECHNOLOGY	46,497	0.71	5.1						
165. NUTRITION & DIETETICS	23,879	0.37	8.5						
166. AGRIC., DAIRY & ANIMAL SCIENCE	23,741	0.36	3.8						
167. HORTICULTURE	11,415	0.18	4.8						
XVI. PLANT & ANIMAL SCIENCE							*404,113*	*7.3*	*7.3*

(ORGANISMIC AND SUPRAORG. LEVEL)									
D61. Animal Sciences				**65,071**	**1.07**	**5.0**			
168. ORNITHOLOGY	4,902	0.08	4.2						
169. ZOOLOGY	38,570	0.59	5.6						
170. ENTOMOLOGY	21,639	0.33	4						
D62. Aquatic Sciences ,				**73,019**	**1.20**	**5.3**			
171. WATER RESOURCES	28,222	0.43	4.4						
172. FISHERIES	17,207	0.26	5.3						
173. MARINE & FRESHWATER BIOLOGY	37,027	0.57	6.1						
D63. Microbiology				**100,770**	**1.65**	**11.5**			
174. MICROBIOLOGY	63,814	0.98	11.2						
175. PARASITOLOGY	13,268	0.2	6.2						
176. VIROLOGY	24,543	0.38	15.1						
D64. Plant Sciences				**91,487**	**1.50**	**7.0**			
177. FORESTRY	12,289	0.19	5.4						
178. MYCOLOGY	6,973	0.11	5.3						
179. PLANT SCIENCES	73,854	1.13	7.5						
D65 = 180. **Pure and Applied Ecology**	46,672	0.72	8.6	**46,672**	**0.76**	**8.6**			
D66 = 181. **VETERINARY SCIENCES**	54,380	0.84	3.8	**54,380**	**0.89**	**3.8**			
XVII. MULTIDISCIPLINARY							*27,961*	*0.5*	*3.2*
D67 = 182. **MULTIDISCIPLINARY SCIENCES**	27,961	0.43	3.2	**27,961**	**0.46**	**3.2**			
XVIII. RESIDUAL SUB-FIELDS							*288,618*	*5.2*	*6.6*
D68 = 183. **MATERIALS SCIENCE, MULT.**	153,666	2.36	4.9	**153,666**	**2.52**	**4.9**			
D69 = 184. **CRYSTALLOGRAPHY**	32,344	0.5	4.4	**32,344**	**0.53**	**4.4**			
D70 = 185. **GEOSCIENCES, MULT.**	54,564	0.84	5.6	**54,564**	**0.89**	**5.6**			
D71 = 186. **MED., RES. & EXPERIMENTAL**	48,413	0.74	14.7	**48,413**	**0.79**	**14.7**			
XIX. SOCIAL SCIENCES, GENERAL							*129,000*	*2.3*	*3.0*
D72. Law & Criminology				**12,480**	**0.20**	**3.5**			
187. CRIMINOLOGY & PENOLOGY	3,259	0.05	3.5						
188. LAW	9,714	0.15	3.4						
D73. Political Science & Public Administration				**15,769**	**0.26**	**2.4**			
P189. OLITICAL SCIENCE	12,582	0.19	2.4						
P190. UBLIC ADMINISTRATION	3,595	0.06	2.5						
D74. Sociology & Other Social Studies				**28,575**	**0.47**	**3.0**			
191. ETHNIC STUDIES	817	0.01	1.9						
192. FAMILY STUDIES	5,268	0.08	4.2						
193. SOCIAL ISSUES	4,257	0.07	2.6						
194. SOCIAL WORK	4,956	0.08	2.7						
195. SOCIOLOGY	12,668	0.19	3						
196. WOMEN'S STUDIES	3,757	0.06	2.8						
D75. Education				**18,810**	**0.31**	**2.6**			
197. EDUCATION & EDUCATIONAL RES.	15,755	0.24	2.4						
198. EDUCATION, SPECIAL	3,055	0.05	3.7						
D76. Geography, Planning & Urban				**20,550**	**0.34**	**3.2**			
199. AREA STUDIES	3,491	0.05	1.4						
200. GEOGRAPHY	5,876	0.09	4.3						
201. PLANNING & DEVELOPMENT	6,403	0.1	3.1						
202. TRANSPORTATION	2,100	0.03	3.5						

2003 URBAN STUDIES	4,856	0.07	3.1						
D77. Ethics				**3,948**	**0.06**	**2.5**			
204. ETHICS	3,667	0.06	2.4						
205. MEDICAL ETHICS	972	0.01	3.8						
D78. Other Social Sciences				**44,619**	**0.73**	**3.0**			
206. NTHROPOLOGY	6,884	0.11	3.2						
207. COMMUNICATION	5,052	0.08	3						
208. DEMOGRAPHY	2,364	0.04	4.2						
209. HISTORY OF SOCIAL SCIENCES	1,346	0.02	1.4						
210. INFORMATION SC. & LIBRARY SC.	9,167	0.14	2.9						
211. INTERNATIONAL RELATIONS	6,460	0.1	2.3						
212. LINGUISTICS	6,031	0.09	4.3						
213. OCIAL SCIENCES, INTERD.	8,996	0.14	2.4						
XX. ECONOMICS & BUSINESS							*65,360*	*1.2*	*3.9*
D79. Economics				**42,067**	**0.69**	**3.6**			
214. AGRICULTURAL ECONOMICS & POLICY	2,034	0.03	2.6						
215. ECONOMICS	40,420	0.62	3.6						
216. INDUSTRIAL RELATIONS & LABOR	2,197	0.03	3.3						
D80. Business & Management				**28,360**	**0.46**	**4.6**			
217. BUSINESS	10,516	0.16	5.1						
218. USINESS, FINANCE	6,982	0.11	4.9						
219. MANAGEMENT	14,854	0.23	4.7						
	6,512,031	**100**	**8**						

Table D. Publication Effort By Geographical Areas In the Double Extended Counts For Sub-fields, Disciplines, and Fields

	SUB-FIELDS			DISCIPLINES			FIELDS		
	U.S. RW	EU Articles	RW %	U.S. MCR	EU	RW	U.S.	EU	
	(1) (9)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
I. BIOSCIENCES							*8.9*	*7.8*	*6.8*
D1. Multidisciplinary Biology				**0.75**	**0.67**	**0.66**			
1. BIOLOGY	0.43	0.41	0.45						
2. BIOLOGY, MISCELLANEOUS	0.01	0.01	0.01						
3. EVOLUTIONARY BIOLOGY	0.25	0.22	0.17						
D2. Biochemistry, Biophysics, Mol. Biology				**5.39**	**4.75**	**4.17**			
4. BIOCHEMICAL RESEARCH METHODS	0.58	0.67	0.49						
5. BIOCHEMISTRY & MOLECULAR BIOLOGY	4.42	3.77	3.41						
6. BIOPHYSICS	0.83	0.87	0.89						
D3 = 7**. Cell Biology**	1.85	1.52	1.21	**1.99**	**1.62**	**1.28**			
D4. Genetics & Development Biology				**1.84**	**1.58**	**1.19**			
8. GENETICS & HEREDITY	1.36	1.23	0.92						
9. DEVELOPMENTAL BIOLOGY	0.42	0.29	0.22						
II. BIOMEDICAL RESEARCH							*6.0*	*5.9*	*5.5*
D5. Anatomy & Pathology				**0.65**	**0.70**	**0.58**			
10. PATHOLOGY	0.52	0.54	0.45						
11. ANATOMY & MORPHOLOGY	0.09	0.13	0.1						
D6. Biomaterials & Bioengineering				**1.40**	**1.58**	**1.49**			
12. ENGINEERING, BIOMEDICAL	0.35	0.38	0.27						
13. BIOTECH. & APPLIED MICROBIOLOGY	0.95	1.1	1.14						
D7. Experimental & Laboratory Medicine				**0.29**	**0.27**	**0.21**			
14. MEDICAL LABORATORY TECHNOLOGY	0.21	0.17	0.13						
15. MICROSCOPY	0.06	0.08	0.07						
D8 Pharmacology & Toxicology				**2.25**	**2.23**	**2.24**			
16. PHARMACOLOGY & PHARMACY	1.62	1.74	1.75						
17. TOXICOLOGY	0.64	0.48	0.47						
D9 = 18. **Physiology**	1.01	0.66	0.64	**1.09**	**0.70**	**0.68**			
III. CLINICAL MEDICINE I (INTERNAL)							*10.1*	*10.6*	*7.3*
D10. Cardiovascular & Respiratory Medicine				**1.58**	**1.48**	**0.95**			
19. CARDIAC & CARDIOVASCULAR SYSTEMS	1.11	1.05	0.68						
20. RESPIRATORY SYSTEM	0.56	0.55	0.35						
D11 = 21. **Endocrinology & Metabolism**	0.92	1.02	0.66	**0.99**	**1.09**	**0.70**			
D12. General & Internal Medicine				**2.38**	**2.82**	**2.18**			
22. ANESTHESIOLOGY	0.24	0.4	0.2						
23. CRITICAL CARE MEDICINE	0.25	0.27	0.15						
24. EMERGENCY MEDICINE	0.19	0.11	0.04						
25. GASTROENTEROLOGY & HEPATOLOGY	0.49	0.71	0.55						
26. MEDICINE, GENERAL & INTERNAL	0.99	1.15	0.92						

27. TROPICAL MEDICINE	0.06	0.11	0.23						
D13. Hematology & Oncology				**2.50**	**2.44**	**1.63**			
28. HEMATOLOGY	0.81	0.9	0.51						
29. ONCOLOGY	1.63	1.54	1.12						
D14. Immunology				**2.21**	**2.12**	**1.46**			
30. ALLERGY	0.12	0.23	0.11						
31. IMMUNOLOGY	1.74	1.55	1.14						
32. INFECTIOUS DISEASES	0.75	0.64	0.4						
IV. CL. MEDICINE II (NON-INTERNAL)							*11.6*	*11..*	*7.6*
D15. Age & Gender Related Medicine				**1.17**	**1.07**	**0.76**			
33. GERIATRICS & GERONTOLOGY	0.24	0.16	0.09						
34. OBSTETRICS & GYNECOLOGY	0.56	0.65	0.42						
35. ANDROLOGY	0.02	0.02	0.03						
36. REPRODUCTIVE BIOLOGY	0.26	0.35	0.26						
37. GERONTOLOGY	0.23	0.08	0.05						
D16 = 38. **Dentistry, Oral Surgery**	0.36	0.38	0.33	**0.39**	**0.41**	**0.36**			
D17. Dermatology & Urogenital System				**1.02**	**1.20**	**0.73**			
39. DERMATOLOGY	0.33	0.48	0.26						
40. UROLOGY & NEPHROLOGY	0.62	0.65	0.43						
D18. Ophthalmology & Otorhinolaryngology				**0.98**	**0.82**	**0.59**			
41. OTORHINOLARYNGOLOGY	0.36	0.32	0.2						
42. OPHTHALMOLOGY	0.55	0.45	0.36						
D19 = 43 **Integrative & Complementary Medicine**	0.03	0.03	0.06	**0.03**	**0.03**	**0.06**			
D20. Psychiatry & Neurology				**2.15**	**2.08**	**1.32**			
44. CLINICAL NEUROLOGY	1.17	1.35	0.9						
45. PSYCHIATRY	0.95	0.81	0.47						
D21 = 46. **Radiology, Nuclear Med. & Imaging**	1.05	1.06	0.67	**1.13**	**1.12**	**0.71**			
D22. Rheumatology & Orthopedics				**1.22**	**0.97**	**0.62**			
47. ORTHOPEDICS	0.55	0.41	0.26						
48. RHEUMATOLOGY	0.15	0.26	0.14						
49. SPORT SCIENCES	0.54	0.31	0.23						
D23. Surgery				**2.92**	**2.77**	**2.06**			
50. SURGERY	1.93	1.77	1.41						
51. TRANSPLANTATION	0.35	0.41	0.29						
P52. ERIPHERAL VASCULAR DISEASE	0.75	0.73	0.44						
D24 = 53. **Pediatrics**	0.85	0.72	0.57	**0.92**	**0.76**	**0.60**			
V. CL. MED. III (HEALTH & OTHER SCS.)							*3.4*	*1.7*	*1.4*
D25. Health Sciences				**2.79**	**1.45**	**1.16**			
54. HEALTH CARE SCIENCES & SERVICES	0.41	0.2	0.12						
55. HEALTH POLICY & SERVICES	0.34	0.07	0.06						
56. MEDICINE, LEGAL	0.08	0.08	0.05						
57. NURSING	0.28	0.1	0.06						
58. PUBLIC, ENVIRON. & OCCUP. HEALTH	1.21	0.78	0.69						
59. REHABILITATION	0.42	0.16	0.12						
60. SUBSTANCE ABUSE	0.26	0.09	0.06						
D26. Other Clinical Medicine				**0.44**	**0.21**	**0.14**			
61. EDUCATION, SCIENTIFIC DISCIPLINES	0.27	0.07	0.07						
62. MEDICAL INFORMATICS	0.14	0.13	0.07						

VI. NEURO, SCIENCE & BEHAVIOR							*6.1*	*3.9*	*2.9*
D27. Neurosciences & Psychopharmacology				**2.56**	**2.22**	**1.71**			
63. NEUROIMAGING	0.12	0.13	0.07						
64. NEUROSCIENCES	2.32	2.02	1.56						
D28. Psychology & Behavioral Sciences				**3.21**	**1.55**	**1.08**			
65. BEHAVIORAL SCIENCES	0.35	0.26	0.17						
66. PSYCHOLOGY, BIOLOGICAL	0.11	0.06	0.04						
67. PSYCHOLOGY	0.43	0.28	0.16						
68. PSYCHOLOGY, APPLIED	0.29	0.08	0.06						
69. PSYCHOLOGY, CLINICAL	0.61	0.21	0.12						
70. PSYCHOLOGY, DEVELOPMENTAL	0.35	0.11	0.08						
71. PSYCHOLOGY, EDUCATIONAL	0.17	0.05	0.05						
72. SYCHOLOGY, EXPERIMENTAL	0.4	0.28	0.16						
73. PSYCHOLOGY, MATHEMATICAL	0.06	0.02	0.02						
74. PSYCHOLOGY, MULTIDISCIPLINARY	0.51	0.23	0.21						
75. PSYCHOLOGY, PSYCHOANALYSIS	0.07	0.05	0.01						
76. PSYCHOLOGY, SOCIAL	0.31	0.12	0.09						
77. SOCIAL SCIENCES, BIOMEDICAL	0.13	0.08	0.09						
VII. CHEMISTRY							*6.7*	*10.*	*13.*
D29 = 78. **Chemistry, Multidisciplinary**	1.02	1.21	2.52	**1.10**	**1.29**	**2.67**			
D30. Analytical, Inorganic & Nuclear Chemistry				**1.28**	**2.34**	**2.41**			
79. CHEMISTRY, INORGANIC & NUCLEAR	0.46	1.01	1.01						
80. CHEMISTRY, ANALYTICAL	0.75	1.22	1.34						
D31. Applied Chemistry & Chemical Engineering				**1.02**	**1.50**	**2.01**			
81. CHEMISTRY, APPLIED	0.33	0.56	0.76						
82. ENGINEERING, CHEMICAL	0.66	0.93	1.28						
D32. Organic & Medicinal Chemistry ,				**1.23**	**1.77**	**2.07**			
83. CHEMISTRY, MEDICINAL	0.37	0.37	0.51						
84. CHEMISTRY, ORGANIC	0.9	1.39	1.52						
D33. Physical Chemistry				**1.65**	**2.84**	**3.40**			
85. CHEMISTRY, PHYSICAL	1.35	2.37	2.72						
86. ELECTROCHEMISTRY	0.19	0.31	0.48						
D34 = 87. **Polymer Science**	0.52	0.82	1.38	**0.56**	**0.87**	**1.46**			
VIII. PHYSICS							*8.1*	*10.*	*13.*
D35. Multidisciplinary Physics				**1.43**	**2.19**	**2.90**			
88. PHYSICS, MULTIDISCIPLINARY	0.92	1.49	2.11						
89. SPECTROSCOPY	0.41	0.57	0.62						
D36. Applied Physics				**2.66**	**3.02**	**4.33**			
90. ACOUSTICS	0.25	0.25	0.24						
91. OPTICS	0.75	0.91	1.12						
92. PHYSICS, APPLIED	1.59	1.88	2.95						
D37 = 93. **Physics, Atomic, Molecular & Chemical**	0.93	1.28	1.19	**1.00**	**1.36**	**1.26**			
D38 = 94. **Thermodynamics (Classical Physics)**	0.24	0.25	0.38	**0.26**	**0.27**	**0.40**			
D39 = 95. **Physics, Mathematical**	0.46	0.69	0.71	**0.49**	**0.74**	**0.75**			
D40. Particle & Nuclear Physics				**0.92**	**1.34**	**1.34**			
96. PHYSICS, NUCLEAR	0.32	0.53	0.63						
97. PHYSICS, PARTICLES & SUB-FIELDS	0.6	0.85	0.85						
D41. Physics of Solids, Fluids & Plasmas				**1.67**	**2.82**	**3.17**			
98. PHYSICS, CONDENSED MATTER	1.11	2.18	2.54						

99. PHYSICS OF SOLIDS, FLUIDS & PLASMAS	0.44	0.48	0.45						
IX. SPACE SCIENCES							*1.6*	*1.6*	*1.3*
D42 = 100. **Astronomy & Astrophysics**	1.36	1.35	1.11	**1.46**	**1.44**	**1.18**			
X. MATHEMATICS							*2.7*	*3.0*	*3.1*
D43. Applied Mathematics				**1.64**	**1.80**	**1.76**			
101. MATHEMATICS, APPLIED	0.77	0.98	1.06						
102. STATISTICS & PROBABILITY	0.48	0.41	0.37						
103. MATHEMATICS,INTERDISC. APPL.	0.29	0.34	0.3						
104. SOCIAL SCIENCES, MATH. METHODS	0.13	0.11	0.06						
D44 = 105. **Pure Mathematics**	0.94	1.16	1.35	**1.01**	**1.23**	**1.43**			
XI. COMPUTER SCIENCE							*2.5*	*2.5*	*2.2*
D45. Computer Science & Information Tech.				**2.31**	**2.27**	**1.96**			
106. COMP. SC., ARTIFICIAL INTELLIGENCE	0.37	0.45	0.4						
107. COMPUTER SCIENCE, CYBERNETICS	0.06	0.07	0.09						
108. COMP. SC., HARDWARE & ARCHITECTURE	0.3	0.15	0.21						
109. COMP. SC., INFORMATION SYSTEMS	0.44	0.29	0.34						
110. COMP. SC., INTERDIS. APPLICATIONS	0.51	0.47	0.45						
111. COMP. SC., SOFTWARE ENGINEERING	0.38	0.27	0.27						
112. COMP. SC., THEORY & METHODS	0.54	0.72	0.49						
113. MATHEMATICAL & COMPUT. BIOLOGY	0.18	0.13	0.1						
XII. ENGINEERING							*6.7*	*6.3*	*8.0*
D46. Electrical & Electronic Engineering				**2.27**	**1.85**	**2.49**			
114. ENG., ELECTRICAL & ELECTRONIC	2.03	1.67	2.29						
115. TELECOMMUNICATIONS	0.36	0.26	0.37						
D47. Civil Engineering				**0.93**	**0.70**	**0.81**			
116. ONSTRUCTION & BUILDING TECH.	0.13	0.13	0.15						
117. ENGINEERING, CIVIL	0.43	0.27	0.38						
118. ENGINEERING, ENVIRONMENTAL	0.38	0.33	0.32						
119. ENGINEERING, MARINE	0.01	0.01	0.01						
120. TRANSPORTATION SC. & TECHNOLOGY	0.16	0.06	0.08						
D48. Mechanical Engineering				**1.53**	**1.41**	**1.90**			
121. ENGINEERING, INDUSTRIAL	0.23	0.16	0.25						
122. ENGINEERING, MANUFACTURING	0.19	0.17	0.29						
123. ENGINEERING, MECHANICAL	0.6	0.5	0.76						
124. MECHANICS	0.61	0.71	0.86						
125. ROBOTICS	0.05	0.05	0.06						
D49. Instruments & Instrumentation				**0.65**	**0.82**	**0.88**			
126. INSTRUMENTS & INSTRUMENTATION	0.52	0.7	0.75						
127. IMAGING SC. & PHOTOGRAPHIC TECH.	0.09	0.08	0.08						
D50. Fuel & Energy				**0.83**	**1.10**	**1.42**			
128. ENERGY & FUELS	0.32	0.34	0.52						
129. NUCLEAR SCIENCE & TECHNOLOGY	0.42	0.69	0.8						
130. ENGINEERING, PETROLEUM	0.13	0.06	0.13						
D51. Other Engineering				**0.99**	**0.91**	**1.07**			
131. UTOMATION & CONTROL SYSTEMS	0.23	0.27	0.32						
132. ENGINEERING, MULTIDISCIPLINARY	0.34	0.28	0.38						
133. ERGONOMICS	0.06	0.06	0.04						

134. OPERATIONS RES. & MANAG. SCIENCE	0.35	0.3	0.32						
XIII. MATERIALS SCIENCE							*1.6*	*2.2*	*3.4*
D52. Materials Science				**1.41**	**2.03**	**3.10**			
135. MATERIALS SCIENCE, BIOMATERIALS	0.1	0.13	0.11						
136. MATERIALS SCIENCE, CERAMICS	0.14	0.3	0.49						
137. MAT. SC., CHARAC. & TESTING	0.07	0.08	0.14						
138. MAT. SC., COATINGS & FILMS	0.25	0.37	0.48						
139. MATERIALS SCIENCE, COMPOSITES	0.11	0.14	0.21						
140. MATERIALS SCIENCE, PAPER & WOOD	0.08	0.1	0.11						
141. MATERIALS SCIENCE, TEXTILES	0.05	0.05	0.12						
142. METALLURGY & METALL. ENGIN.	0.3	0.49	1.06						
143. NANOSCIENCE & NANOTECHNOLOGY	0.29	0.34	0.37						
XIV. GEOSCIENCES							*2.6*	*2.5*	*2.4*
D53. Geosciences & Technology				**0.99**	**1.11**	**1.07**			
144. GEOCHEMISTRY & GEOPHYSICS	0.49	0.53	0.49						
145. GEOGRAPHY, PHYSICAL	0.14	0.18	0.15						
146. GEOLOGY	0.13	0.15	0.16						
147. ENGINEERING, GEOLOGICAL	0.07	0.07	0.1						
148. PALEONTOLOGY	0.09	0.15	0.13						
149. REMOTE SENSING	0.11	0.09	0.08						
D54. Hydrology & Oceanography				**0.42**	**0.40**	**0.40**			
150. OCEANOGRAPHY	0.34	0.35	0.34						
151. ENGINEERING, OCEAN	0.08	0.04	0.06						
D55 Meteo., Atmosph., Aero., Sc. & Tech.				**0.92**	**0.63**	**0.59**			
152. METEOROLOGY & ATMOSPH. SCS.	0.63	0.48	0.44						
153 ENGINEERING, AEROSPACE	0.27	0.16	0.18						
D56. Mineralogy & Petrology				**0.16**	**0.23**	**0.31**			
154. MINERALOGY	0.09	0.16	0.16						
155. MINING & MINERAL PROCESSING	0.08	0.08	0.17						
XV. AGRIC. AND ENVIRONMENT							*4.0*	*4.2*	*4.5*
D57. Agricultural Science & Technology				**0.61**	**0.70**	**0.95**			
156. AGRICULTURAL ENGINEERING	0.09	0.06	0.07						
157. AGRICULTURE, MULTIDISCIPLINARY	0.12	0.26	0.32						
158. AGRONOMY	0.35	0.34	0.5						
D58. Plant & Animal Science & Tech,				**0.35**	**0.36**	**0.37**			
159. LIMNOLOGY	0.13	0.08	0.08						
160. SOIL SCIENCE	0.19	0.25	0.27						
D59. Environmental Science & Technology				**1.63**	**1.50**	**1.38**			
161. BIODIVERSITY CONSERVATION	0.15	0.09	0.1						
162. ENVIRONMENTAL SCIENCES	1.26	1.22	1.15						
163. ENVIRONMENTAL STUDIES	0.21	0.18	0.12						
D60. Food & Animal Science & Technology				**1.37**	**1.69**	**1.74**			
164. FOOD SCIENCE & TECHNOLOGY	0.5	0.82	0.79						
165. NUTRITION & DIETETICS	0.4	0.41	0.31						
166. AGRIC., DAIRY & ANIMAL SCIENCE	0.3	0.33	0.45						
167. HORTICULTURE	0.17	0.15	0.2						
XVI. PLAN AND ANIMAL SC.							*7.0*	*7.3*	*7.5*

D61. Animal Sciences				**1.24**	**0.89**	**1.08**			
168. ORNITHOLOGY	0.09	0.07	0.06						
169. ZOOLOGY	0.64	0.52	0.62						
170. ENTOMOLOGY	0.42	0.24	0.34						
D62. Aquatic Sciences ,				**1.06**	**1.21**	**1.29**			
171. WATER RESOURCES	0.39	0.44	0.46						
172. FISHERIES	0.22	0.2	0.35						
173. MARINE & FRESHWATER BIOLOGY	0.47	0.64	0.59						
D63. Microbiology				**1.61**	**1.89**	**1.48**			
174. MICROBIOLOGY	0.88	1.19	0.88						
175. PARASITOLOGY	0.14	0.2	0.26						
176. VIROLOGY	0.49	0.41	0.27						
D64. Plant Sciences				**1.16**	**1.50**	**1.75**			
177. FORESTRY	0.2	0.19	0.17						
178. MYCOLOGY	0.07	0.12	0.12						
179. PLANT SCIENCES	0.82	1.13	1.38						
D65 = 180. **Pure and Applied Ecology**	0.87	0.66	0.65	**0.93**	**0.70**	**0.69**			
D66 = 181. **VETERINARY SCIENCES**	0.79	0.82	0.88	**0.85**	**0.87**	**0.93**			
XVII. MULTIDISCIPLINARY							*0.4*	*0.4*	*0.7*
D67 = 182. **MULTIDISCIPLINARY SCIENCES**	0.33	0.3	0.61	**0.36**	**0.32**	**0.65**			
XVIII. RESIDUAL SUB-FIELDS							*3.8*	*5.0*	*6.4*
D68 = 183. **MATERIALS SCIENCE, MULT.**	1.36	2.23	3.23	**1.46**	**2.37**	**3.43**			
D69 = 184. **CRYSTALLOGRAPHY**	0.22	0.52	0.69	**0.24**	**0.55**	**0.73**			
D70 = 185. **GEOSCIENCES, MULT.**	0.74	0.83	0.92	**0.79**	**0.88**	**0.98**			
D71 = 186. **MED., RES. & EXPERIMENTAL**	0.89	0.7	0.67	**0.96**	**0.74**	**0.71**			
XIX. SOCIAL SCIENCES, GENERAL							*4.3*	*1.8*	*1.3*
D72. Law & Criminology				**0.52**	**0.10**	**0.06**			
187. CRIMINOLOGY & PENOLOGY	0.08	0.05	0.03						
188. LAW	0.41	0.06	0.03						
D73. Political Science & Public Administration				**0.47**	**0.22**	**0.14**			
189. POLITICAL SCIENCE	0.35	0.16	0.1						
190. PUBLIC ADMINISTRATION	0.09	0.05	0.03						
D74. Sociology & Other Social Studies				**0.91**	**0.30**	**0.27**			
191. ETHNIC STUDIES	0.03	0.01	0						
192. FAMILY STUDIES	0.2	0.03	0.03						
193. SOCIAL ISSUES	0.12	0.05	0.04						
194. SOCIAL WORK	0.17	0.04	0.04						
195. SOCIOLOGY	0.31	0.15	0.14						
196. WOMEN'S STUDIES	0.13	0.03	0.03						
D75. Education				**0.67**	**0.19**	**0.14**			
197. EDUCATION & EDUCATIONAL RES.	0.5	0.15	0.12						
198. EDUCATION, SPECIAL	0.12	0.02	0.01						
D76. Geography, Planning & Urban				**0.46**	**0.35**	**0.23**			
199. AREA STUDIES	0.08	0.03	0.05						
200. GEOGRAPHY	0.1	0.13	0.06						
201. PLANNING & DEVELOPMENT	0.12	0.11	0.07						
202. TRANSPORTATION	0.05	0.03	0.03						
2003 URBAN STUDIES	0.13	0.06	0.04						

D77. Ethics				**0.12**	**0.05**	**0.04**			
204. ETHICS	0.11	0.03	0.04						
205. MEDICAL ETHICS	0.02	0.02	0.01						
D78. Other Social Sciences				**1.30**	**0.59**	**0.42**			
206. NTHROPOLOGY	0.16	0.08	0.09						
207. COMMUNICATION	0.17	0.05	0.03						
208. DEMOGRAPHY	0.06	0.03	0.02						
209. HISTORY OF SOCIAL SCIENCES	0.03	0.02	0.01						
210. INFORMATION SC. & LIBRARY SC.	0.27	0.11	0.07						
211. INTERNATIONAL RELATIONS	0.15	0.1	0.06						
212. LINGUISTICS	0.17	0.07	0.05						
213. OCIAL SCIENCES, INTERD.	0.25	0.11	0.07						
XX. ECONOMICS & BUSINESS							*1.9*	*1.1*	*0.7*
D79. Economics				**1.06**	**0.67**	**0.42**			
214. AGRICULTURAL ECONOMICS & POLICY	0.06	0.02	0.02						
215. ECONOMICS	0.93	0.62	0.38						
216. INDUSTRIAL RELATIONS & LABOR	0.07	0.02	0.02						
D80. Business & Management				**0.87**	**0.36**	**0.25**			
217. BUSINESS	0.33	0.1	0.08						
218. BUSINESS, FINANCE	0.24	0.06	0.04						
	0.35	0.22	0.14						
ALL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table E. Number of Articles, MCR, and Publication Efforts At the Grand Field Level In the Corresponding Double Extended Count

	Number Of Articles (1)	% (2)	MCR (3)	Publication Effort By: U.S. (4)	EU (5)	RW (6)
A. LIFE SCIENCES	1,769,872	37.1	11.3	44.1	39.6	29.8
B. PHYSICAL SCIENCES	1,444,746	30.3	6.7	23.2	29.9	35.9
C. OTHER NATURAL SCS.	1,375,958	28.8	5.7	25.8	27.4	32.2
D. SOCIAL SCIENCES	181,216	3.8	3.3	6.9	3.1	2.1
ALL	**4,771,792**	**100.0**	**8.0**	**100.0**	**100.0**	**100.0**

Table F.1. Average-based Indicators At the Sub-field Level According to the Multiplicative Strategy

	M^{US} (1)	M^{EU} (2)	M^{RW} (3)	M^{US}/M^{EU} (4)	M^{RW}/M^{EU} (5)
I. BIOSCIENCES					
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
II. BIOMEDICAL RESEARCH					
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
III. CLINICAL MED. I (INTERNAL)					
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
IV. CL. MED. II (NON- INTERNAL)					
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
V. CL. M. III (HEALTH SC. & OTHER)					
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
VI. NEUROSC. & BEHAVIORAL					
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
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 & SUB-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

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

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

XIIII. 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 (ORG. & SUPRAORG.)

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
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
XX. ECONOMICS & BUSINESS					
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.2. Average-based Indicators At the Sub-field Level According to the Fractional Strategy

	M^{US}	M^{EU}	M^{RW}	M^{US}/	M^{RW}/ M^{EU}	[(4) – (9)]/ M^{EU} (4)
	(6)	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
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
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
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
DENTISTRY, ORAL SURGERY &	1.05	1.02	0.94	1.031	0.925	0.3
INTEGRATIVE & COMPLEM. MED.	1.14	0.86	1.03	1.329	1.205	-27.2
SPORT SCIENCES	1.05	0.92	1	1.134	1.085	-0.5
REPRODUCTIVE BIOLOGY	1.14	1	0.88	1.139	0.883	0.1
OBSTETRICS & GYNECOLOGY	1.17	0.97	0.85	1.200	0.880	-4.6
GERONTOLOGY	1.07	0.94	0.81	1.147	0.866	0.9
DERMATOLOGY	1.18	0.96	0.89	1.227	0.919	-1.1
ANDROLOGY	1.27	1.04	0.82	1.221	0.785	0.1
CLINICAL NEUROLOGY	1.27	0.96	0.77	1.326	0.800	-6.4
RADIO., NUCL. MED. & MEDICAL IMAG.	1.21	0.97	0.77	1.255	0.800	-0.2
RHEUMATOLOGY	1.22	0.96	0.89	1.265	0.921	-0.7
PERIPHERAL VASCULAR DISEASE	1.23	0.92	0.86	1.343	0.939	-3.6
GERIATRICS & GERONTOLOGY	1.16	0.86	0.92	1.348	1.066	-3.2
TRANSPLANTATION	1.3	0.99	0.74	1.311	0.748	2.2
ORTHOPEDICS	1.18	0.85	0.91	1.385	1.073	-0.7
SURGERY	1.31	0.92	0.76	1.435	0.832	-2.9
OPHTHALMOLOGY	1.27	0.85	0.86	1.507	1.017	-5.9
UROLOGY & NEPHROLOGY	1.3	0.91	0.78	1.434	0.861	-0.7
PSYCHIATRY	1.32	0.85	0.74	1.545	0.875	-6.8
OTORHINOLARYNGOLOGY	1.31	0.86	0.84	1.521	0.971	-3.3
PEDIATRICS	1.37	0.83	0.78	1.659	0.949	-8.3

NURSING	0.88	1.17	1.13	0.749	0.966	0.1
EDUCATION, SC. DISCIPLINES	0.99	1.12	0.92	0.882	0.815	0.9
REHABILITATION	0.97	1.08	0.99	0.902	0.924	0.4
MEDICAL INFORMATICS	1.1	0.99	0.85	1.108	0.861	-6.0
MEDICINE, LEGAL	1.05	1.06	0.88	0.993	0.829	6.2
SUBSTANCE ABUSE	1.09	0.93	0.82	1.170	0.884	-0.2
HEALTH CARE SC. & SERVICES	1.12	0.9	0.85	1.236	0.938	-0.9
PUBLIC, ENVIRON. & OCCUP. HEALTH	1.21	0.95	0.78	1.270	0.818	-3.6
HEALTH POLICY & SERVICES	1.09	0.86	0.79	1.260	0.909	-0.2
SOCIAL SCIENCES, BIOMEDICAL	0.93	1.24	0.9	0.756	0.727	7.8
PSYCHOLOGY, EXPERIMENTAL	1.04	1.06	0.83	0.982	0.780	-3.1
PSYCHOLOGY, BIOLOGICAL	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
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
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 & SUB-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
ASTRONOMY & ASTROPHYSICS	1.25	0.99	0.76	1.265	0.775	1.5
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
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. APPS.	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
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
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
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
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
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
MULTIDISCIPLINARY SCIENCES	1.74	1.26	0.61	1.382	0.483	-2.3
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
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
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

Table G.A. Average-based Indicators At the Discipline Level

DISCIPLINES	C^{US} (1)	C^{EU} (2)	C^{RW} (3)	$MNCS^{US}$ (4)	$MNCS^{EU}$ (5)	$MNCS^{RW}$ (6)	I^{US} (7)	I^{EU} (8)	I^{RW} (9)
D1. Multidisciplinary Biology	1.230	1.192	0.670	1.238	1.235	0.649	1.197	1.147	0.706
D2. Bioch., Biophysics & Molecular Biology	1.258	0.976	0.751	1.254	0.981	0.758	1.303	0.971	0.733
D3. Cell Biology	1.317	0.933	0.705	1.317	0.933	0.705	1.302	0.927	0.725
D4. Genetics & Development Biology	1.227	0.968	0.766	1.229	0.971	0.766	1.229	0.959	0.779
D5. Anatomy & Pathology	1.286	0.974	0.772	1.291	0.976	0.771	1.288	1.000	0.755
D6. Biomaterials & Bioengineering	1.376	1.009	0.737	1.356	1.006	0.747	1.335	1.020	0.747
D7. Experimental & Laboratory Medicine	1.063	1.088	0.845	1.063	1.089	0.843	1.039	1.100	0.853
D8. Pharmacology & Toxicology	1.204	1.037	0.805	1.201	1.037	0.806	1.200	1.055	0.802
D9. Physiology	1.223	0.971	0.772	1.223	0.971	0.772	1.230	0.941	0.776
D10. Cardiovascular & Respiratory Medicine	1.195	0.956	0.827	1.195	0.956	0.828	1.207	0.939	0.820
D11. Endocrinology & Metabolism	1.225	0.940	0.840	1.225	0.940	0.840	1.229	0.942	0.834
D12. General & Internal Medicine	1.472	0.937	0.701	1.419	0.939	0.730	1.401	0.958	0.717
D13. Hematology & Oncology	1.292	0.906	0.800	1.293	0.905	0.800	1.260	0.914	0.809
D14. Immunology	1.204	0.921	0.838	1.202	0.919	0.846	1.251	0.914	0.820
D15. Age & Gender Related Medicine	1.148	0.966	0.867	1.149	0.964	0.864	1.126	0.980	0.877
D16. Dentistry, Oral Surgery	1.049	1.017	0.941	1.049	1.017	0.941	1.049	1.015	0.946
D17. Dermatology & Urogenital System	1.273	0.926	0.810	1.263	0.931	0.819	1.287	0.915	0.815
D18. Ophthalmology & Otorhinolaryngology	1.282	0.850	0.855	1.287	0.852	0.852	1.242	0.857	0.865
D19. Paramedicine	1.137	0.856	1.031	1.137	0.856	1.031	0.978	0.936	1.041
D20. Psychiatry & Neurology	1.292	0.920	0.760	1.292	0.920	0.760	1.248	0.950	0.764
D21. Radiology & Nuclear Medicine	1.213	0.967	0.774	1.213	0.967	0.774	1.226	0.978	0.759
D22. Rheumatology & Orthopedics	1.144	0.926	0.922	1.132	0.912	0.933	1.064	0.977	0.936
D23. Surgery	1.279	0.922	0.798	1.293	0.923	0.782	1.267	0.955	0.767
D24. Pediatrics	1.370	0.826	0.783	1.370	0.826	0.783	1.319	0.861	0.783
D25. Health Sciences	1.127	0.967	0.816	1.094	0.986	0.842	1.085	0.983	0.864
D26. Other Clinical Medicine	1.026	1.043	0.888	1.019	1.053	0.892	0.988	1124.881	0.871
D27. Neurosciences & Psychopharmacology	1.284	0.933	0.747	1.284	0.934	0.747	1.271	0.945	0.754
D28. Psychology & Behavioral Sciences	1.103	0.943	0.835	1.122	0.925	0.815	1.082	0.976	0.846
D29. Multidisciplinary Chemistry	2.040	1.263	0.608	2.040	1.263	0.608	1.914	1.216	0.627
D30. Analytical, Inorganic & Nuclear Chem.	1.432	1.053	0.798	1.427	1.054	0.799	1.347	1.052	0.819
D31. Applied Chemistry & Chemical Eng.	1.197	1.203	0.804	1.194	1.196	0.808	1.162	1.181	0.824
D32. Organic & Medicinal Chemistry	1.311	1.049	0.818	1.310	1.049	0.820	1.324	1.043	0.824
D33. Physical Chemistry	1.434	1.076	0.792	1.433	1.077	0.793	1.396	1.059	0.813
D34. Polymer Science	1.487	1.120	0.806	1.487	1.120	0.806	1.442	1.095	0.824
D35. Multidisciplinary Physics	1.720	1.133	0.677	1.688	1.137	0.682	1.621	1.109	0.700
D36. Applied Physics	1.371	1.098	0.784	1.360	1.101	0.782	1.316	1.078	0.808
D37. Atomic, Molecular & Chemical Physics	1.217	1.019	0.835	1.217	1.019	0.835	1.243	1.022	0.834

D38. Thermodynamics	1.221	1.027	0.878	1.221	1.027	0.878	1.249	1.034	0.858
D39. Mathematical & Theoretical Physics	1.238	1.068	0.820	1.238	1.068	0.820	1.237	1.088	0.811
D40. Particle & Nuclear Physics	1.320	0.997	0.826	1.300	1.011	0.829	1.361	1.004	0.810
D41. Physics of Solids, Fluids & Plasmas	1.320	1.092	0.798	1.324	1.092	0.798	1.328	1.091	0.801
D42. Astronomy & Astrophysics	1.248	0.987	0.765	1.248	0.987	0.765	1.268	0.987	0.762
D43. Applied Mathematics	1.245	1.025	0.795	1.245	1.031	0.797	1.285	1.029	0.774
D44. Pure mathematics	1.241	1.088	0.805	1.241	1.088	0.805	1.228	1.091	0.812
D45. Computer Science	1.240	0.990	0.798	1.245	0.981	0.804	1.256	0.983	0.789
D46. Electrical & Electronic Engineering	1.347	1.009	0.774	1.351	1.008	0.771	1.303	1.004	0.790
D47. Civil Engineering	1.076	1.007	0.924	1.009	1.034	0.967	1.073	1.078	0.880
D48. Mechanical Engineering	1.272	1.044	0.815	1.251	1.048	0.824	1.254	1.062	0.807
D49. Instruments & Instrumentation	1.208	1.102	0.805	1.199	1.103	0.810	1.186	1.096	0.821
D50. Fuel & Energy	1.095	1.120	0.885	1.076	1.128	0.887	1.112	1.124	0.869
D51. Other Engineering	1.169	1.057	0.840	1.168	1.062	0.838	1.185	1.075	0.816
D52. Materials Science	1.355	1.039	0.856	1.375	1.082	0.843	1.398	1.065	0.827
D53. Geosciences & Technology	1.240	1.024	0.810	1.236	1.024	0.817	1.237	1.027	0.811
D54. Hydrology & Oceanography	1.249	1.052	0.738	1.226	1.059	0.743	1.213	1.080	0.764
D55. Meteorology, Atmos„ Aero. Sc. & Tech	1.185	1.002	0.753	1.215	0.962	0.751	1.183	1.040	0.750
D56. Mineralogy & Petrology	1.269	1.077	0.842	1.243	1.138	0.820	1.205	1.205	0.790
D57. Agricultural Science & Technology	1.208	1.271	0.772	1.202	1.274	0.772	1.163	1.223	0.783
D58. Plant & Animal Science & Technology	1.181	1.122	0.786	1.185	1.134	0.781	1.176	1.084	0.808
D59. Environmental Science & Technology	1.151	1.022	0.852	1.140	1.028	0.852	1.144	1.003	0.869
D60. Food & Animal Science & Technology	1.256	1.069	0.759	1.260	1.107	0.752	1.299	1.095	0.746
D61. Animal Sciences	1.176	1.057	0.819	1.161	1.063	0.825	1.140	1.080	0.823
D62. Aquatic Sciences	1.110	1.034	0.911	1.111	1.036	0.909	1.081	1.061	0.901
D63. Microbiology	1.217	1.017	0.779	1.224	1.028	0.781	1.280	1.024	0.746
D64. Plant Sciences	1.256	1.116	0.780	1.249	1.111	0.785	1.261	1.110	0.790
D65. Pure and Applied Ecology	1.108	1.085	0.827	1.108	1.085	0.827	1.068	1.087	0.855
D66. Veterinary Sciences	1.253	1.069	0.771	1.253	1.069	0.771	1.213	1.081	0.788
D67. Multidisciplinary	1.739	1.258	0.608	1.739	1.258	0.608	1.665	1.232	0.626
D68. Materials Science, Multidisciplinary	1.449	1.060	0.829	1.449	1.060	0.829	1.449	1.060	0.821
D69. Crystallography	1.355	1.125	0.846	1.355	1.125	0.846	1.477	1.121	0.806
D70. Geosciences, Multidisciplinary	1.309	1.073	0.776	1.309	1.073	0.776	1.234	1.083	0.795
D71. Medicine, Research & Experimental	1.514	0.900	0.628	1.514	0.900	0.628	1.379	0.929	0.678
D72. Law & Criminology	1.107	0.569	0.772	1.107	0.569	0.772	1.107	0.592	0.869
D73. Political Science & Public Administration	1.209	0.865	0.652	1.209	0.865	0.652	1.180	0.906	0.665
D74. Sociology & Other Social Studies	1.223	0.896	0.578	1.217	0.907	0.584	1.167	0.917	0.661
D75. Education	1.042	1.006	0.853	1.047	0.997	0.851	1.040	1.025	0.827
D76. Geography, Planning & Urban	1.038	1.100	0.803	1.036	1.102	0.823	0.994	1.167	0.798
D77. Ethics	1.166	0.947	0.731	1.158	0.970	0.716	1.078	1.013	0.818
D78. Other Social Sciences	1.130	0.898	0.810	1.125	0.903	0.816	1.108	0.918	0.847

D79. Economics	1.267	0.871	0.684	1.263	0.874	0.686	1.223	0.893	0.718
D80. Business & Management	1.178	0.796	0.754	1.183	0.795	0.752	1.173	0.814	0.767

Table G.B. Gaps Between Geographical Areas At the Discipline Level

	$MNCS^{US}/MNCS^{EU}$ (1)	$MNCS^{RW}/MNCS^{EU}$ (2)	C^{US}/C^{EU} (3)	C^{RW}/C^{EU} (4)	I^{US}/I^{EU} (5)	I^{RW}/I^{EU} (6)
D1. Multidisciplinary Biology	1.002	0.525	1.031	0.562	1.044	0.615
D2. Bioch., Biophysics & Molecular Biology	1.278	0.772	1.289	0.769	1.343	0.755
D3. Cell Biology	1.411	0.755	1.411	0.755	1.405	0.782
D4. Genetics & Development Biology	1.266	0.789	1.267	0.791	1.281	0.812
D5. Anatomy & Pathology	1.323	0.790	1.321	0.793	1.288	0.755
D6. Biomaterials & Bioengineering	1.348	0.743	1.364	0.730	1.309	0.732
D7. Experimental & Laboratory Medicine	0.976	0.774	0.977	0.777	0.945	0.775
D8. Pharmacology & Toxicology	1.158	0.777	1.161	0.776	1.138	0.760
D9. Physiology	1.260	0.795	1.260	0.795	1.307	0.825
D10. Cardiovascular & Respiratory Medicine	1.250	0.866	1.250	0.866	1.285	0.873
D11. Endocrinology & Metabolism	1.303	0.893	1.303	0.893	1.304	0.885
D12. General & Internal Medicine	1.512	0.777	1.570	0.747	1.463	0.748
D13. Hematology & Oncology	1.428	0.884	1.426	0.882	1.379	0.885
D14. Immunology	1.307	0.920	1.307	0.910	1.368	0.897
D15. Age & Gender Related Medicine	1.192	0.896	1.188	0.898	1.149	0.895
D16. Dentistry, Oral Surgery	1.031	0.925	1.031	0.925	1.033	0.932
D17. Dermatology & Urogenital System	1.357	0.880	1.375	0.875	1.407	0.891
D18. Ophthalmology & Otorhinolaryngology	1.510	1.000	1.508	1.006	1.449	1.009
D19. Paramedicine	1.329	1.205	1.329	1.205	1.045	1.113
D20. Psychiatry & Neurology	1.404	0.826	1.405	0.827	1.314	0.804
D21. Radiology & Nuclear Medicine	1.255	0.800	1.255	0.800	1.253	0.776
D22. Rheumatology & Orthopedics	1.241	1.023	1.235	0.996	1.089	0.959
D23. Surgery	1.401	0.847	1.388	0.866	1.327	0.804
D24. Pediatrics	1.659	0.949	1.659	0.949	1.532	0.909
D25. Health Sciences	1.110	0.854	1.166	0.844	1.104	0.879
D26. Other Clinical Medicine	0.967	0.847	0.984	0.851	0.878	0.774
D27. Neurosciences & Psychopharmacology	1.374	0.800	1.376	0.800	1.345	0.798
D28. Psychology & Behavioral Sciences	1.213	0.881	1.169	0.885	1.109	0.867
D29. Multidisciplinary Chemistry	1.616	0.481	1.616	0.481	1.574	0.516
D30. Analytical, Inorganic & Nuclear Chem.	1.355	0.759	1.360	0.758	1.281	0.779
D31. Applied Chemistry & Chemical Eng.	0.998	0.676	0.995	0.669	0.984	0.697
D32. Organic & Medicinal Chemistry	1.249	0.782	1.250	0.780	1.270	0.790
D33. Physical Chemistry	1.331	0.737	1.333	0.737	1.319	0.768
D34. Polymer Science	1.327	0.719	1.327	0.719	1.317	0.753
D35. Multidisciplinary Physics	1.484	0.599	1.518	0.598	1.461	0.631
D36. Applied Physics	1.236	0.710	1.249	0.714	1.220	0.749

D37. Atomic, Molecular & Chemical Physics	1.195	0.820	1.195	0.820	1.216	0.816
D38. Thermodynamics	1.189	0.855	1.189	0.855	1.207	0.829
D39. Mathematical & Theoretical Physics	1.159	0.768	1.159	0.768	1.137	0.745
D40. Particle & Nuclear Physics	1.286	0.820	1.324	0.829	1.356	0.806
D41. Physics of Solids, Fluids & Plasmas	1.213	0.731	1.209	0.731	1.217	0.734
D42. Astronomy & Astrophysics	1.265	0.775	1.265	0.775	1.285	0.772
D43. Applied Mathematics	1.207	0.773	1.214	0.775	1.249	0.752
D44. Pure mathematics	1.141	0.740	1.141	0.740	1.125	0.744
D45. Computer Science	1.269	0.820	1.253	0.806	1.278	0.803
D46. Electrical & Electronic Engineering	1.340	0.766	1.336	0.767	1.298	0.787
D47. Civil Engineering	0.976	0.935	1.068	0.918	0.995	0.816
D48. Mechanical Engineering	1.193	0.786	1.219	0.781	1.181	0.760
D49. Instruments & Instrumentation	1.086	0.734	1.097	0.731	1.082	0.749
D50. Fuel & Energy	0.954	0.786	0.977	0.789	0.989	0.773
D51. Other Engineering	1.101	0.789	1.106	0.794	1.102	0.759
D52. Materials Science	1.271	0.779	1.304	0.824	1.312	0.777
D53. Geosciences & Technology	1.206	0.798	1.210	0.791	1.204	0.789
D54. Hydrology & Oceanography	1.158	0.702	1.188	0.702	1.123	0.708
D55. Meteorology, Atmos,, Aero. Sc. & Tech	1.262	0.780	1.182	0.752	1.137	0.721
D56. Mineralogy & Petrology	1.093	0.720	1.178	0.782	1.000	0.655
D57. Agricultural Science & Technology	0.943	0.606	0.950	0.607	0.950	0.640
D58. Plant & Animal Science & Technology	1.046	0.689	1.052	0.701	1.084	0.746
D59. Environmental Science & Technology	1.109	0.829	1.126	0.834	1.140	0.866
D60. Food & Animal Science & Technology	1.138	0.680	1.175	0.710	1.186	0.681
D61. Animal Sciences	1.093	0.777	1.113	0.775	1.056	0.762
D62. Aquatic Sciences	1.072	0.878	1.073	0.880	1.019	0.849
D63. Microbiology	1.190	0.760	1.197	0.767	1.250	0.729
D64. Plant Sciences	1.125	0.707	1.126	0.699	1.136	0.712
D65. Pure and Applied Ecology	1.022	0.763	1.022	0.763	0.982	0.786
D66. Veterinary Sciences	1.173	0.721	1.173	0.721	1.122	0.729
D67. Multidisciplinary	1.382	0.483	1.382	0.483	1.352	0.508
D68. Materials Science, Multidisciplinary	1.367	0.782	1.367	0.782	1.367	0.774
D69. Crystallography	1.205	0.753	1.205	0.753	1.317	0.718
D70. Geosciences, Multidisciplinary	1.220	0.724	1.220	0.724	1.139	0.734
D71. Medicine, Research & Experimental	1.681	0.698	1.681	0.698	1.485	0.730
D72. Law & Criminology	1.946	1.358	1.946	1.358	1.870	1.469
D73. Political Science & Public Administration	1.397	0.754	1.397	0.754	1.302	0.733
D74. Sociology & Other Social Studies	1.342	0.644	1.365	0.645	1.273	0.721
D75. Education	1.050	0.853	1.035	0.847	1.015	0.807
D76. Geography, Planning & Urban	0.940	0.747	0.944	0.730	0.851	0.684
D77. Ethics	1.193	0.738	1.232	0.772	1.065	0.807

D78. Other Social Sciences	1.247	0.904	1.258	0.901	1.207	0.923
D79. Economics	1.445	0.785	1.455	0.786	1.370	0.805
D80. Business & Management	1.488	0.946	1.479	0.947	1.441	0.942