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# "THE EFFECT ON CITATION INEQUALITY OF DIFFERENCES IN CITATION PRACTICES AT THE WEB OF SCIENCE SUBJECT CATEGORY LEVEL"

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**Abstract.** This paper studies the impact of differences in citation practices at the sub-field, or Web of Science subject category level using the model introduced in Crespo *et al.* (2012) according to which the number of citations received by an article depends on its underlying scientific influence and the field to which it belongs. We use the same Thomson Reuters  dataset of about 4.4 million articles published in 1998-2003 with a five-year citation window used in Crespo *et al.* (2013) to analyze a classification system consisting of 22 broad fields. The main results are the following four. Firstly, as expected, when the classification system goes from 22 broad fields to 219 sub-fields the effect on citation inequality of differences in citation practices increases from approximately 14% at the field level to 18% at the sub-field level. Secondly, we estimate a set of exchange rates (*ER*s) to express the citation counts of articles in a wide quantile interval into the equivalent counts in the all-sciences case. For example, in the fractional case we find that in 187 out of 219 sub-fields the *ER*s are reliable in the sense that the coefficient of variation is smaller than or equal to 0.10. *ER*s are estimated over the [660, 978] interval that, on average, covers about 62% of all citations. Thirdly, in the fractional case the normalization of the raw data using the *ER*s (or sub-field mean citations) as normalization factors reduces the importance of the differences in citation practices from 18% to 3.8% (3.4%) of overall citation inequality. Fourthly, the results in the fractional case are essentially replicated when we adopt the multiplicative approach.

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## I. INTRODUCTION

From the beginning of Scientometrics as a field of study, scholars have been very aware of the field dependence of reference and citation counts in scientific articles (see *inter alia* Pinski and Narin, 1976, Murugesan and Moravcsik, 1978, and Garfield, 1979). In Crespo *et al.*'s (2013), three of us introduced a measurement framework where, given a classification system –namely, a classification of science into scientific disciplines–, it is possible to quantify the importance of differences in publication and citation practices. The framework is based on a simple model in which the number of citations received by an article is a function of two variables: the article's underlying scientific influence, and the field to which it belongs. Consequently, the citation inequality of the distribution consisting of all articles in all fields –the *all-sciences case*– is the result of two forces: differences in scientific influence within homogeneous fields, and differences in citation practices across disciplines. In the implementation of this model using an additively decomposable inequality index, the citation inequality attributed to the second force is captured by a between-group inequality term in a certain partition by field and citation quantile. We denote it as the *IDCP* (*I*nequality attributable to *D*ifferences in *C*itation *P*ractices) term. For expository reasons, Crespo *et al.* (2013) choose a very simple classification system consisting of the 22 broad categories distinguished by Thomson Reuters that will be refereed to as *fields*. This classification system has the important property that every publication in the periodical literature is assigned to only one field.

It should be noted that one of the assumptions of the model requires that, given the field, citation impact varies monotonically with scientific influence. Thus, if one article has greater scientific influence than another in the same field, then we expect the former to also have a greater citation impact than the latter. As pointed out in Crespo *et al.* (2013), given the heterogeneity of at least some of the 22 broad fields, adopting this assumption is not very realistic. Consider two publications *i* and *j* in the same field that belong to two research areas with a rather different citation density. Contrary to the assumption, it may very well be the case that publication *i* has a greater influence but receives fewer citations than publication *j* (for a recent contribution emphasizing differences in citation density within closed heterogeneous categories, see Van Eck *et al.*, 2012).

Consequently, the first aim of this paper is to extend the analysis to the lowest aggregation level permitted by our data, namely, the 219 Web of Science categories, or *sub-fields* also distinguished by Thomson Reuters. As is well known, a practical problem is that in the Thomson Reuters (and Scopus) databases publications in the periodical literature are assigned to sub-fields via the journal in which they have been published. Many journals are assigned to a single sub-field, but many others are assigned to two, three, or more sub-fields. As a result, only about 58% of all articles in our dataset are assigned to a single sub-field. To solve this problem, in this paper we follow two different approaches: a *fractional* strategy according to which each publication is fractioned into as many equal pieces as necessary, with each piece assigned to a corresponding sub-field, and a *multiplicative* strategy in which each paper is wholly counted as many times as necessary in the several sub-fields to which it is assigned. The conjecture is that the lower the aggregation level characterizing the classification system, the greater should be the relative effect on overall citation inequality of differences in citation practices.

Since its inception, practitioners of Scientometrics have recognized that differences in citation practices –regardless of how their impact is measured, and independently of the aggregation level– pose fundamental difficulties for direct comparisons of the absolute number of citations received by articles in different scientific disciplines. However, Crespo *et al.* (2013) show that the striking similarity between citation distributions at the field level, documented in Albarrán and Ruiz-Castillo (2011), causes the citation inequality attributable to differences in citation practices to be approximately constant over a wide range of quantiles. This makes it possible to estimate a set of average-based indicators, called *exchange rates* (*ER*s hereafter) that serve to answer the following two questions. Firstly, how many citations received by an article in a given field are equivalent to, say, 10 citations in the all-sciences case? Secondly, how much can we reduce the effect of differences in citation practices by normalizing the raw citation data with the *ER*s? Based on the similarity between citation distributions at the sub-field level –recently documented in Albarrán *et al.* (2011), Radicchi *et al.* (2008) and Radicchi and Castellano (2012) in the multiplicative case, and in Herranz and Ruiz-Castillo (2012) in the fractional case– the second aim of this paper is to extend the above empirical strategy to the sub-field level.

Naturally, the difficulty of comparing citation counts across scientific disciplines is a very well known issue. Differences in citation practices are usually taken into account by choosing the world mean citation rates as normalization factors (see *inter alia* Moed *et al.*, 1985, 1988, 1995, Braun *et al.*, 1985, Schubert *et al.*, 1983, 1987, 1988, Schubert and Braun, 1986, 1996, and Vinkler 1986, 2003). More recently, other contributions support this traditional procedure on different grounds (Radicchi *et al.*, 2008, Radicchi and Castellano, 2012a). Crespo *et al.* (2013) find that, for the 22-field classification system, this procedure leads to a slightly greater reduction of the *IDCP* term than the reduction generated by the *ER*s. Thus, the third aim of this paper is to investigate the relative performance of *ER*s and mean citation rates as normalization factors for the classification system consisting of 219 sub-fields.

To place this paper in its context, it is useful to distinguish between two types of normalization procedures. Firstly, target or "cited side" procedures, including the use of *ER*s and mean citation rates as normalization factors, as well as the recent proposals by Glänzel (2011) and Radicchi and Castellano (2012a). Beyond the two cases studied here, a wide set of target normalization procedures at the sub-field level are extensively analyzed in Castellano *et al.* (2013). Secondly, we have source or "citing side" procedures (see *inter alia* Zitt and Small, 2008, Moed, 2010, and Leydesdorff and Opthof, 2010, Glänzel *et al.*, 2011, and Waltman and Van Eck, 2012). Since our dataset lacks citing side information, applying the latter is beyond the scope of this paper. At any rate, given a classification system, the performance of the two types of procedures are compared in Radicchi and Castellano (2012b), Leydesdorff *et al.* (2012), and Watman and Van Eck (2013).

The rest of the paper consists of three Sections. Section II summarizes the model for the measurement of the effect on overall citation inequality of differences in citation practices, and presents the corresponding empirical evidence for both the fractional and the multiplicative strategy at the sub-field level. Section III presents the estimation of average-based *ER*s and their standard deviations (StDevs hereafter) over a large quantile interval in the fractional case, and explores the consequences of using them *versus* sub-field mean citations as normalization factors. Section IV studies the same issues under the multiplicative approach, while Section V contains some concluding comments.

## II. THE MEASUREMENT OF THE EFFECT ON CITATION INEQUALITY OF DIFFERENCES IN CITATION PRACTICES AT THE SUB-FIELD LEVEL

### II. 1. The Fractional Case

Suppose we have an initial citation distribution $Q = \{c_l\}$ consisting of $N$ distinct articles, indexed by $l = 1,\ldots, N$, where $c_l$ is the number of citations received by article $l$. The total number of citations is denoted by $\gamma = \Sigma_l c_l$. A sub-field is said to be *homogeneous* if the number of citations received by its papers is comparable independently of the journal in which each has been published. Assume that here are $S$ sub-fields, indexed by $s = 1,\ldots, S$. For later reference, let $N_s$ be the number of distinct articles in sub-field $s$ under the multiplicative approach, indexed by $i = 1,\ldots, N_s$. As indicated in the Introduction, the problem is that about 42% of all articles in our dataset are assigned to two or more sub-fields.

Let $X_l$ be the non-empty set of sub-fields to which article $l$ is assigned, and denote by $x_l$ the cardinal of this set, that is, $x_l = |X_l|$. Since, at most, an article is assigned to six sub-fields, we have that $x_l \in [1, 6]$. In the fractional strategy, sub-field $s$'s citation distribution can be described by $\mathbf{c}_s = \{w_{si}\ c_{si}\}$, where $w_{si} = (1/x_l)$ for all $s \in X_l$ and some article $l$ in the initial distribution for which $c_{si} = c_l$. Therefore, $\Sigma_{s \in Xl}\ w_{si} = 1$. The fractional number of articles in sub-field $s$ is $n_s = \Sigma_i w_{si}$, the citations received by each fractional article are $w_{si}\, c_{si}$, and the fractional number of citations in sub-field $s$ is $\Sigma_i w_{si}\, c_{si}$. It should be noted that $\Sigma_s n_s = \Sigma_s \Sigma_i w_{si} = \Sigma_l \Sigma_{s \in Xl} w_{si} = N$ and $\Sigma_s \Sigma_i w_{si}\, c_{si} = \gamma$, that is, in the fractional strategy the total number of articles and citations in the original dataset, and hence the mean citation, are preserved.

Any distinct article $i$ in sub-field $s$ with $c_{si} = c_l$ for some $l$ in the initial distribution $\boldsymbol{Q}$, is assumed to have a scientific influence $q_{si}$ that, for simplicity, is taken to be a single-dimensional variable. We assume that the citations received $c_{si}$ are a function of two variables: the sub-field $s$ to which the article belongs, and the scientific influence of the article in question, $q_{si}$. Thus, for every $s$ we write:

$$c_{si} = \phi(s, q_{si}),\ i = 1,\ldots, N_s. \tag{1}$$

Let $\boldsymbol{q}_s = (w_{s1}\, q_{s1},\ w_{s2}\, q_{s2},\ldots,\ w_{sN_s}\, q_{sN_s})$ with $q_{s1} \leq q_{s2} \leq \ldots \leq q_{sN_s}$ be the ordered distribution of scientific influence in every sub-field in the fractional case. Each distribution $\boldsymbol{q}_s$ is assumed to be a characteristic of sub-field $s$. No restriction is *a priori* imposed on distributions $\boldsymbol{q}_s$, $s = 1,\ldots, S$. Consequently, for any two articles $i$ and $j$ in two different fields $s$ and $t$ the values $w_{si}\, q_{si}$ and $w_{tj}\, q_{tj}$ cannot be directly compared. To overcome this difficulty, we adopt the following key assumption.

Assumption 1 (A1). *Articles at the same quantile $\pi$ of any sub-field scientific influence distribution have the same degree of scientific influence in their respective field.*

Typically, scientific influence is an unobservable variable. However, although the form of $\phi$ in Eq. 1 is unknown, we adopt the following assumption about it:

Assumption 2 (A2). *The function $\phi$ in expression (1) is assumed to be monotonic in scientific influence, that is, for every pair of articles i and j in sub-field s, if $q_{si} \leq q_{sj}$, then $c_{si} \leq c_{sj}$.*

Under A2, the degree of scientific influence uniquely determines the location of an article in its sub-field citation distribution. Consequently, for every $s$, the partition of distribution $\boldsymbol{q}_s$ into $\boldsymbol{\Pi}$ quantiles $\boldsymbol{q}_s^{\boldsymbol{\pi}}$ of size $n_s/\boldsymbol{\Pi}$, induces a corresponding partition of the citation distribution $\boldsymbol{c}_s$ into $\boldsymbol{\Pi}$ quantiles $\boldsymbol{c}_s^{\boldsymbol{\pi}}$ with the number of citations received by the $n_s/\boldsymbol{\Pi}$ articles in the $\pi$-th quantile $\boldsymbol{q}_s^{\boldsymbol{\pi}}$. Note that $\boldsymbol{c}_s^{\boldsymbol{\pi}} = \{w_{sk}^{\pi}\ c_{sk}^{\pi}\}$, with $c_{sk}^{\pi} = c_{si} = c_l$, and $w_{sk}^{\pi} = 1/x_l$ for some $k = 1,\ldots, N_s$ and some $l$ in $\boldsymbol{Q}$. Assume for a moment that we disregard the citation inequality within every vector $\boldsymbol{c}_s^{\boldsymbol{\pi}}$ by assigning to every article in that vector the (fractional) mean citation of the vector itself, $\mu_s^{\pi}$, defined by $\mu_s^{\pi} = (\Sigma_{i\in\pi}\ w_{si}\ c_{si})/\Sigma_{i\in\pi}\ w_{si}$. Since the quantiles of citation impact correspond –as we have already seen– to quantiles of the underlying scientific influence distribution, holding constant the degree of scientific influence at any $\pi$ as in A1 is equivalent to holding constant the degree of citation impact at that quantile. Thus, for any $\pi$, the difference between $\mu_s^{\pi}$ and $\mu_t^{\pi}$ for articles with the same degree of scientific influence is entirely attributable to differences in citation practices between the two sub-fields.

To implement our measurement framework, it is convenient to work with additively decomposable citation inequality indices. For reasons explained in Crespo *et al.* (2013), we choose a member of the so-called Generalized Entropy family of inequality indices, which are the only measures of relative inequality that satisfy the usual properties required from any inequality index and, in addition, are decomposable by population subgroup. This is the first Theil index, denoted by $I_1$, and defined by:

$$I_1(\boldsymbol{Q}) = (1/N)\ \Sigma_l\ (c_l/\mu)\ \log\ (c_l/\mu), \qquad (2)$$

where $\mu$ is the mean of distribution $Q$. Let $c$ be the union of all sub-field distributions $c_s$, that is, let $c = \cup_s c_s$. As we have seen already, the number of articles and the mean citation of distributions $Q$ and $c$ coincide. Clearly, citation inequality is also the same, that is, $I_1(c) = I_1(Q)$. Therefore, in the sequel we will work with distribution $c$.

For each $\pi$, let $c^{\pi} = (c_1^{\pi},\ldots, c_s^{\pi},\ldots, c_S^{\pi})$. Note that the vector $c^{\pi}$ has dimension $\Sigma_s (n_s/\Pi) = N/\Pi$, and that the set $c^{\pi}$, $\pi = 1,\ldots, \Pi$, form a partition of distribution $c$. For any $s$ and $\pi$, let $\mu_s^{\pi} = \{w_{sk}^{\pi}\ \mu_s^{\pi}\}$ be the $(n_s/\Pi)$-vector where every $c_{sk}^{\pi}$ in $c_s^{\pi} = \{w_{sk}^{\pi}\ c_{sk}^{\pi}\}$ has been replaced by the mean citation $\mu_s^{\pi}$. Similarly, for any $\pi$, let $\mu^{\pi}$ be the $(N/\Pi)$-vector where every element in $c^{\pi}$ has been replaced by the mean citation $\mu^{\pi} = \Sigma_s\, [(n_s/N]\mu_s^{\pi}$. As in Crespo *et al.* (2013), applying the decomposability property of citation inequality index $I_1$ first to the partition $c = (c^1,\ldots, c^{\pi},\ldots, c^{\Pi})$, and then to the partition $c^{\pi} = (c_1^{\pi},\ldots, c_s^{\pi},\ldots\ c_S^{\pi})$ for each $\pi$, the overall citation inequality $I_1(c)$ can be seen to be decomposable into the following three terms:

$$I_1(c) = W + S + IDCP, \tag{3}$$

with:

$$W = \Sigma_{\pi}\, \Sigma_s\, v^{\pi,s}\, I_1(c_s^{\pi})$$

$$S = I_1(\mu^1,\ldots, \mu^{\Pi})$$

$$IDCP = \Sigma_{\pi}\, v^{\pi}\, I_1(\mu_1^{\pi},\ldots, \mu_S^{\pi}) = \Sigma_{\pi}\, v^{\pi}\, I(\pi),$$

where $v^{\pi,s}$ is the share of total citations in quantile $\pi$ of sub-field $s$, and and $v^{\pi} = \Sigma_s\, v^{\pi,s}$ is the share of total citations in vector $c^{\pi}$. The term $W$ is a within-group term that captures the weighted citation inequality within each quantile in every sub-field. The term $S$ is the citation inequality of the distribution $(\mu^1,\ldots, \mu^{\Pi})$, and therefore it is a measure of citation inequality at different degrees of citation impact that captures well the skewness of science in the all-sciences case. Finally, for any $\pi$, the expression $I_1(\boldsymbol{\mu}_1^{\pi},\ldots, \boldsymbol{\mu}_S^{\pi})$, abbreviated as $I(\pi)$, is the citation inequality attributable to differences in citation practices according to $I_1$. Thus, the weighted average that constitutes the third term in expression (3), denoted by *IDCP* (*I*nequality due to *D*ifferences in *C*itation *P*ractices), provides a good measure of the citation inequality due to such differences at the sub-field level.

### II.2. The Multiplicative Approach

In the multiplicative approach each article is wholly counted as many times as necessary in the several sub-fields to which it is assigned. In this way, the space of articles is expanded as much as necessary beyond the initial size in what we call the *sub-field extended count*, say distribution $\mathbf{C}$. Then sub-field $s$'s citation distribution can be described by $\mathbf{C}_s = \{c_{si}\}$ with $i = 1,\ldots, N_s$, where $c_{si}$ is the number of citations of article $i$ in sub-field $s$, and $c_{si} = c_l$ for some article $l$ in the initial distribution. Of course, $\mathbf{C} = \cup_s \mathbf{C}_s$, and the total number of articles is $M = \Sigma_s N_s > N$.

In what follows, let us order sub-field citation distributions, so that for any $s$ we have $\mathbf{C}_s = (c_{s1},\ldots, c_{si},\ldots, c_{sN_s})$ with $c_{s1} \leq c_{s2} \leq \ldots \leq c_{sN_s}$. Consider the partition of distribution $\mathbf{C}_s$ into $\Pi$ quantiles, $\mathbf{C}_s = (\mathbf{C}_s^1,\ldots, \mathbf{C}_s^{\pi},\ldots, \mathbf{C}_s^{\Pi})$, where each vector $\mathbf{C}_s^{\pi} = \{c_{sj}\}$ with $j = 1,\ldots, N_s/\Pi$. For each $\pi$, define the citation distribution $\mathbf{C}^{\pi} = (\mathbf{C}_1^{\pi},\ldots, \mathbf{C}_s^{\pi},\ldots, \mathbf{C}_S^{\pi})$. Clearly, the number of articles in $\mathbf{C}^{\pi}$ is $\Sigma_s N_s/\Pi = M/\Pi$, and the set of vectors $(\mathbf{C}^1,\ldots,\mathbf{C}^{\pi},\ldots, \mathbf{C}^{\Pi})$ form a partition of distribution $\mathbf{C}$. For any $s$ and $\pi$, let $\mathbf{m}_s^{\pi}$ be the $(N_s/\Pi)$-vector where every $c_{sj}^{\pi}$ in $\mathbf{C}_s^{\pi} = \{c_{sj}^{\pi}\}$ has been replaced by the mean citation $m_s^{\pi} = (\Sigma_j$

$c_{sj}^{\pi})/(N_s/\Pi)$. Similarly, for any $\pi$, let $\boldsymbol{m}^{\pi}$ be the $(N/\Pi)$-vector where every element in $\boldsymbol{C}^{\pi}$ has been replaced by the mean citation $m^{\pi} = \Sigma_s\ [(n_s/N]m_s^{\pi}$. Applying the decomposability property of citation inequality index $I_1$ first to the partition $\boldsymbol{C} = (\boldsymbol{C}^1,\ldots,\boldsymbol{C}^{\pi},\ldots, \boldsymbol{C}^{\Pi})$, and then to the partition $\boldsymbol{C}^{\pi} = (\boldsymbol{C}_1^{\pi},\ldots, \boldsymbol{C}_s^{\pi},\ldots, \boldsymbol{C}_S^{\pi})$ for each $\pi$, the overall citation inequality $I_1(\boldsymbol{C})$ can be seen to be decomposable into the following three terms analogous to what we had in expression (3):

$$I_1(\boldsymbol{C}) = W' + S' + IDCP', \tag{4}$$

with:

$$W' = \Sigma_{\pi}\, \Sigma_s\, V^{\pi,s}\, I_1(\boldsymbol{C}_s^{\pi})$$

$$S' = I_1(\boldsymbol{m}^1,\ldots, \boldsymbol{m}^{\Pi})$$

$$IDCP' = \Sigma_{\pi}\, V^{\pi}\, I_1(\boldsymbol{m}_1^{\pi},\ldots, \boldsymbol{m}_S^{\pi}),$$

where $V^{\pi,s}$ is the share of total citations in quantile $\pi$ of sub-field $s$, and $V^{\pi} = \Sigma_s V^{\pi,s}$ is the share of total citations in vector $\boldsymbol{C}^{\pi}$. As before, the term $W'$ is a within-group citation inequality term, $S'$ captures the skewness of science, and $IDCP'$ is the citation *I*nequality that can be attributed to *D*ifferences in *C*itation *P*ractices in the multiplicative case.

### II.3. Empirical results

In this paper only research articles or, simply, articles, are studied. Our dataset consists of 4.4 million articles published in 1998-2003, and the 35 million citations they receive after a common five-year citation window for every year.[1] The extended count is 7,027,037, or 57.4% larger than the total number of articles in the fractional approach. Table A in the Appendix presents the number of articles and mean citation

[1] It should be noted that, due to some missing variables, this dataset has only 4,465,348 articles, or 6,984 articles fewer than the dataset in Crespo *et al.* (2013). Because this slight change, overall citation inequality is 0.8644 rather than 0.8755 as in Crespo *et al.* (2013).

rates in the fractional case. For convenience, sub-fields are classified in terms of 19 fields, and four large groups: Life Sciences, Physical Sciences, Other Natural Sciences, and Social Sciences, which represent, respectively, 40.1%, 30.2%, 25.8%, and 3.9% of all articles (the same information for the multiplicative case is available on request).

Table 1, which includes the decompositions of $I_1(c)$ and $I_1(C)$ presented in expressions (3) and (4), respectively, deserves the following three comments.[2] Firstly, as in Crespo *et al.* (2013), the terms $W$ and $W'$ are small, while the terms $S$ and $S'$ are large. Secondly, as expected, the importance of the effect on overall citation inequality of differences in citation practices is larger when working with 219 sub-fields than with 22 broad fields. In particular, the *IDCP* term that represents in Crespo *et al.* (2013) about 14% of overall citation inequality increases four percentage points, up to 17.95%, in the fractional case. Thirdly, interestingly enough the *IDCP'* term in the multiplicative case represents 18.1% of overall citation inequality, a figure remarkably close to the corresponding one in the fractional case.

**Table 1 around here**

## III. NORMALIZATION PROCEDURES. THE FRACTIONAL CASE

This Section analyzes two empirical problems in the fractional case: (i) how to compare the citations received by two articles in any pair of the 219 sub-fields in our dataset by using *ER*s that are approximately constant over a large quantile interval, (ii) how much the *IDCP* term is reduced when these *ER*s, or the field mean citations are used as normalization factors. In the third place, we study the robustness of these results in the multiplicative approach.

### III. 1. The Comparison of Citation Counts Across Different Fields

What we call the *exchange rates at quantile* $\pi$, $e_s(\pi)$, defined by

[2] As in Crespo *et al.* (2013), in the definition of the inequality index $I_1$ in expressions (3) and (4), we have followed the convention 0 log(0) = 0 for articles without citations.

$$e_s(\pi) = \mu_s^{\pi} / \mu^{\pi}, \quad (9)$$

allow us to answer the following question: how many citations for an article at the degree $\pi$ of scientific influence in sub-field $s$ are equivalent on average to one citation in the all-fields case? In the metaphor according to which a sub-field's citation distribution is like an income distribution in a certain currency, the exchange rates $e_s(\pi)$ permit to express all citations in the same reference currency for that $\pi$: since $c_{si}$ is the number of citations received by article $i$ in quantile $\pi$ of sub-field $s$, the ratio $c_{si}^*(\pi) = c_{si}/e_s(\pi)$ is the equivalent number of citations in the reference currency at that quantile. Naturally, if for many fields $e_s(\pi)$ were to drastically vary with $\pi$, then we might not be able to claim that differences in citation of practices have a common element that can be precisely estimated. However, it has been established that the shapes of sub-field citation distributions are highly skewed and, what is more important for our purposes, very similar indeed. In particular, in the fractional case, on average over the 219 sub-fields 68.3% of all articles (with a StDev of 3.4) receive citations below the mean, and account for 21.5% (4.2) of all citations, while articles with a remarkable or outstanding number of citations represent 10.2% (1.6) of the total, and account for 44.7% (3.9) of all citations (see Herranz and Ruiz-Castillo, 2012). As we will presently see, the similarity between sub-field citation distributions imply that exchange rates are sufficiently constant over a wide range of quantiles.

Figure 1 represents how the effect of differences in citation practices, measured by $I(\pi)$, changes with $\pi$ when $\Pi = 1{,}000$ (since $I(\pi)$ is very high for $\pi < 260$, for clarity these quantiles are omitted from Figure 1). It is observed that $I(\pi)$ is particularly high until $\pi \approx 600$, as well as for a few quantiles at the very upper tail of citation distributions. However, as in Crespo *et al.* (2013) $I(\pi)$ is rather similar for a wide range of intermediate values, indicating that, over that interval, sub-field citation distributions essentially differ by a scale factor. In this situation, for each $s$ it is reasonable to define an average-based *exchange rate* (*ER*) over some interval $[\pi_m, \pi^M]$ in that range as

$$ER_s = [1/(\pi^M - \pi_m)] [\Sigma_\pi e_s(\pi)], \quad (5)$$

where, for each $\pi$,

$$e_s(\pi) = \mu_s^\pi/\mu^\pi.$$

**Figure 1 around here**

We find that the choice $[\pi_m, \pi^M] = [661, 978]$ –where $I(\pi)$ for most $\pi$ is equal to $I(\pi_m) = 0.1356$ and $I(\pi^M) = 0.1392$– is a good one. The *ER*s, as well as the StDev, and the coefficient of variation (*CV* hereafter) are in columns 1 to 3 in Table 2. For convenience, *ER*s are multiplied by 10. Thus, for example, the first row indicates that 10.3 citations with a StDev of 0.3 for an article in Biology between, approximately, the $66^{st}$ and the $98^{th}$ percentile of its citation distribution, are equivalent to 10 citations for an article in that interval in the all-sciences case. We find it useful to divide fields into four groups according to the *CV*. Group I (colored in dark green in Table 2), consisting of 69 sub-fields, has a *CV* smaller than or equal to 0.05. This means that the StDev of the exchange rate is less than or equal to five percent of the exchange rate itself. Hence, we consider *ER*s in this group as highly reliable. Group II (pale green), consisting of 118 sub-fields, has a *CV* between 0.05 and 0.10. We consider *ER*s in this group as fairly reliable. Group III (orange), consists of 22 sub-fields, has a *CV* between 0.10 and 0.15. This group includes some important sub-fields, such as *Physics, Particles and Fields; Information and Library Science*, and *Political Science* (sub-fields 97, 210, and 189), as well seven out of eight sub-fields within the broad field *Computer Science* (the exception is *Mathematical and Computational Biology*) that is known to behave as an outlier (Herranz and Ruiz-Castillo, 2012, and Crespo *et al.*, 2013). Some would find *ER*s in this group as minimally reliable, while others will find them quite unreliable. Finally, Group IV (red), consisting of nine sub-fields, has a *CV* greater than 0.15. This group includes *Multidisciplinary Sciences* and *Physics, Multidisciplinary*, hybrid sub-fields some of which also behave badly in Radicchi and Castellano (2012a). *ER*s in this group can be considered unreliable.

**Table 2 around here**

As is observed in column 4 in Table 2, on average the [661, 978] interval includes 62.2% of all citations (with a StDev of 3.0). Although this is a relatively large percentage, expanding the interval in either direction would bring a larger percentage of citations. It turns out that, when we do this, the *ER*s do not change much. However, they exhibit greater variability. For example, moving the upper bound $\pi^M$ to quantile 986 or 995 would increase the percentage of citations to 66.7% (StDev = 3.3) or 73.1% (StDev = 3.9). However, the CV would increase in all but five and two sub-fields, the number of sub-fields in Group I would decrease from 69 in the reference case down to 63 or 52, while the number of sub-fields in Groups III and IV would increase from 32 to 34 and 39. In the other direction, moving the lower bound $\pi_m$ to quantiles 637, or 614, for example, would slightly increase the percentage of citations to 64.3%, (StDev = 3.0) and 66.2% (StDev = 2.9). However, relative to the initial choice, in these two instances the *CV* would increase in one sub-field, the number of fields in Groups I would decrease from 69 to 64 and 58, while the number of sub-fields in Groups III and IV would increase from 32 to 39 and 42. On the other hand, after normalization by the *ER*s corresponding to the four alternatives [706, 986], [706, 995], [637, 978], and [614, 978], the *IDCP* term represents essentially the same percentage of the overall citation inequality in the normalized distributions. Therefore, we retain the interval [661, 978] in the sequel.

### III. 2. Normalization Results

In the first place, we want to assess the normalization procedure based on *ER*s whereby the citations received by any article *i* in sub-field *s*, $c_{si}$, are converted into normalized citations $c_{si}$* as follows: $c_i$* = $c_{si}/ER_s$. The numerical results before and after this normalization are in Panels A and B in Table 3. As in Crespo *et al.* (2013), the terms *W* and *S* remain essentially constant after normalization by the *ER*s. In absolute terms the *IDPC* term is reduced from 0.1552 to 0.0293, a 81.1% difference. Of course, total citation inequality after normalization is also reduced. On balance, the *IDPC* term after normalization only represents 3.85% of total citation inequality –an important reduction from the 17.95% with the raw data.

**Table 3 around here**

However, it should be recognized that in the last 22 quantiles and, above all, in the [1, 660] interval normalization results quickly deteriorate. Figure 2, which focuses on the product $v^{\pi} I(\pi)$ as a function of $\pi$, illustrates the situation. Of course, the term *IDCP* introduced in expression (3) is equal to the integral of this expression (for clarity, quantiles $\pi < 600$, and $\pi > 994$, are omitted from Figure 2). Relative to the blue curve, the red curve illustrates the correction achieved by normalization with the 219 *ER*s: the size of the *IDCP* term is very much reduced, particularly in the [661, 978] interval.

**Figure 2 around here**

Finally, as in Crespo *et al.* (2013) it is interesting to examine the consequences of the traditional procedure in which sub-field mean citations are taken as normalization factors. The exchange rates based on mean citations, $e_s(\mu_s) = \mu_s/\mu$, are in column 5 in Table 2. As illustrated in Figure 3, they are very close indeed to our own $ER_s$. As a matter of fact, they are between one StDev of the $ER_s$ for 50 sub-fields out of 69 in Group I, 102 out of 118 in Group II, 22 out of 23 in Group III, and in all nine cases in Group IV. When sub-field mean citations are used as normalization factors, the *IDCP* term only represents 3.45% of total citation inequality (see Panel C in Table 3). The two solutions are so near that we refrain to illustrate the latter in Figure 2 because it will be indistinguishable from the red curve after normalization by our *ER*s.[3]

**Figure 3 around here**

The similarity between the results of the two normalization procedures lies in the fact that, as we have seen in Figure 1, sub-field citation distributions appear to differ by a set of scale factors only in the

[3] This confirms the results in both Crespo *et al.* (2013) and Radicchi and Castellano (2012a).

[660, 978] interval. These scale factors are well captured by any average-based measure of what takes place in that interval –such as our *ER*s. However, as documented in Herranz and Ruiz-Castillo (2012), sub-field mean citations in the fractional approach, $\mu_s$, are reached, on average, at the 68.3 percentile with a StDev of 3.4, that is, in the interior of the [661, 978] interval. This is the reason why the *ER*s based on mean citations also work so well.

## IV. NORMALIZATION PROCEDURES. THE MULTIPLICATIVE CASE

The information about the evolution of $I(\pi)$ as a function of $\pi$ (available on request), as well as the aim of facilitating the comparison with the fractional case justifies the same choice as before: $[\pi_m, \pi^M]$ = [661, 978]. The corresponding *ER*s, StDevs, and *CV*s are in columns 1 to 3 in Table 4. As observed in column 4, on average the percentage of citations covered in this interval is 62.3% (with a StDev equal to 3.0). The *ER*s based on sub-field citation means appear in column 5, while the consequences of the normalization using both sets of *ER*s are in Table 5.

**Tables 4 and 5 around here**

This massive information deserves the following four comments. Firstly, Groups I, II, III, and IV consist now of 77, 113, 19, and 10 sub-fields –figures that slightly improve on those obtained in the fractional case. Secondly, the normalization using our own *ER*s or those based on sub-field mean citations reduces the *IDCP'* term to 3.57% and 3.27%, respectively. Thus, in both cases normalization results slightly improve what was obtained under the fractional approach. Thirdly, it should be emphasized that the success of our empirical strategy in the multiplicative case is again based on the similarity of the shapes of sub-field citation distributions: on average over the 219 sub-fields 68.6% of all articles (with a StDev of 3.7) receive citations below the mean, and account for 21.1% (5.0) of all citations, while articles with a remarkable or outstanding number of citations represent 10.2% (1.6) of the total, and account for 44.9%

(4.6) of all citations (see Albarrán *et al.*, 2011). Fourthly, the results in the fractional and the multiplicative cases are extremely similar: except for two sub-fields, the multiplicative *ER*s are always within one StDev of the fractional ones (see the illustration in Figure 4). As indicated in Herranz and Ruiz-Castillo (2012), the similarity of the citation characteristics of articles published in journals assigned to one or several sub-fields guarantees that choosing one of the two strategies may not lead to a radically different picture in practical applications.

**Figure 4 around here**

## V. CONCLUSIONS

The lessons that can be drawn from this paper can be summarized in the following four points.

1. As expected, the relative importance of the citation inequality attributable to differences in citation practices is greater at lower aggregation levels. In particular, the *IDCP* term that represents about 14% of overall citation inequality in the case of 22 broad fields (Crespo *et al.*, 2013), represents approximately 18% with the 219 sub-fields identified with the Web of Science subject-categories distinguished by Thomson Reuters.

2. The regularities found in Crespo *et al.* (2013) for 22 fields characterize also the sub-field level studied in this paper. The citation inequality attributable to differences in citation practices is very high and variable for both a long lower tail –consisting of uncited and poorly cited articles below the mean– and a small number of quantiles at the very upper tail of citation distributions where citation excellence possibly resides. However, the *IDCP* term remains relatively constant for a wide range of intermediate quantiles. The conjecture is that this constancy reflects the fact that, approximately, citation distributions over that range differ only by a scale factor. This allows us to estimate a set of *ER*s to express the citation counts of articles in that interval into the equivalent counts in a reference situation, namely, the all-sciences case. For example, in the fractional case we find that in 187 out of 219 sub-fields, or 85% of the total, the *ER*s have

a tolerably low coefficient of variation, that is, a coefficient of variation smaller than or equal to 0.10. The *ER*s are estimated over a [660, 978] interval that, on average, covers about 62% of all citations in each sub-field.

3. The normalization of the raw data using the *ER*s as normalization factors is rather successful: in the fractional case, we find that the *IDCP* term at the sub-field level is reduced from 18% to 3.8%, while the procedure using mean citations as normalization factors achieves even slightly better results. The reason for this coincidence is that mean citations are essentially located at approximately the 69$^{th}$ percentile of citation distributions, very near the lower bound or inside the quantile interval where citation distributions appear to differ only by a scale factor.

4. Interestingly enough, our results at the lowest aggregate level about the *ER*s and their role as normalization factors in the fractional case are essentially replicated when we adopt the multiplicative approach.

Among the possible extensions of our work, we will comment on the following three. Firstly, as already pointed out in Crespo *et al.* (2013), since the citation process evolves at different velocity in different scientific domains, using variable citation windows to ensure that the process has reached a similar stage in all domains should improve the comparability of citation distributions at the lower tail. Secondly, we should test our results on the selection of *ER*s and normalization in a statistical framework using, for example, a bootstrap approach. Thirdly, as indicated in the Introduction, in a companion paper Castellano *et al.* (2013) study by how much the *IDCP* term is reduced when using a number of alternative normalization procedures that includes the non-linear transformation advocated by Radicchi and Castellano (2012a).

It should be concluded that the striking similarity of citation distributions at different aggregate levels seems to provide a firm basis for the solution of the following two crucial practical problems: the comparison of citation counts across different scientific disciplines, and the normalization of the raw citation data before aggregating heterogeneous fields into larger categories.

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## STATISTICAL APPENDIX

**Table A. Number of Articles and Mean Citation Rates in the 219 Sub-fields and the 19 Fields in the Fractional Case**

| | Number of Articles (1) | % (2) | Mean Citation (3) | Standard Deviation (4) |
|---|---|---|---|---|
| **A. LIFE SCIENCES** | | | | |
| *I. BIOSCIENCES* | **342,480.5** | **7.67** | **15.8** | **20.1** |
| 1. BIOLOGY | 19,590.7 | 0.44 | 7.3 | 8.4 |
| 2. BIOLOGY, MISCELLANEOUS | 277.1 | 0.01 | 3.3 | 0.9 |
| 3. EVOLUTIONARY BIOLOGY | 5,953.0 | 0.13 | 12.6 | 11.5 |
| 4. BIOCHEMICAL RESEARCH METHODS | 17,636.6 | 0.39 | 9.6 | 10.7 |
| 5. BIOCHEMISTRY & MOLECULAR BIOLOGY | 161,192.8 | 3.61 | 17.4 | 19.7 |
| 6. BIOPHYSICS | 28,162.4 | 0.63 | 10.9 | 8.3 |
| 7. CELL BIOLOGY | 53,873.7 | 1.21 | 21.2 | 20.3 |
| 8. GENETICS & HEREDITY | 43,311.1 | 0.97 | 15.8 | 20.3 |
| 9. DEVELOPMENTAL BIOLOGY | 12,483.3 | 0.28 | 20.0 | 17.6 |
| *II. BIOMEDICAL RESEARCH* | **247,383.6** | **5.54** | **9.0** | **9.9** |
| 10. PATHOLOGY | 22,487.5 | 0.50 | 9.9 | 11.7 |
| 11. ANATOMY & MORPHOLOGY | 4,835.0 | 0.11 | 5.5 | 5.2 |
| 12. ENGINEERING, BIOMEDICAL | 12,047.9 | 0.27 | 7.1 | 4.8 |
| 13. BIOTECHNOLOGY & APPLIED MICROBIOLOGY | 37,682.5 | 0.84 | 9.2 | 11.4 |
| 14. MEDICAL LABORATORY TECHNOLOGY | 8,619.5 | 0.19 | 6.6 | 8.9 |
| 15. MICROSCOPY | 3,376.8 | 0.08 | 6.3 | 6.4 |
| 16. PHARMACOLOGY & PHARMACY | 77,316.8 | 1.73 | 8.5 | 8.8 |
| 17. TOXICOLOGY | 19,485.3 | 0.44 | 7.3 | 5.8 |
| 18. PHYSIOLOGY | 29,551.8 | 0.66 | 10.9 | 7.9 |
| 19. MEDICINE, RESEARCH & EXPERIMENTAL | 31,980.5 | 0.72 | 12.2 | 18.0 |
| *III. CLINICAL MEDICINE I (INTERNAL)* | **440,082.7** | **9.86** | **12.6** | **22.8** |
| 20. CARDIAC & CARDIOVASCULAR SYSTEMS | 44591.9 | 1.00 | 10.2 | 12.3 |
| 21. RESPIRATORY SYSTEM | 19873.3 | 0.45 | 10.1 | 8.9 |
| 22. ENDOCRINOLOGY & METABOLISM | 47015.3 | 1.05 | 13.8 | 17.2 |
| 23. ANESTHESIOLOGY | 16604.1 | 0.37 | 6.8 | 7.9 |
| 24. CRITICAL CARE MEDICINE | 9488.3 | 0.21 | 11.5 | 11.4 |
| 25. EMERGENCY MEDICINE | 5752.0 | 0.13 | 4.7 | 5.6 |

| | | | | |
|---|---|---|---|---|
| 26. GASTROENTEROLOGY & HEPATOLOGY | 35192.5 | 0.79 | 11.1 | 16.3 |
| 27. MEDICINE, GENERAL & INTERNAL | 68428.2 | 1.53 | 13.6 | 51.5 |
| 28. TROPICAL MEDICINE | 3793.3 | 0.08 | 5.4 | 3.4 |
| 29. HEMATOLOGY | 33278.8 | 0.75 | 15.9 | 17.0 |
| 30. ONCOLOGY | 74461.9 | 1.67 | 15.0 | 22.6 |
| 31. ALLERGY | 5783.1 | 0.13 | 8.3 | 6.3 |
| 32. IMMUNOLOGY | 53757.7 | 1.20 | 16.7 | 18.9 |
| 33. INFECTIOUS DISEASES | 22062.3 | 0.49 | 11.3 | 9.2 |
| *IV. CLINICAL MEDICINE II (NON-INTERNAL)* | **490,198.0** | **10.98** | **7.8** | **9.2** |
| 34. GERIATRICS & GERONTOLOGY | 6,566.1 | 0.15 | 7.9 | 6.2 |
| 35. OBSTETRICS & GYNECOLOGY | 27,665.7 | 0.62 | 6.6 | 6.9 |
| 36. ANDROLOGY | 1,663.5 | 0.04 | 5.7 | 6.8 |
| 37. REPRODUCTIVE BIOLOGY | 10,972.9 | 0.25 | 10.2 | 7.6 |
| 38. GERONTOLOGY | 4,473.6 | 0.10 | 6.8 | 5.1 |
| 39. DENTISTRY & ORAL SURGERY | 22,405.0 | 0.50 | 5.3 | 6.1 |
| 40. DERMATOLOGY | 21,692.7 | 0.49 | 6.2 | 8.1 |
| 41. UROLOGY & NEPHROLOGY | 36,395.5 | 0.82 | 9.4 | 13.7 |
| 42. OTORHINOLARYNGOLOGY | 16,012.2 | 0.36 | 4.0 | 3.7 |
| 43. OPHTHALMOLOGY | 28,190.0 | 0.63 | 7.2 | 10.2 |
| 44. INTEGRATIVE & COMPLEMENTARY MEDICINE | 1,708.3 | 0.04 | 4.2 | 4.0 |
| 45. CLINICAL NEUROLOGY | 46,788.9 | 1.05 | 9.7 | 10.2 |
| 46. PSYCHIATRY | 29,982.2 | 0.67 | 10.3 | 11.3 |
| 47. RADIOLOGY, NUCLEAR MED. & MED. IMAGING | 45,722.9 | 1.02 | 8.0 | 9.5 |
| 48. ORTHOPEDICS | 17,814.0 | 0.40 | 5.7 | 5.0 |
| 49. RHEUMATOLOGY | 12,684.5 | 0.28 | 11.3 | 16.6 |
| 50. SPORT SCIENCES | 15,515.9 | 0.35 | 5.8 | 5.4 |
| 51. SURGERY | 74,364.1 | 1.67 | 6.4 | 6.5 |
| 52. TRANSPLANTATION | 9,570.3 | 0.21 | 7.0 | 4.2 |
| 53. PERIPHERAL VASCULAR DISEASE | 26,002.3 | 0.58 | 13.8 | 13.3 |
| 54. PEDIATRICS | 34,007.5 | 0.76 | 6.1 | 7.7 |
| *V. CLINICAL MEDICINE III* | **86,658.5** | **1.94** | **5.9** | **6.0** |
| 55. HEALTH CARE SCIENCES & SERVICES | 7,940.6 | 0.18 | 5.7 | 4.1 |
| 56. HEALTH POLICY & SERVICES | 4,799.4 | 0.11 | 5.9 | 4.1 |
| 57. MEDICINE, LEGAL | 3,991.6 | 0.09 | 4.4 | 5.1 |
| 58. NURSING | 9,202.2 | 0.21 | 3.1 | 3.6 |
| 59. PUBLIC, ENV. & OCCUPATIONAL HEALTH | 37,040.0 | 0.83 | 7.7 | 7.8 |

| | | | | |
|---|---|---|---|---|
| 60. REHABILITATION | 10,015.6 | 0.22 | 4.1 | 3.5 |
| 61. SUBSTANCE ABUSE | 6,574.7 | 0.15 | 7.5 | 6.6 |
| 62. EDUCATION, SCIENTIFIC DISCIPLINES | 4,667.8 | 0.10 | 2.9 | 2.3 |
| 63. MEDICAL INFORMATICS | 2,426.8 | 0.05 | 4.1 | 2.1 |
| | | | | |
| *VI. NEUROSCIENCES & BEHAVIORAL* | **184,618.5** | **4.13** | **9.8** | **10.1** |
| 64. NEUROIMAGING | 2,603.3 | 0.06 | 10.8 | 5.6 |
| 65. NEUROSCIENCES | 89,408.4 | 2.00 | 14.2 | 15.6 |
| 66. BEHAVIORAL SCIENCES | 7,069.2 | 0.16 | 9.2 | 4.1 |
| 67. PSYCHOLOGY, BIOLOGICAL | 1,760.5 | 0.04 | 7.5 | 3.4 |
| 68. PSYCHOLOGY | 7,229.1 | 0.16 | 7.9 | 3.9 |
| 69. PSYCHOLOGY, APPLIED | 6,307.8 | 0.14 | 5.0 | 5.0 |
| 70. PSYCHOLOGY, CLINICAL | 14,166.8 | 0.32 | 7.1 | 6.9 |
| 71. PSYCHOLOGY, DEVELOPMENTAL | 7,866.2 | 0.18 | 7.4 | 6.7 |
| 72. PSYCHOLOGY, EDUCATIONAL | 4,820.3 | 0.11 | 4.8 | 5.3 |
| 73. PSYCHOLOGY, EXPERIMENTAL | 11,416.3 | 0.26 | 7.0 | 6.2 |
| 74. PSYCHOLOGY, MATHEMATICAL | 910.0 | 0.02 | 5.6 | 3.9 |
| 75. PSYCHOLOGY, MULTIDISCIPLINARY | 16,339.0 | 0.37 | 4.3 | 7.7 |
| 76. PSYCHOLOGY, PSYCHOANALYSIS | 2,109.6 | 0.05 | 2.2 | 2.9 |
| 77. PSYCHOLOGY, SOCIAL | 9,586.7 | 0.21 | 6.6 | 8.4 |
| 78. SOCIAL SCIENCES, BIOMEDICAL | 3,025.5 | 0.07 | 5.6 | 3.5 |
| | | | | |
| **B. PHYSICAL SCIENCES** | | | | |
| *VII. CHEMISTRY* | **513,159.1** | **11.49** | **7.4** | **8.7** |
| 79. CHEMISTRY, MULTIDISCIPLINARY | 99,218.4 | 2.22 | 9.3 | 14.7 |
| 80. CHEMISTRY, INORGANIC & NUCLEAR | 42,292.0 | 0.95 | 6.9 | 7.2 |
| 81. CHEMISTRY, ANALYTICAL | 51,764.0 | 1.16 | 7.8 | 8.7 |
| 82. CHEMISTRY, APPLIED | 17,483.2 | 0.39 | 4.8 | 2.8 |
| 83. ENGINEERING, CHEMICAL | 44,458.1 | 1.00 | 4.1 | 4.2 |
| 84. CHEMISTRY, MEDICINAL | 14,015.7 | 0.31 | 8.9 | 7.6 |
| 85. CHEMISTRY, ORGANIC | 76,098.6 | 1.70 | 8.1 | 8.9 |
| 86. CHEMISTRY, PHYSICAL | 95,580.2 | 2.14 | 8.0 | 7.9 |
| 87. ELECTROCHEMISTRY | 15,409.6 | 0.35 | 7.1 | 6.2 |
| 88. POLYMER SCIENCE | 56,839.4 | 1.27 | 6.5 | 8.8 |
| | | | | |
| *VIII. PHYSICS* | **522,921.8** | **11.71** | **6.4** | **11.2** |
| 89. PHYSICS, MULTIDISCIPLINARY | 92,884.0 | 2.08 | 8.5 | 20.2 |
| 90. SPECTROSCOPY | 19,435.0 | 0.44 | 5.5 | 4.6 |

| | | | | |
|---|---|---|---|---|
| 91. ACOUSTICS | 10,604.0 | 0.24 | 4.1 | 3.8 |
| 92. OPTICS | 45,132.7 | 1.01 | 5.4 | 6.9 |
| 93. PHYSICS, APPLIED | 100,099.9 | 2.24 | 6.6 | 9.2 |
| 94. PHYSICS, ATOMIC, MOLECULAR & CHEMICAL | 43,633.8 | 0.98 | 9.3 | 8.2 |
| 95. THERMODYNAMICS | 7,968.4 | 0.18 | 3.4 | 1.8 |
| 96. PHYSICS, MATHEMATICAL | 22,179.4 | 0.50 | 5.7 | 5.3 |
| 97. PHYSICS, NUCLEAR | 18,519.7 | 0.41 | 5.7 | 7.4 |
| 98. PHYSICS, PARTICLES & SUB-FIELDS | 28,648.3 | 0.64 | 10.1 | 20.6 |
| 99. PHYSICS, CONDENSED MATTER | 86,321.6 | 1.93 | 6.3 | 8.6 |
| 100. PHYSICS OF SOLIDS, FLUIDS & PLASMAS | 17,900.6 | 0.40 | 6.9 | 5.8 |
| 101. CRYSTALLOGRAPHY | 29,594.6 | 0.66 | 4.0 | 28.9 |
| *IX. SPACE SCIENCES* | **61,173.1** | **1.37** | **12.0** | **19.2** |
| 102. ASTRONOMY & ASTROPHYSICS | 61,173.1 | 1.37 | 12.0 | 19.2 |
| *X. MATHEMATICS* | **139,956.3** | **3.13** | **2.8** | **9.4** |
| 103. MATHEMATICS, APPLIED | 41,617.9 | 0.93 | 2.7 | 3.2 |
| 104. STATISTICS & PROBABILITY | 19,012.8 | 0.43 | 3.6 | 7.7 |
| 105. MATH., INTERDISCIPLINARY APPLICATIONS | 8,159.0 | 0.18 | 4.1 | 2.6 |
| 106. SOCIAL SCIENCES, MATHEMATICAL METHODS | 2,598.8 | 0.06 | 4.2 | 3.1 |
| 107. PURE MATHEMATICS | 68,567.8 | 1.54 | 2.0 | 2.9 |
| *XI. COMPUTER SCIENCE* | **113,370.0** | **2.54** | **3.4** | **5.8** |
| 108. COMP. SCIENCE, ARTIFICIAL INTELLIGENCE | 21,725.7 | 0.49 | 3.2 | 5.0 |
| 109. COMPUTER SCIENCE, CYBERNETICS | 2,965.5 | 0.07 | 2.4 | 2.7 |
| 110. COMP. SCIENCE, HARDWARE & ARCHITECTURE | 6,329.8 | 0.14 | 2.7 | 2.4 |
| 111. COMPUTER SCIENCE, INFORMATION SYSTEMS | 12,870.5 | 0.29 | 3.1 | 3.6 |
| 112. COMP. SC., INTERDISCIPLINARY APPLICATIONS | 13,659.9 | 0.31 | 4.2 | 5.3 |
| 113. COMP. SCIENCE, SOFTWARE ENGINEERING | 12,780.8 | 0.29 | 2.7 | 3.3 |
| 114. COMPUTER SCIENCE, THEORY & METHODS | 39,914.7 | 0.89 | 1.8 | 3.3 |
| 115. MATHEMATICAL & COMPUTATIONAL BIOLOGY | 3,123.1 | 0.07 | 8.1 | 9.7 |
| **C. OTHER NATURAL SCIENCES** | | | | |
| *XII. ENGINEERING* | **288,058.5** | **6.45** | **3.3** | **3.4** |
| 116. ENGINEERING, ELECTRICAL & ELECTRONIC | 83,565.7 | 1.87 | 3.5 | 4.3 |
| 117. TELECOMMUNICATIONS | 12,247.1 | 0.27 | 2.7 | 3.2 |
| 118. CONSTRUCTION & BUILDING TECHNOLOGY | 4,639.8 | 0.10 | 2.5 | 1.7 |
| 119. ENGINEERING, CIVIL | 12,516.2 | 0.28 | 2.2 | 1.8 |

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|---|---|---|---|---|
| 120. ENGINEERING, ENVIRONMENTAL | 9,672.1 | 0.22 | 7.1 | 5.0 |
| 121. ENGINEERING, MARINE | 357.0 | 0.01 | 1.1 | 0.7 |
| 122. TRANSPORTATION SCIENCE & TECHNOLOGY | 3,547.8 | 0.08 | 1.3 | 1.2 |
| 123. ENGINEERING, INDUSTRIAL | 6,285.9 | 0.14 | 2.2 | 1.3 |
| 124. ENGINEERING, MANUFACTURING | 6,932.4 | 0.16 | 2.4 | 1.5 |
| 125. ENGINEERING, MECHANICAL | 26,333.2 | 0.59 | 2.6 | 2.4 |
| 126. MECHANICS | 27,838.5 | 0.62 | 3.9 | 3.4 |
| 127. ROBOTICS | 2,104.7 | 0.05 | 2.4 | 2.3 |
| 128. INSTRUMENTS & INSTRUMENTATION | 17,583.1 | 0.39 | 3.5 | 2.2 |
| 129. IMAGING SCIENCE & PHOTOGR. TECHNOLOGY | 2,679.8 | 0.06 | 4.3 | 3.1 |
| 130. ENERGY & FUELS | 12,929.4 | 0.29 | 3.7 | 3.0 |
| 131. NUCLEAR SCIENCE & TECHNOLOGY | 21,161.0 | 0.47 | 2.8 | 2.6 |
| 132. ENGINEERING, PETROLEUM | 3,566.8 | 0.08 | 1.0 | 1.1 |
| 133. AUTOMATION & CONTROL SYSTEMS | 9,343.5 | 0.21 | 2.8 | 2.7 |
| 134. ENGINEERING, MULTIDISCIPLINARY | 11,279.3 | 0.25 | 2.6 | 2.2 |
| 135. ERGONOMICS | 1,382.3 | 0.03 | 3.2 | 1.5 |
| 136. OPERATIONS RES. & MANAGEMENT SCIENCE | 12,092.9 | 0.27 | 2.9 | 2.6 |
| | | | | |
| *XIII. MATERIALS SCIENCE* | **185,225.7** | **4.15** | **4.4** | **5.1** |
| 137. MATERIALS SCIENCE, MULTIDISCIPLINARY | 90,734.1 | 2.03 | 4.5 | 4.7 |
| 138. MATERIALS SCIENCE, BIOMATERIALS | 3,953.5 | 0.09 | 10.2 | 5.8 |
| 139. MATERIALS SCIENCE, CERAMICS | 18,866.3 | 0.42 | 3.5 | 4.8 |
| 140. MAT. SC., CHARACTERIZATION & TESTING | 5,159.8 | 0.12 | 1.4 | 2.4 |
| 141. MATERIALS SCIENCE, COATINGS & FILMS | 10,519.9 | 0.24 | 5.6 | 3.3 |
| 142. MATERIALS SCIENCE, COMPOSITES | 7,957.8 | 0.18 | 2.9 | 3.9 |
| 143. MATERIALS SCIENCE, PAPER & WOOD | 6,000.6 | 0.13 | 1.8 | 2.4 |
| 144. MATERIALS SCIENCE, TEXTILES | 3,656.8 | 0.08 | 1.8 | 2.0 |
| 145. METALL. & METALLURGICAL ENGINEERING | 29,468.1 | 0.66 | 2.8 | 3.3 |
| 146. NANOSCIENCE & NANOTECHNOLOGY | 8,908.6 | 0.20 | 6.1 | 4.1 |
| | | | | |
| *XIV. GEOSCIENCES* | **144,907.0** | **3.25** | **6.0** | **7.0** |
| 147. GEOCHEMISTRY & GEOPHYSICS | 27,878.1 | 0.62 | 7.4 | 10.4 |
| 148. GEOGRAPHY, PHYSICAL | 4,368.3 | 0.10 | 7.0 | 3.8 |
| 149. GEOLOGY | 7,291.2 | 0.16 | 6.5 | 7.3 |
| 150. ENGINEERING, GEOLOGICAL | 2,717.6 | 0.06 | 2.8 | 1.8 |
| 151. PALEONTOLOGY | 5,862.2 | 0.13 | 3.9 | 3.5 |
| 152. REMOTE SENSING | 2,389.6 | 0.05 | 5.6 | 3.4 |
| 153. OCEANOGRAPHY | 13,918.8 | 0.31 | 7.6 | 6.6 |

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|---|---|---|---|---|
| 154. ENGINEERING, OCEAN | 1,928.3 | 0.04 | 2.6 | 2.6 |
| 155. METEOROLOGY & ATMOSPHERIC SCIENCES | 23,267.3 | 0.52 | 9.2 | 11.0 |
| 156. ENGINEERING, AEROSPACE | 10,028.8 | 0.22 | 1.8 | 2.4 |
| 157. MINERALOGY | 5,410.5 | 0.12 | 5.3 | 4.8 |
| 158. MINING & MINERAL PROCESSING | 3,672.2 | 0.08 | 2.4 | 1.9 |
| 159. GEOSCIENCES, MULTIDISCIPLINARY | 36,174.3 | 0.81 | 5.5 | 5.9 |
| *XV. AGRICULTURAL & ENVIRONMENT* | **180,472.2** | **4.04** | **5.6** | **6.1** |
| 160. AGRICULTURAL ENGINEERING | 3,675.5 | 0.08 | 3.2 | 2.9 |
| 161. AGRICULTURE, MULTIDISCIPLINARY | 11,518.7 | 0.26 | 3.5 | 3.3 |
| 162. AGRONOMY | 16,837.2 | 0.38 | 3.8 | 3.5 |
| 163. LIMNOLOGY | 2,742.4 | 0.06 | 7.3 | 3.8 |
| 164. SOIL SCIENCE | 11,948.1 | 0.27 | 5.4 | 5.7 |
| 165. BIODIVERSITY CONSERVATION | 3,507.3 | 0.08 | 5.6 | 3.3 |
| 166. ENVIRONMENTAL SCIENCES | 44,640.7 | 1.00 | 6.6 | 5.4 |
| 167. ENVIRONMENTAL STUDIES | 5,592.3 | 0.13 | 3.5 | 2.3 |
| 168. FOOD SCIENCE & TECHNOLOGY | 31,783.8 | 0.71 | 4.7 | 3.9 |
| 169. NUTRITION & DIETETICS | 19,574.3 | 0.44 | 9.2 | 10.8 |
| 170. AGRICULTURE, DAIRY & ANIMAL SCIENCE | 20,968.0 | 0.47 | 3.6 | 4.4 |
| 171. HORTICULTURE | 7,683.9 | 0.17 | 3.3 | 2.6 |
| *XVI. BIOLOGY (ORGANISMIC AND SUPRAORGONISMIC LEVEL)* | **323,550.6** | **7.25** | **7.0** | **8.0** |
| 172. ORNITHOLOGY | 5,141.0 | 0.12 | 4.2 | 7.7 |
| 173. ZOOLOGY | 28,223.6 | 0.63 | 4.9 | 4.5 |
| 174. ENTOMOLOGY | 20,111.8 | 0.45 | 3.6 | 4.0 |
| 175. WATER RESOURCES | 13,317.7 | 0.30 | 4.4 | 2.8 |
| 176. FISHERIES | 12,410.6 | 0.28 | 4.7 | 3.5 |
| 177. MARINE & FRESHWATER BIOLOGY | 23,026.3 | 0.52 | 5.7 | 3.9 |
| 178. MICROBIOLOGY | 44,835.5 | 1.00 | 11.0 | 9.8 |
| 179. PARASITOLOGY | 9,784.2 | 0.22 | 6.1 | 6.3 |
| 180. VIROLOGY | 19,375.5 | 0.43 | 15.1 | 14.8 |
| 181. FORESTRY | 10,665.6 | 0.24 | 5.2 | 5.5 |
| 182. MYCOLOGY | 5,700.2 | 0.13 | 4.3 | 5.4 |
| 183. PLANT SCIENCES | 53,680.8 | 1.20 | 7.4 | 9.0 |
| 184. ECOLOGY | 28,265.6 | 0.63 | 8.6 | 7.3 |
| 185. VETERINARY SCIENCES | 49,012.4 | 1.10 | 3.2 | 4.0 |

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|---|---|---|---|---|
| ***XVII. MULTIDISCIPLINARY*** | **27,218.9** | **0.61** | **3.2** | **6.5** |
| 186. MULTIDISCIPLINARY SCIENCES | 27,218.9 | 0.61 | 3.2 | 6.5 |
| **D. SOCIAL SCIENCES** | | | | |
| ***XVIII. SOCIAL SCIENCES, GENERAL*** | **118,297.3** | **2.65** | **3.0** | **3.6** |
| 187. CRIMINOLOGY & PENOLOGY | 2,777.0 | 0.06 | 3.5 | 4.2 |
| 188. LAW | 8,529.8 | 0.19 | 3.5 | 4.7 |
| 189. POLITICAL SCIENCE | 10,838.3 | 0.24 | 2.5 | 4.1 |
| 190. PUBLIC ADMINISTRATION | 3,036.5 | 0.07 | 2.6 | 3.1 |
| 191. ETHNIC STUDIES | 701.3 | 0.02 | 1.7 | 1.1 |
| 192. FAMILY STUDIES | 3,166.8 | 0.07 | 4.0 | 3.0 |
| 193. SOCIAL ISSUES | 2,771.7 | 0.06 | 2.6 | 3.2 |
| 194. SOCIAL WORK | 3,880.8 | 0.09 | 2.4 | 2.2 |
| 195. SOCIOLOGY | 10,554.0 | 0.24 | 3.0 | 4.7 |
| 196. WOMEN'S STUDIES | 2,656.7 | 0.06 | 2.4 | 2.3 |
| 197. EDUCATION & EDUCATIONAL RESEARCH | 14,580.3 | 0.33 | 2.2 | 3.0 |
| 198. EDUCATION, SPECIAL | 2,076.2 | 0.05 | 3.4 | 2.7 |
| 199. AREA STUDIES | 3,197.6 | 0.07 | 1.3 | 1.8 |
| 200. GEOGRAPHY | 4,487.6 | 0.10 | 4.3 | 4.9 |
| 201. PLANNING & DEVELOPMENT | 4,041.8 | 0.09 | 3.2 | 2.9 |
| 202. TRANSPORTATION | 1,050.8 | 0.02 | 3.0 | 1.7 |
| 203. URBAN STUDIES | 2,802.9 | 0.06 | 3.1 | 2.4 |
| 204. ETHICS | 2,208.6 | 0.05 | 2.1 | 1.6 |
| 205. MEDICAL ETHICS | 305.3 | 0.01 | 3.8 | 1.2 |
| 206. ANTHROPOLOGY | 5,620.2 | 0.13 | 2.7 | 3.2 |
| 207. COMMUNICATION | 4,085.0 | 0.09 | 3.1 | 3.2 |
| 208. DEMOGRAPHY | 1,749.8 | 0.04 | 4.2 | 4.9 |
| 209. HISTORY OF SOCIAL SCIENCES | 867.0 | 0.02 | 1.3 | 1.0 |
| 210. INFORMATION SCIENCE & LIBRARY SCIENCE | 7,034.7 | 0.16 | 2.4 | 2.9 |
| 211. INTERNATIONAL RELATIONS | 4,820.8 | 0.11 | 2.3 | 3.6 |
| 212. LINGUISTICS | 3,921.7 | 0.09 | 3.8 | 3.0 |
| 213. SOCIAL SCIENCES, INTERDISCIPLINARY | 6,534.3 | 0.15 | 2.3 | 2.5 |
| ***XIX. ECONOMICS & BUSINESS*** | **55,615.8** | **1.25** | **4.1** | **5.1** |
| 214. AGRICULTURAL ECONOMICS & POLICY | 1,005.5 | 0.02 | 2.8 | 1.8 |
| 215. ECONOMICS | 30,439.6 | 0.68 | 3.5 | 5.2 |
| 216. INDUSTRIAL RELATIONS & LABOR | 1,917.7 | 0.04 | 3.0 | 3.5 |
| 217. BUSINESS | 7,255.2 | 0.16 | 5.0 | 5.1 |

| | | | | | |
|---|---|---|---|---|---|
| 218. BUSINESS, FINANCE | 5,351.8 | 0.12 | | 4.9 | 6.7 |
| 219. MANAGEMENT | 9,646.2 | 0.22 | | 4.5 | 4.3 |
| **Total** | **4,465,348** | **100.00** | **Mean** | **5.9** | **3.6** |
| | | | **Std** | **6.4** | **5.6** |

**Table 1. Citation Inequality Decomposition at the Sub-field Level**

| A. FRACTIONAL CASE | Within-group Term, *W* (1) | Skewness of Science Term, *S* (2) | *IDCP* Term (3) | Overall Inequality (4) | Percentages In %: (1)/(4) | (2)/(4) | (3)/(4) |
|---|---|---|---|---|---|---|---|
| | 0.0030 | 0.7062 | 0.1552 | 0.8644 | 0.35 | 81.70 | 17.95 |

| B. MULTIPLICATIVE CASE | *W'* (1) | *S'* (2) | *IDCP'* (3) | Overall Inequality (4) | Percentages In %: (1)/(4) | (2)/(4) | (3)/(4) |
|---|---|---|---|---|---|---|---|
| | 0.0030 | 0.6950 | 0.1544 | 0.8524 | 0.35 | 81.54 | 18.11 |

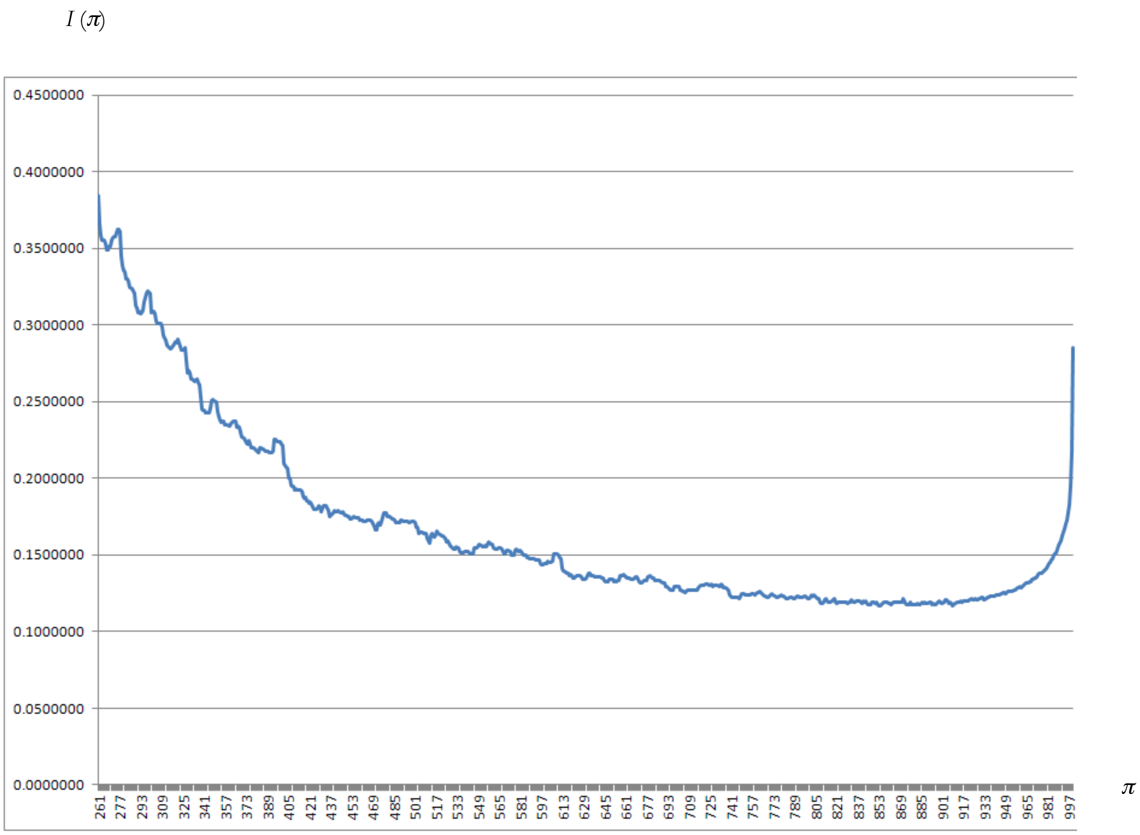


**Figure 1. Citation Inequality Due to Differences in Citation Practices, $I(\pi)$ versus $\pi$. Raw Data**

**Table 2. Exchange Rates, Standard Deviations, and Coefficients of Variation for the [661, 978] Interval**

| | | Exchange Rates (1) | Standard Deviation (2) | Coefficient of Variation (3) | % of Citations (4) | Exch. Rates Based on Mean Citations (5) |
|---|---|---|---|---|---|---|
| | **A. LIFE SCIENCES** | | | | | |
| | *I. BIOSCIENCES* | | | | | |
| 1 | BIOLOGY | 10.3 | 0.3 | 0.032 | 64.1 | 9.8 |
| 2 | BIOLOGY, MISCELLANEOUS | 5.0 | 0.3 | 0.063 | 65.4 | 4.6 |
| 3 | EVOLUTIONARY BIOLOGY | 16.1 | 1.8 | 0.109 | 56.3 | 16.4 |
| 4 | BIOCHEMICAL RESEARCH METHODS | 11.5 | 0.7 | 0.060 | 52.9 | 12.8 |
| 5 | BIOCHEMISTRY & MOLECULAR BIOLOGY | 20.6 | 0.5 | 0.023 | 58.2 | 21.2 |
| 6 | BIOPHYSICS | 14.0 | 0.7 | 0.053 | 58.7 | 14.1 |
| 7 | CELL BIOLOGY | 26.9 | 0.9 | 0.032 | 60.3 | 27.3 |
| 8 | GENETICS & HEREDITY | 19.4 | 0.4 | 0.022 | 57.7 | 20.5 |
| 9 | DEVELOPMENTAL BIOLOGY | 23.4 | 0.4 | 0.016 | 59.0 | 24.0 |
| | *II. BIOMEDICAL RESEARCH* | | | | | |
| 10 | PATHOLOGY | 11.8 | 0.3 | 0.023 | 62.3 | 11.5 |
| 11 | ANATOMY & MORPHOLOGY | 7.7 | 0.5 | 0.066 | 60.9 | 7.4 |
| 12 | ENGINEERING, BIOMEDICAL | 9.5 | 0.5 | 0.053 | 61.3 | 9.1 |
| 13 | BIOTECHNOLOGY & APPLIED MICROBIOLOGY | 11.5 | 0.3 | 0.024 | 58.0 | 11.9 |
| 14 | MEDICAL LABORATORY TECHNOLOGY | 8.1 | 0.3 | 0.031 | 62.0 | 7.9 |
| 15 | MICROSCOPY | 8.6 | 0.7 | 0.077 | 60.8 | 8.3 |
| 16 | PHARMACOLOGY & PHARMACY | 10.6 | 0.5 | 0.046 | 60.0 | 10.5 |
| 17 | TOXICOLOGY | 9.7 | 0.7 | 0.071 | 58.9 | 9.6 |
| 18 | PHYSIOLOGY | 14.0 | 1.4 | 0.102 | 59.4 | 13.5 |
| 19 | MEDICINE, RESEARCH & EXPERIMENTAL | 15.4 | 2.6 | 0.171 | 61.2 | 16.5 |
| | *III. CLINICAL MEDICINE I (INTERNAL)* | | | | | |
| 20 | CARDIAC & CARDIOVASCULAR SYSTEMS | 14.9 | 1.0 | 0.070 | 61.6 | 15.1 |
| 21 | RESPIRATORY SYSTEM | 13.7 | 0.7 | 0.051 | 60.6 | 13.4 |
| 22 | ENDOCRINOLOGY & METABOLISM | 16.9 | 1.1 | 0.066 | 58.3 | 16.9 |
| 23 | ANESTHESIOLOGY | 9.2 | 0.3 | 0.037 | 62.8 | 8.8 |
| 24 | CRITICAL CARE MEDICINE | 14.8 | 0.5 | 0.036 | 61.9 | 14.2 |
| 25 | EMERGENCY MEDICINE | 5.8 | 0.3 | 0.050 | 62.8 | 5.5 |
| 26 | GASTROENTEROLOGY & HEPATOLOGY | 13.5 | 0.3 | 0.022 | 60.1 | 13.6 |
| 27 | MEDICINE, GENERAL & INTERNAL | 12.0 | 4.9 | 0.405 | 52.1 | 16.7 |
| 28 | TROPICAL MEDICINE | 7.2 | 0.5 | 0.074 | 62.1 | 6.8 |
| 29 | HEMATOLOGY | 22.2 | 0.3 | 0.014 | 60.2 | 22.3 |
| 30 | ONCOLOGY | 18.0 | 0.6 | 0.031 | 58.6 | 18.3 |
| 31 | ALLERGY | 12.2 | 0.5 | 0.038 | 63.1 | 11.5 |
| 32 | IMMUNOLOGY | 17.8 | 0.3 | 0.017 | 59.0 | 18.3 |
| 33 | INFECTIOUS DISEASES | 15.4 | 1.0 | 0.068 | 59.6 | 15.1 |

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|---|---|---|---|---|---|---|
| | *IV. CLINICAL MEDICINE II (NON-INTERNAL)* | | | | | |
| 34 | GERIATRICS & GERONTOLOGY | 11.2 | 0.6 | 0.051 | 60.9 | 10.9 |
| 35 | OBSTETRICS & GYNECOLOGY | 9.2 | 0.4 | 0.044 | 62.3 | 8.8 |
| 36 | ANDROLOGY | 7.3 | 0.5 | 0.068 | 60.3 | 7.1 |
| 37 | REPRODUCTIVE BIOLOGY | 12.5 | 1.1 | 0.089 | 59.0 | 12.3 |
| 38 | GERONTOLOGY | 10.2 | 0.5 | 0.049 | 62.7 | 9.6 |
| 39 | DENTISTRY & ORAL SURGERY | 7.2 | 0.6 | 0.077 | 60.6 | 6.9 |
| 40 | DERMATOLOGY | 8.2 | 0.3 | 0.038 | 62.1 | 7.9 |
| 41 | UROLOGY & NEPHROLOGY | 12.3 | 0.3 | 0.025 | 61.6 | 12.0 |
| 42 | OTORHINOLARYNGOLOGY | 6.0 | 0.4 | 0.069 | 62.5 | 5.6 |
| 43 | OPHTHALMOLOGY | 9.5 | 0.3 | 0.034 | 61.7 | 9.2 |
| 44 | INTEGRATIVE & COMPLEMENTARY MEDICINE | 6.3 | 0.6 | 0.097 | 61.4 | 5.9 |
| 45 | CLINICAL NEUROLOGY | 12.4 | 0.3 | 0.023 | 61.3 | 12.1 |
| 46 | PSYCHIATRY | 13.1 | 0.3 | 0.019 | 62.0 | 12.7 |
| 47 | RADIOLOGY, NUCLEAR MED. & MED. IMAGING | 10.1 | 0.3 | 0.026 | 61.5 | 9.9 |
| 48 | ORTHOPEDICS | 7.9 | 0.3 | 0.043 | 61.6 | 7.6 |
| 49 | RHEUMATOLOGY | 14.6 | 0.6 | 0.041 | 59.7 | 14.5 |
| 50 | SPORT SCIENCES | 8.1 | 0.5 | 0.064 | 62.2 | 7.7 |
| 51 | SURGERY | 8.5 | 0.2 | 0.028 | 61.9 | 8.3 |
| 52 | TRANSPLANTATION | 9.5 | 0.2 | 0.026 | 61.9 | 9.2 |
| 53 | PERIPHERAL VASCULAR DISEASE | 20.2 | 0.3 | 0.013 | 59.8 | 20.4 |
| 54 | PEDIATRICS | 7.7 | 0.3 | 0.035 | 62.1 | 7.5 |
| | *V. CLINICAL MEDICINE III* | | | | | |
| 55 | HEALTH CARE SCIENCES & SERVICES | 7.9 | 0.5 | 0.061 | 60.3 | 7.7 |
| 56 | HEALTH POLICY & SERVICES | 8.4 | 0.4 | 0.042 | 59.3 | 8.5 |
| 57 | MEDICINE, LEGAL | 5.8 | 0.4 | 0.072 | 60.5 | 5.6 |
| 58 | NURSING | 4.3 | 0.4 | 0.090 | 61.9 | 4.1 |
| 59 | PUBLIC, ENV. & OCCUPATIONAL HEALTH | 9.7 | 0.3 | 0.034 | 60.8 | 9.5 |
| 60 | REHABILITATION | 5.9 | 0.4 | 0.065 | 62.2 | 5.6 |
| 61 | SUBSTANCE ABUSE | 9.8 | 0.9 | 0.096 | 59.2 | 9.6 |
| 62 | EDUCATION, SCIENTIFIC DISCIPLINES | 4.0 | 0.3 | 0.068 | 64.9 | 3.7 |
| 63 | MEDICAL INFORMATICS | 5.7 | 0.3 | 0.045 | 62.9 | 5.5 |
| | *VI. NEUROSCIENCES & BEHAVIORAL* | | | | | |
| 64 | NEUROIMAGING | 14.6 | 0.4 | 0.025 | 63.1 | 14.0 |
| 65 | NEUROSCIENCES | 16.9 | 0.5 | 0.031 | 59.6 | 16.9 |
| 66 | BEHAVIORAL SCIENCES | 11.5 | 1.4 | 0.119 | 56.0 | 11.7 |
| 67 | PSYCHOLOGY, BIOLOGICAL | 9.9 | 0.9 | 0.086 | 56.9 | 10.1 |
| 68 | PSYCHOLOGY | 10.3 | 0.7 | 0.068 | 60.6 | 9.9 |
| 69 | PSYCHOLOGY, APPLIED | 6.4 | 0.4 | 0.070 | 62.4 | 6.0 |
| 70 | PSYCHOLOGY, CLINICAL | 9.9 | 0.4 | 0.042 | 60.6 | 9.7 |
| 71 | PSYCHOLOGY, DEVELOPMENTAL | 10.6 | 0.5 | 0.051 | 60.8 | 10.2 |
| 72 | PSYCHOLOGY, EDUCATIONAL | 6.8 | 0.3 | 0.040 | 64.2 | 6.5 |
| 73 | PSYCHOLOGY, EXPERIMENTAL | 10.2 | 0.5 | 0.046 | 61.2 | 9.9 |
| 74 | PSYCHOLOGY, MATHEMATICAL | 6.9 | 0.3 | 0.038 | 61.3 | 6.8 |

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|
| 75 | PSYCHOLOGY, MULTIDISCIPLINARY | 6.2 | 0.5 | 0.087 | 63.3 | 6.2 |
| 76 | PSYCHOLOGY, PSYCHOANALYSIS | 3.7 | 0.4 | 0.106 | 67.8 | 3.4 |
| 77 | PSYCHOLOGY, SOCIAL | 8.3 | 0.3 | 0.032 | 61.5 | 8.2 |
| 78 | SOCIAL SCIENCES, BIOMEDICAL | 7.2 | 0.3 | 0.047 | 61.2 | 7.0 |
|  | **B. PHYSICAL SCIENCES** |  |  |  |  |  |
|  | *VII. CHEMISTRY* |  |  |  |  |  |
| 79 | CHEMISTRY, MULTIDISCIPLINARY | 11.9 | 1.2 | 0.103 | 65.4 | 11.5 |
| 80 | CHEMISTRY, INORGANIC & NUCLEAR | 9.2 | 0.7 | 0.074 | 61.4 | 8.8 |
| 81 | CHEMISTRY, ANALYTICAL | 9.9 | 0.4 | 0.044 | 60.5 | 9.7 |
| 82 | CHEMISTRY, APPLIED | 7.6 | 0.5 | 0.070 | 62.3 | 7.2 |
| 83 | ENGINEERING, CHEMICAL | 6.0 | 0.3 | 0.044 | 63.7 | 5.7 |
| 84 | CHEMISTRY, MEDICINAL | 9.8 | 0.8 | 0.083 | 59.4 | 9.6 |
| 85 | CHEMISTRY, ORGANIC | 10.7 | 1.0 | 0.096 | 59.3 | 10.4 |
| 86 | CHEMISTRY, PHYSICAL | 10.5 | 0.5 | 0.047 | 60.5 | 10.3 |
| 87 | ELECTROCHEMISTRY | 10.2 | 0.8 | 0.076 | 60.4 | 9.9 |
| 88 | POLYMER SCIENCE | 8.2 | 0.3 | 0.031 | 61.4 | 8.1 |
|  | *VIII. PHYSICS* |  |  |  |  |  |
| 89 | PHYSICS, MULTIDISCIPLINARY | 10.0 | 1.7 | 0.169 | 61.8 | 10.5 |
| 90 | SPECTROSCOPY | 7.6 | 0.4 | 0.050 | 62.1 | 7.3 |
| 91 | ACOUSTICS | 5.5 | 0.3 | 0.055 | 63.3 | 5.2 |
| 92 | OPTICS | 7.3 | 0.3 | 0.036 | 62.7 | 7.0 |
| 93 | PHYSICS, APPLIED | 7.5 | 0.4 | 0.048 | 60.7 | 7.6 |
| 94 | PHYSICS, ATOMIC, MOLECULAR & CHEMICAL | 11.0 | 0.8 | 0.074 | 59.8 | 10.7 |
| 95 | THERMODYNAMICS | 4.8 | 0.4 | 0.080 | 61.6 | 4.6 |
| 96 | PHYSICS, MATHEMATICAL | 7.3 | 0.3 | 0.035 | 61.7 | 7.2 |
| 97 | PHYSICS, NUCLEAR | 6.2 | 0.4 | 0.065 | 62.0 | 6.2 |
| 98 | PHYSICS, PARTICLES & SUB-FIELDS | 10.8 | 1.1 | 0.102 | 59.8 | 11.4 |
| 99 | PHYSICS, CONDENSED MATTER | 7.4 | 0.3 | 0.045 | 61.4 | 7.4 |
| 100 | PHYSICS OF SOLIDS, FLUIDS & PLASMAS | 9.3 | 0.6 | 0.063 | 59.8 | 9.1 |
| 101 | CRYSTALLOGRAPHY | 5.1 | 0.3 | 0.053 | 58.8 | 5.2 |
|  | *IX. SPACE SCIENCES* |  |  |  |  |  |
| 102 | ASTRONOMY & ASTROPHYSICS | 14.8 | 0.3 | 0.018 | 60.6 | 14.8 |
|  | *X. MATHEMATICS* |  |  |  |  |  |
| 103 | MATHEMATICS, APPLIED | 3.9 | 0.2 | 0.062 | 65.7 | 3.6 |
| 104 | STATISTICS & PROBABILITY | 5.2 | 0.5 | 0.098 | 52.5 | 6.2 |
| 105 | MATH., INTERDISCIPLINARY APPLICATIONS | 5.6 | 0.3 | 0.045 | 60.8 | 5.6 |
| 106 | SOCIAL SCIENCES, MATHEMATICAL METHODS | 5.5 | 0.3 | 0.045 | 61.4 | 5.5 |
| 107 | PURE MATHEMATICS | 2.8 | 0.2 | 0.087 | 66.4 | 2.6 |
|  | *XI. COMPUTER SCIENCE* |  |  |  |  |  |
| 108 | COMP. SCIENCE, ARTIFICIAL INTELLIGENCE | 5.4 | 0.6 | 0.118 | 63.3 | 5.4 |
| 109 | COMPUTER SCIENCE, CYBERNETICS | 3.6 | 0.4 | 0.108 | 66.7 | 3.4 |
| 110 | COMP. SCIENCE, HARDWARE & ARCHITECTURE | 4.0 | 0.5 | 0.124 | 61.4 | 4.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 111 | COMPUTER SCIENCE, INFORMATION SYSTEMS | 4.4 | 0.6 | 0.143 | 62.4 | 4.5 |
| 112 | COMP. SC., INTERDISCIPLINARY APPLICATIONS | 5.5 | 0.6 | 0.102 | 58.1 | 6.0 |
| 113 | COMP. SCIENCE, SOFTWARE ENGINEERING | 3.6 | 0.4 | 0.107 | 65.5 | 3.4 |
| 114 | COMPUTER SCIENCE, THEORY & METHODS | 3.1 | 0.4 | 0.115 | 65.5 | 3.0 |
| 115 | MATHEMATICAL & COMPUTATIONAL BIOLOGY | 9.8 | 0.4 | 0.044 | 52.9 | 11.4 |

**C. OTHER NATURAL SCIENCES**

*XII. ENGINEERING*

| | | | | | | |
|---|---|---|---|---|---|---|
| 116 | ENGINEERING, ELECTRICAL & ELECTRONIC | 4.7 | 0.4 | 0.077 | 63.1 | 4.6 |
| 117 | TELECOMMUNICATIONS | 3.8 | 0.5 | 0.144 | 62.2 | 3.9 |
| 118 | CONSTRUCTION & BUILDING TECHNOLOGY | 3.5 | 0.3 | 0.090 | 65.4 | 3.1 |
| 119 | ENGINEERING, CIVIL | 3.4 | 0.3 | 0.086 | 67.0 | 3.1 |
| 120 | ENGINEERING, ENVIRONMENTAL | 9.1 | 0.3 | 0.035 | 62.4 | 8.7 |
| 121 | ENGINEERING, MARINE | 1.6 | 0.3 | 0.212 | 71.5 | 1.4 |
| 122 | TRANSPORTATION SCIENCE & TECHNOLOGY | 2.1 | 0.5 | 0.227 | 69.9 | 2.0 |
| 123 | ENGINEERING, INDUSTRIAL | 3.3 | 0.3 | 0.091 | 66.6 | 2.9 |
| 124 | ENGINEERING, MANUFACTURING | 3.6 | 0.3 | 0.089 | 64.8 | 3.2 |
| 125 | ENGINEERING, MECHANICAL | 3.9 | 0.2 | 0.060 | 63.7 | 3.7 |
| 126 | MECHANICS | 5.2 | 0.3 | 0.050 | 63.8 | 4.9 |
| 127 | ROBOTICS | 3.8 | 0.2 | 0.065 | 65.0 | 3.6 |
| 128 | INSTRUMENTS & INSTRUMENTATION | 5.1 | 0.3 | 0.051 | 65.0 | 4.7 |
| 129 | IMAGING SCIENCE & PHOTOGR. TECHNOLOGY | 7.4 | 0.4 | 0.061 | 64.6 | 7.0 |
| 130 | ENERGY & FUELS | 5.0 | 0.3 | 0.064 | 64.9 | 4.7 |
| 131 | NUCLEAR SCIENCE & TECHNOLOGY | 4.4 | 0.3 | 0.061 | 64.0 | 4.1 |
| 132 | ENGINEERING, PETROLEUM | 1.7 | 0.4 | 0.255 | 73.5 | 1.5 |
| 133 | AUTOMATION & CONTROL SYSTEMS | 4.1 | 0.2 | 0.059 | 63.8 | 3.9 |
| 134 | ENGINEERING, MULTIDISCIPLINARY | 3.9 | 0.4 | 0.089 | 66.0 | 3.7 |
| 135 | ERGONOMICS | 4.8 | 0.4 | 0.088 | 63.0 | 4.4 |
| 136 | OPERATIONS RES. & MANAGEMENT SCIENCE | 4.1 | 0.2 | 0.060 | 63.6 | 3.8 |

*XIII. MATERIALS SCIENCE*

| | | | | | | |
|---|---|---|---|---|---|---|
| 137 | MATERIALS SCIENCE, MULTIDISCIPLINARY | 6.4 | 0.4 | 0.056 | 60.7 | 6.4 |
| 138 | MATERIALS SCIENCE, BIOMATERIALS | 13.0 | 1.1 | 0.085 | 59.3 | 12.7 |
| 139 | MATERIALS SCIENCE, CERAMICS | 4.7 | 0.3 | 0.074 | 68.3 | 4.2 |
| 140 | MAT. SC., CHARACTERIZATION & TESTING | 2.2 | 0.4 | 0.167 | 70.6 | 2.0 |
| 141 | MATERIALS SCIENCE, COATINGS & FILMS | 7.5 | 0.4 | 0.057 | 61.0 | 7.3 |
| 142 | MATERIALS SCIENCE, COMPOSITES | 3.4 | 0.3 | 0.087 | 65.9 | 3.1 |
| 143 | MATERIALS SCIENCE, PAPER & WOOD | 2.9 | 0.3 | 0.092 | 68.1 | 2.6 |
| 144 | MATERIALS SCIENCE, TEXTILES | 2.9 | 0.3 | 0.095 | 65.5 | 2.7 |
| 145 | METALL. & METALLURGICAL ENGINEERING | 4.7 | 0.4 | 0.089 | 63.5 | 4.7 |

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|---|---|---|---|---|---|---|
| 146 | NANOSCIENCE & NANOTECHNOLOGY | 8.0 | 0.3 | 0.036 | 60.0 | 8.1 |
| | *XIV. GEOSCIENCES* | | | | | |
| 147 | GEOCHEMISTRY & GEOPHYSICS | 9.7 | 0.6 | 0.066 | 61.5 | 9.3 |
| 148 | GEOGRAPHY, PHYSICAL | 9.1 | 0.9 | 0.097 | 59.8 | 8.8 |
| 149 | GEOLOGY | 8.0 | 0.5 | 0.061 | 62.4 | 7.5 |
| 150 | ENGINEERING, GEOLOGICAL | 3.8 | 0.3 | 0.093 | 62.1 | 3.6 |
| 151 | PALEONTOLOGY | 6.5 | 0.4 | 0.057 | 63.7 | 6.1 |
| 152 | REMOTE SENSING | 7.8 | 0.3 | 0.037 | 60.8 | 7.8 |
| 153 | OCEANOGRAPHY | 10.1 | 1.0 | 0.101 | 61.6 | 9.5 |
| 154 | ENGINEERING, OCEAN | 3.6 | 0.4 | 0.106 | 66.7 | 3.4 |
| 155 | METEOROLOGY & ATMOSPHERIC SCIENCES | 10.9 | 0.5 | 0.047 | 61.3 | 10.5 |
| 156 | ENGINEERING, AEROSPACE | 2.5 | 0.2 | 0.095 | 68.4 | 2.2 |
| 157 | MINERALOGY | 6.9 | 0.4 | 0.060 | 61.4 | 6.6 |
| 158 | MINING & MINERAL PROCESSING | 4.0 | 0.3 | 0.069 | 65.5 | 3.7 |
| 159 | GEOSCIENCES, MULTIDISCIPLINARY | 7.3 | 0.4 | 0.055 | 62.7 | 6.9 |
| | *XV. AGRICULTURAL & ENVIRONMENT* | | | | | |
| 160 | AGRICULTURAL ENGINEERING | 5.0 | 0.4 | 0.073 | 61.6 | 4.7 |
| 161 | AGRICULTURE, MULTIDISCIPLINARY | 6.8 | 0.3 | 0.045 | 63.8 | 6.6 |
| 162 | AGRONOMY | 5.8 | 0.3 | 0.050 | 62.9 | 5.5 |
| 163 | LIMNOLOGY | 9.7 | 0.8 | 0.078 | 60.8 | 9.3 |
| 164 | SOIL SCIENCE | 6.9 | 0.5 | 0.072 | 62.5 | 6.5 |
| 165 | BIODIVERSITY CONSERVATION | 8.8 | 0.4 | 0.046 | 62.1 | 8.5 |
| 166 | ENVIRONMENTAL SCIENCES | 8.9 | 0.5 | 0.056 | 60.1 | 8.8 |
| 167 | ENVIRONMENTAL STUDIES | 5.0 | 0.4 | 0.072 | 61.4 | 4.8 |
| 168 | FOOD SCIENCE & TECHNOLOGY | 7.1 | 0.5 | 0.075 | 61.9 | 6.7 |
| 169 | NUTRITION & DIETETICS | 11.4 | 0.4 | 0.037 | 61.3 | 11.1 |
| 170 | AGRICULTURE, DAIRY & ANIMAL SCIENCE | 5.4 | 0.3 | 0.051 | 66.5 | 4.9 |
| 171 | HORTICULTURE | 6.0 | 0.3 | 0.045 | 62.9 | 5.8 |
| | *XVI. BIOLOGY (ORGANISMIC AND SUPRAORGONISMIC LEVEL)* | | | | | |
| 172 | ORNITHOLOGY | 5.5 | 0.5 | 0.082 | 59.7 | 5.4 |
| 173 | ZOOLOGY | 7.5 | 0.5 | 0.068 | 61.8 | 7.1 |
| 174 | ENTOMOLOGY | 5.5 | 0.4 | 0.071 | 62.9 | 5.1 |
| 175 | WATER RESOURCES | 6.3 | 0.5 | 0.075 | 61.7 | 5.9 |
| 176 | FISHERIES | 7.1 | 0.8 | 0.115 | 59.3 | 6.9 |
| 177 | MARINE & FRESHWATER BIOLOGY | 8.2 | 0.9 | 0.115 | 59.2 | 7.9 |
| 178 | MICROBIOLOGY | 14.3 | 1.1 | 0.077 | 59.3 | 14.0 |
| 179 | PARASITOLOGY | 8.1 | 0.6 | 0.070 | 59.6 | 8.0 |
| 180 | VIROLOGY | 18.8 | 1.6 | 0.083 | 57.7 | 18.9 |
| 181 | FORESTRY | 7.2 | 0.6 | 0.089 | 60.0 | 7.0 |
| 182 | MYCOLOGY | 6.8 | 0.3 | 0.046 | 62.1 | 6.5 |
| 183 | PLANT SCIENCES | 9.6 | 0.3 | 0.029 | 60.1 | 9.8 |
| 184 | ECOLOGY | 11.4 | 1.0 | 0.087 | 59.7 | 11.0 |
| 185 | VETERINARY SCIENCES | 5.2 | 0.3 | 0.056 | 65.9 | 4.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | *XVII. MULTIDISCIPLINARY* | | | | | |
| 186 | MULTIDISCIPLINARY SCIENCES | 4.0 | 0.6 | 0.158 | 64.3 | 4.0 |
| | **D. SOCIAL SCIENCES** | | | | | |
| | *XVIII. SOCIAL SCIENCES, GENERAL* | | | | | |
| 187 | CRIMINOLOGY & PENOLOGY | 4.8 | 0.3 | 0.058 | 66.5 | 4.4 |
| 188 | LAW | 4.3 | 0.3 | 0.076 | 65.1 | 4.1 |
| 189 | POLITICAL SCIENCE | 3.3 | 0.4 | 0.119 | 65.5 | 3.2 |
| 190 | PUBLIC ADMINISTRATION | 3.6 | 0.3 | 0.075 | 66.2 | 3.3 |
| 191 | ETHNIC STUDIES | 2.5 | 0.3 | 0.115 | 65.7 | 2.4 |
| 192 | FAMILY STUDIES | 5.7 | 0.3 | 0.057 | 62.1 | 5.5 |
| 193 | SOCIAL ISSUES | 3.4 | 0.3 | 0.091 | 64.4 | 3.3 |
| 194 | SOCIAL WORK | 3.9 | 0.3 | 0.078 | 63.2 | 3.7 |
| 195 | SOCIOLOGY | 4.2 | 0.3 | 0.065 | 65.6 | 3.9 |
| 196 | WOMEN'S STUDIES | 4.1 | 0.2 | 0.061 | 63.8 | 3.8 |
| 197 | EDUCATION & EDUCATIONAL RESEARCH | 3.3 | 0.3 | 0.085 | 64.6 | 3.1 |
| 198 | EDUCATION, SPECIAL | 5.0 | 0.3 | 0.065 | 62.7 | 4.7 |
| 199 | AREA STUDIES | 1.9 | 0.3 | 0.157 | 67.0 | 1.8 |
| 200 | GEOGRAPHY | 5.8 | 0.3 | 0.057 | 60.5 | 5.7 |
| 201 | PLANNING & DEVELOPMENT | 4.4 | 0.3 | 0.059 | 61.3 | 4.4 |
| 202 | TRANSPORTATION | 5.3 | 0.4 | 0.079 | 61.8 | 5.0 |
| 203 | URBAN STUDIES | 4.4 | 0.3 | 0.068 | 61.7 | 4.2 |
| 204 | ETHICS | 3.3 | 0.3 | 0.092 | 65.6 | 3.0 |
| 205 | MEDICAL ETHICS | 5.2 | 0.4 | 0.075 | 62.1 | 4.9 |
| 206 | ANTHROPOLOGY | 4.4 | 0.3 | 0.074 | 66.3 | 4.1 |
| 207 | COMMUNICATION | 4.6 | 0.3 | 0.060 | 64.1 | 4.3 |
| 208 | DEMOGRAPHY | 5.5 | 0.3 | 0.053 | 61.8 | 5.3 |
| 209 | HISTORY OF SOCIAL SCIENCES | 2.1 | 0.3 | 0.140 | 69.2 | 1.8 |
| 210 | INFORMATION SCIENCE & LIBRARY SCIENCE | 4.1 | 0.4 | 0.103 | 65.2 | 3.9 |
| 211 | INTERNATIONAL RELATIONS | 2.9 | 0.4 | 0.134 | 65.4 | 2.8 |
| 212 | LINGUISTICS | 6.1 | 0.3 | 0.049 | 63.0 | 5.8 |
| 213 | SOCIAL SCIENCES, INTERDISCIPLINARY | 3.6 | 0.4 | 0.100 | 66.7 | 3.3 |
| | *XIX. ECONOMICS & BUSINESS* | | | | | |
| 214 | AGRICULTURAL ECONOMICS & POLICY | 3.8 | 0.3 | 0.082 | 63.9 | 3.5 |
| 215 | ECONOMICS | 4.6 | 0.3 | 0.074 | 61.9 | 4.6 |
| 216 | INDUSTRIAL RELATIONS & LABOR | 4.6 | 0.4 | 0.086 | 63.3 | 4.2 |
| 217 | BUSINESS | 6.7 | 0.3 | 0.047 | 64.0 | 6.4 |
| 218 | BUSINESS, FINANCE | 6.3 | 0.5 | 0.087 | 63.6 | 6.2 |
| 219 | MANAGEMENT | 6.4 | 0.4 | 0.055 | 63.5 | 6.2 |
| | **Mean** | | | **0.071** | **62.2** | |
| | **StDev** | | | **0.043** | **3.0** | |

**Table 3. Citation Inequality Decomposition at the Sub-field Level In the Fractional Case**

| | Quantiles | Within-group Term, $W$ | Skew. of Sc. Term, $S$ | $IDCP$ Term | Total Citation Inequality | Percentages In %: (1)/(4) | (2)/(4) | (3)/(4) |
|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **A. Raw Data** | 1,000 | 0.0030 | 0.7062 | 0.1552 | 0.8644 | 0.35 | 81.70 | 17.95 |
| | [1, 660] | | | 0.0463 | | | | 5.36 |
| | [661, 978] | | | 0.0750 | | | | 8.68 |
| | [979, 1000] | | | 0.0338 | | | | 3.91 |
| **B. Sub-field $ER$** | 1,000 | 0.0032 | 0.7301 | 0.0293 | 0.7627 | 0.42 | 95.73 | 3.85 |
| **Normalization** | [1, 660] | | | 0.0162 | | | | 2.13 |
| | [661, 978] | | | 0.0027 | | | | 0.35 |
| | [979, 1000] | | | 0.0104 | | | | 1.37 |
| **C. Sub-field Mean** | 1,000 | 0.0030 | 0.7240 | 0.0260 | 0.7531 | 0.40 | 96.14 | 3.45 |
| **Normalization** | [1, 660] | | | 0.0168 | | | | 2.23 |
| | [661, 978] | | | 0.0026 | | | | 0.35 |
| | [979, 1000] | | | 0.0066 | | | | 0.87 |

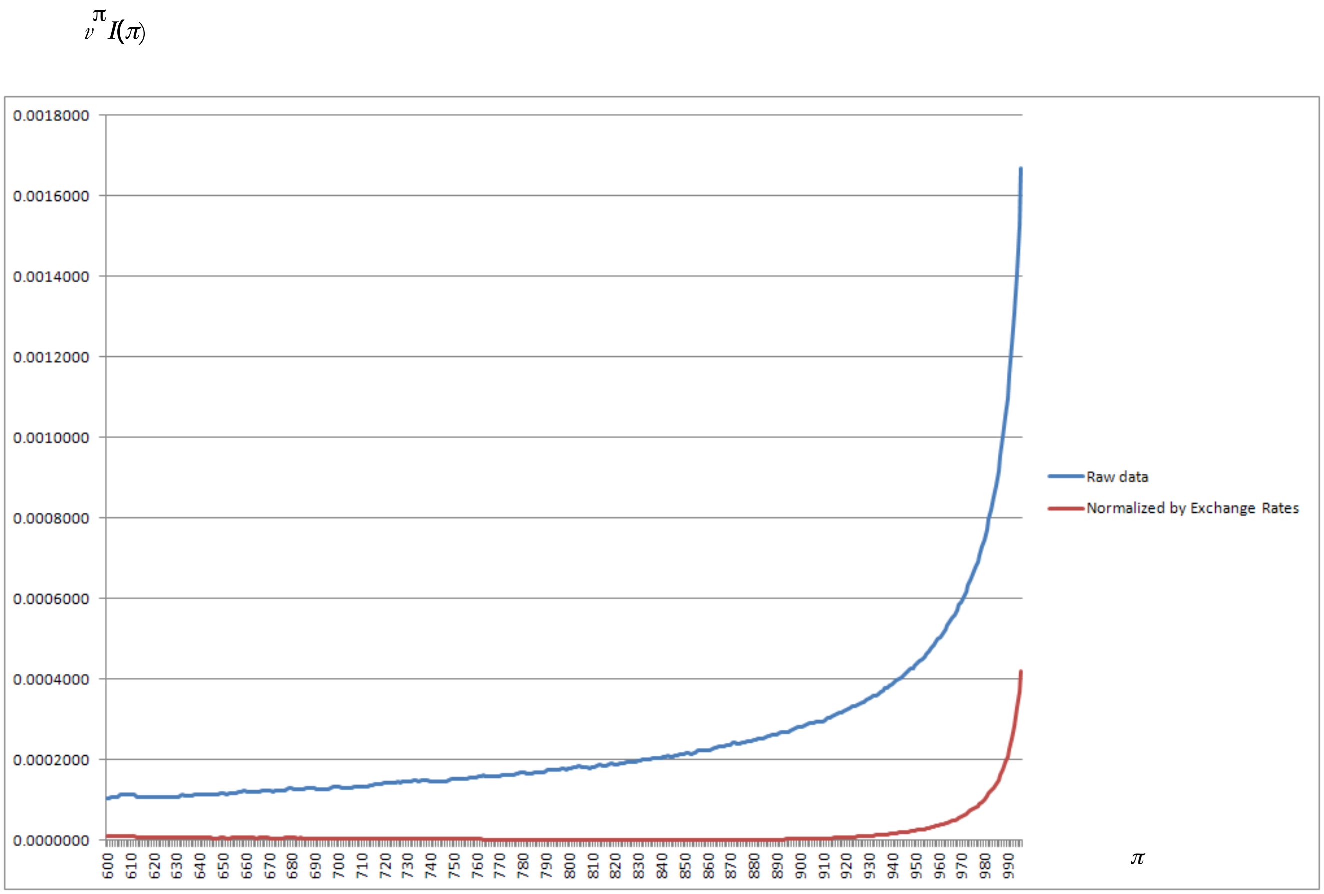
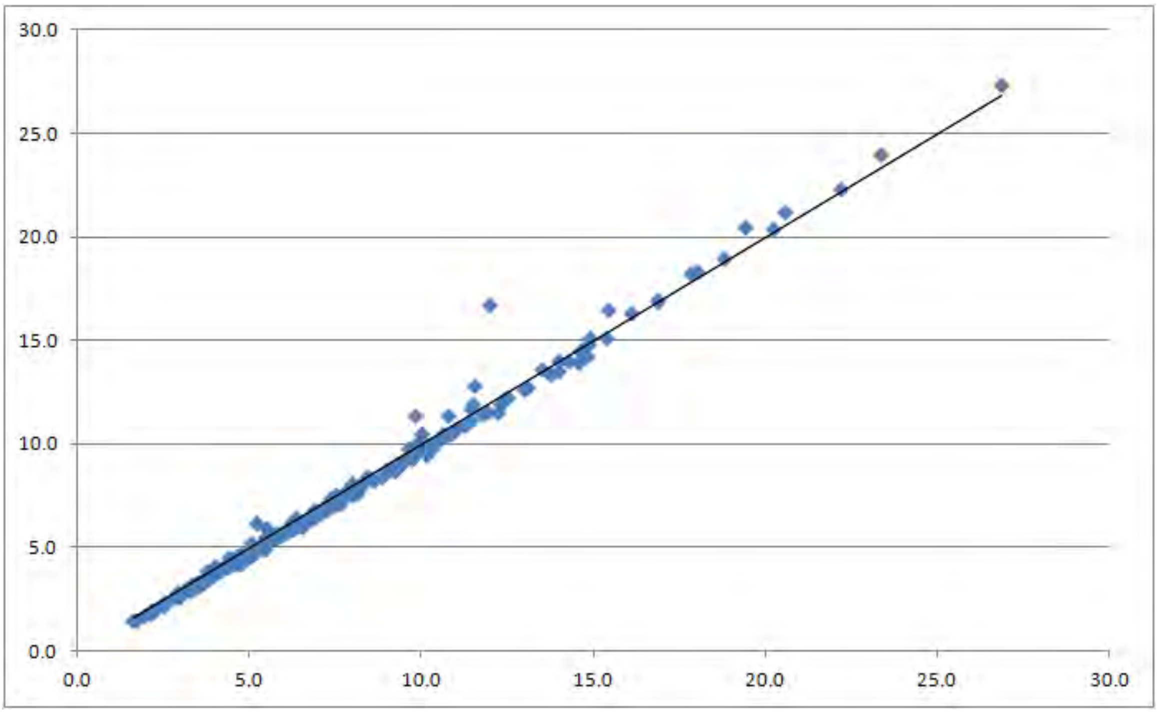



**Figure 2. Weighted Citation Inequality Due to Differences in Citation Practices, $v^{\pi} I(\pi)$ vs. $\pi$. Raw *vs.* Normalized Data**

**Figure 3. A Comparison at the Sub-field Level of the Estimated $ER$s Over the [661, 978] Interval *versus* the Exchange Rates Based on Mean Citations. The Fractional Case.**

Exchange Rates Based on Mean Citations




Estimated Exchange Rates

**Table 4. Exchange Rates, Standard Deviations, and Coefficients of Variation for the [661, 978] Interval. Multiplicative case.**

| | | Exchange Rates | Standard Deviation | Coefficient of Variation | % of Citations | Exch. Rates Based on Mean Citations |
|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) |
| | **A. LIFE SCIENCES** | | | | | |
| | **I. BIOSCIENCES** | | | | | |
| 1 | BIOLOGY | 10.5 | 0.4 | 0.035 | 63.8 | 10.0 |
| 2 | BIOLOGY, MISCELLANEOUS | 4.7 | 0.3 | 0.067 | 64.7 | 4.4 |
| 3 | EVOLUTIONARY BIOLOGY | 16.1 | 1.7 | 0.108 | 56.7 | 16.3 |
| 4 | BIOCHEMICAL RESEARCH METHODS | 11.5 | 0.6 | 0.054 | 54.7 | 12.4 |
| 5 | BIOCHEMISTRY & MOLECULAR BIOLOGY | 20.6 | 0.4 | 0.021 | 58.4 | 21.2 |
| 6 | BIOPHYSICS | 14 | 0.7 | 0.050 | 58.4 | 14.1 |
| 7 | CELL BIOLOGY | 27 | 1 | 0.038 | 60.4 | 27.5 |
| 8 | GENETICS & HEREDITY | 19.7 | 0.4 | 0.021 | 58.5 | 20.5 |
| 9 | DEVELOPMENTAL BIOLOGY | 24.4 | 0.5 | 0.021 | 60.4 | 24.6 |
| | **II. BIOMEDICAL RESEARCH** | | | | | |
| 10 | PATHOLOGY | 11.7 | 0.3 | 0.024 | 62 | 11.5 |
| 11 | ANATOMY & MORPHOLOGY | 7.8 | 0.5 | 0.064 | 60.9 | 7.6 |
| 12 | ENGINEERING, BIOMEDICAL | 9.6 | 0.5 | 0.048 | 61.2 | 9.2 |
| 13 | BIOTECHNOLOGY & APPLIED MICROBIOLOGY | 11.6 | 0.3 | 0.022 | 57.9 | 12.1 |
| 14 | MEDICAL LABORATORY TECHNOLOGY | 8.1 | 0.3 | 0.031 | 61.3 | 8.0 |
| 15 | MICROSCOPY | 8.5 | 0.6 | 0.068 | 60.6 | 8.3 |
| 16 | PHARMACOLOGY & PHARMACY | 10.7 | 0.4 | 0.041 | 59.8 | 10.6 |
| 17 | TOXICOLOGY | 9.6 | 0.6 | 0.067 | 59.2 | 9.5 |
| 18 | PHYSIOLOGY | 14.1 | 1.4 | 0.101 | 59.3 | 13.7 |
| 19 | MEDICINE, RESEARCH & EXPERIMENTAL | 15.7 | 2.8 | 0.180 | 59.9 | 17.2 |
| | **III. CLINICAL MEDICINE I (INTERNAL)** | | | | | |
| 20 | CARDIAC & CARDIOVASCULAR SYSTEMS | 14.9 | 1.1 | 0.076 | 61.3 | 15.2 |
| 21 | RESPIRATORY SYSTEM | 13.5 | 0.6 | 0.042 | 60.6 | 13.2 |
| 22 | ENDOCRINOLOGY & METABOLISM | 16.7 | 1.1 | 0.066 | 58.2 | 16.9 |
| 23 | ANESTHESIOLOGY | 9.4 | 0.3 | 0.032 | 62.8 | 8.9 |
| 24 | CRITICAL CARE MEDICINE | 14.6 | 0.4 | 0.030 | 61.5 | 14.2 |
| 25 | EMERGENCY MEDICINE | 5.8 | 0.3 | 0.050 | 62.2 | 5.6 |
| 26 | GASTROENTEROLOGY & HEPATOLOGY | 13.7 | 0.4 | 0.027 | 60.4 | 13.8 |
| 27 | MEDICINE, GENERAL & INTERNAL | 12.1 | 5 | 0.411 | 52.2 | 16.9 |
| 28 | TROPICAL MEDICINE | 7.2 | 0.5 | 0.069 | 62.1 | 6.8 |
| 29 | HEMATOLOGY | 21.9 | 0.4 | 0.020 | 61 | 21.8 |
| 30 | ONCOLOGY | 18 | 0.5 | 0.027 | 58.8 | 18.3 |
| 31 | ALLERGY | 12.2 | 0.4 | 0.033 | 62.7 | 11.7 |
| 32 | IMMUNOLOGY | 17.8 | 0.3 | 0.016 | 58.9 | 18.3 |
| 33 | INFECTIOUS DISEASES | 15.3 | 0.9 | 0.060 | 59.4 | 15.2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | **IV. CLINICAL MEDICINE II (NON-INTERNAL)** | | | | | |
| **34** | GERIATRICS & GERONTOLOGY | 11.1 | 0.6 | 0.054 | 61.5 | 10.7 |
| **35** | OBSTETRICS & GYNECOLOGY | 9.2 | 0.4 | 0.042 | 62.1 | 8.8 |
| **36** | ANDROLOGY | 7.4 | 0.6 | 0.079 | 60.1 | 7.2 |
| **37** | REPRODUCTIVE BIOLOGY | 12.6 | 1.1 | 0.088 | 58.7 | 12.4 |
| **38** | GERONTOLOGY | 10 | 0.4 | 0.038 | 63.3 | 9.4 |
| **39** | DENTISTRY & ORAL SURGERY | 7.2 | 0.5 | 0.073 | 60.6 | 7.0 |
| **40** | DERMATOLOGY | 8.1 | 0.3 | 0.036 | 62.1 | 7.8 |
| **41** | UROLOGY & NEPHROLOGY | 12.4 | 0.3 | 0.022 | 61.9 | 12.0 |
| **42** | OTORHINOLARYNGOLOGY | 6.1 | 0.4 | 0.069 | 62.4 | 5.7 |
| **43** | OPHTHALMOLOGY | 9.5 | 0.3 | 0.030 | 61.3 | 9.3 |
| **44** | INTEGRATIVE & COMPLEMENTARY MEDICINE | 6.2 | 0.6 | 0.090 | 61.2 | 5.9 |
| **45** | CLINICAL NEUROLOGY | 12.4 | 0.3 | 0.021 | 61.4 | 12.2 |
| **46** | PSYCHIATRY | 13.1 | 0.3 | 0.020 | 62 | 12.8 |
| **47** | RADIOLOGY, NUCLEAR MED. & MED. IMAGING | 10.4 | 0.3 | 0.025 | 61.4 | 10.3 |
| **48** | ORTHOPEDICS | 7.9 | 0.3 | 0.038 | 61.4 | 7.7 |
| **49** | RHEUMATOLOGY | 14.6 | 0.6 | 0.038 | 59.7 | 14.6 |
| **50** | SPORT SCIENCES | 8.2 | 0.5 | 0.056 | 62.5 | 7.7 |
| **51** | SURGERY | 8.6 | 0.2 | 0.028 | 62 | 8.4 |
| **52** | TRANSPLANTATION | 9.3 | 0.3 | 0.029 | 61.9 | 9.1 |
| **53** | PERIPHERAL VASCULAR DISEASE | 20.4 | 0.3 | 0.013 | 60.3 | 20.5 |
| **54** | PEDIATRICS | 7.7 | 0.3 | 0.035 | 61.8 | 7.5 |
| | **V. CLINICAL MEDICINE III** | | | | | |
| **55** | HEALTH CARE SCIENCES & SERVICES | 7.8 | 0.4 | 0.049 | 60.7 | 7.6 |
| **56** | HEALTH POLICY & SERVICES | 8.2 | 0.3 | 0.039 | 59.3 | 8.2 |
| **57** | MEDICINE, LEGAL | 5.8 | 0.4 | 0.069 | 60.5 | 5.6 |
| **58** | NURSING | 4.4 | 0.4 | 0.091 | 62.4 | 4.1 |
| **59** | PUBLIC, ENV. & OCCUPATIONAL HEALTH | 9.6 | 0.3 | 0.035 | 60.7 | 9.5 |
| **60** | REHABILITATION | 5.9 | 0.4 | 0.060 | 62.5 | 5.6 |
| **61** | SUBSTANCE ABUSE | 10 | 0.9 | 0.090 | 59.1 | 9.8 |
| **62** | EDUCATION, SCIENTIFIC DISCIPLINES | 4 | 0.3 | 0.071 | 64.8 | 3.8 |
| **63** | MEDICAL INFORMATICS | 5.7 | 0.3 | 0.046 | 61.6 | 5.6 |
| | **VI. NEUROSCIENCES & BEHAVIORAL** | | | | | |
| **64** | NEUROIMAGING | 14.6 | 0.4 | 0.026 | 63.1 | 14.0 |
| **65** | NEUROSCIENCES | 17 | 0.5 | 0.029 | 59.5 | 17.1 |
| **66** | BEHAVIORAL SCIENCES | 11.5 | 1.3 | 0.115 | 56 | 11.7 |
| **67** | PSYCHOLOGY, BIOLOGICAL | 9.9 | 0.8 | 0.084 | 57.3 | 10.0 |
| **68** | PSYCHOLOGY | 10.6 | 0.7 | 0.069 | 60.1 | 10.3 |
| **69** | PSYCHOLOGY, APPLIED | 6.5 | 0.4 | 0.063 | 61.9 | 6.2 |
| **70** | PSYCHOLOGY, CLINICAL | 10 | 0.4 | 0.038 | 61.2 | 9.8 |
| **71** | PSYCHOLOGY, DEVELOPMENTAL | 10.4 | 0.5 | 0.052 | 60.8 | 10.1 |
| **72** | PSYCHOLOGY, EDUCATIONAL | 7.1 | 0.3 | 0.043 | 64 | 6.7 |
| **73** | PSYCHOLOGY, EXPERIMENTAL | 10.2 | 0.4 | 0.042 | 61 | 10.0 |
| **74** | PSYCHOLOGY, MATHEMATICAL | 7 | 0.3 | 0.038 | 61 | 6.9 |
| **75** | PSYCHOLOGY, MULTIDISCIPLINARY | 6.4 | 0.6 | 0.092 | 62.6 | 6.4 |
| **76** | PSYCHOLOGY, PSYCHOANALYSIS | 3.8 | 0.4 | 0.100 | 66.3 | 3.5 |
| **77** | PSYCHOLOGY, SOCIAL | 8.3 | 0.3 | 0.031 | 61.6 | 8.1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 78 | SOCIAL SCIENCES, BIOMEDICAL | 7.4 | 0.3 | 0.039 | 60.7 | 7.3 |
| | **B. PHYSICAL SCIENCES** | | | | | |
| | **VII. CHEMISTRY** | | | | | |
| 79 | CHEMISTRY, MULTIDISCIPLINARY | 12 | 1.3 | 0.108 | 65 | 11.7 |
| 80 | CHEMISTRY, INORGANIC & NUCLEAR | 9.1 | 0.6 | 0.062 | 61.6 | 8.7 |
| 81 | CHEMISTRY, ANALYTICAL | 10 | 0.5 | 0.046 | 60.6 | 9.8 |
| 82 | CHEMISTRY, APPLIED | 7.7 | 0.5 | 0.063 | 61.9 | 7.3 |
| 83 | ENGINEERING, CHEMICAL | 6 | 0.3 | 0.045 | 63.9 | 5.7 |
| 84 | CHEMISTRY, MEDICINAL | 9.8 | 0.8 | 0.078 | 59 | 9.7 |
| 85 | CHEMISTRY, ORGANIC | 10.7 | 1 | 0.090 | 59.1 | 10.5 |
| 86 | CHEMISTRY, PHYSICAL | 10.5 | 0.4 | 0.043 | 60 | 10.4 |
| 87 | ELECTROCHEMISTRY | 10.4 | 0.7 | 0.072 | 60.6 | 10.0 |
| 88 | POLYMER SCIENCE | 8.3 | 0.3 | 0.031 | 61.3 | 8.1 |
| | **VIII. PHYSICS** | | | | | |
| 89 | PHYSICS, MULTIDISCIPLINARY | 10.1 | 1.7 | 0.169 | 62.2 | 10.6 |
| 90 | SPECTROSCOPY | 7.7 | 0.3 | 0.043 | 61.8 | 7.4 |
| 91 | ACOUSTICS | 5.6 | 0.3 | 0.052 | 62.7 | 5.3 |
| 92 | OPTICS | 7.3 | 0.3 | 0.038 | 62.8 | 7.1 |
| 93 | PHYSICS, APPLIED | 7.5 | 0.4 | 0.049 | 60.9 | 7.6 |
| 94 | PHYSICS, ATOMIC, MOLECULAR & CHEMICAL | 11.1 | 0.8 | 0.071 | 59.1 | 11.0 |
| 95 | THERMODYNAMICS | 4.8 | 0.4 | 0.081 | 61.7 | 4.6 |
| 96 | PHYSICS, MATHEMATICAL | 7.5 | 0.3 | 0.037 | 61.6 | 7.4 |
| 97 | PHYSICS, NUCLEAR | 6.6 | 0.4 | 0.067 | 63.3 | 6.4 |
| 98 | PHYSICS, PARTICLES & SUB-FIELDS | 11.1 | 1.2 | 0.106 | 60.7 | 11.6 |
| 99 | PHYSICS, CONDENSED MATTER | 7.5 | 0.3 | 0.039 | 62 | 7.4 |
| 100 | PHYSICS OF SOLIDS, FLUIDS & PLASMAS | 9.4 | 0.6 | 0.064 | 60 | 9.2 |
| 101 | CRYSTALLOGRAPHY | 5.2 | 0.2 | 0.046 | 56.4 | 5.6 |
| | **IX. SPACE SCIENCES** | | | | | |
| 102 | ASTRONOMY & ASTROPHYSICS | 14.9 | 0.3 | 0.018 | 60.7 | 14.9 |
| | **X. MATHEMATICS** | | | | | |
| 103 | MATHEMATICS, APPLIED | 3.7 | 0.3 | 0.075 | 65 | 3.5 |
| 104 | STATISTICS & PROBABILITY | 5.4 | 0.5 | 0.097 | 54.1 | 6.2 |
| 105 | MATH., INTERDISCIPLINARY APPLICATIONS | 5.6 | 0.2 | 0.044 | 61.6 | 5.5 |
| 106 | SOCIAL SCIENCES, MATHEMATICAL METHODS | 5.6 | 0.3 | 0.047 | 61.4 | 5.5 |
| 107 | PURE MATHEMATICS | 2.8 | 0.2 | 0.087 | 66 | 2.6 |
| | **XI. COMPUTER SCIENCE** | | | | | |
| 108 | COMP. SCIENCE, ARTIFICIAL INTELLIGENCE | 4.8 | 0.5 | 0.107 | 63.4 | 4.8 |
| 109 | COMPUTER SCIENCE, CYBERNETICS | 3.7 | 0.4 | 0.102 | 67.1 | 3.4 |
| 110 | COMP. SCIENCE, HARDWARE & ARCHITECTURE | 3.9 | 0.5 | 0.123 | 62.9 | 4.0 |
| 111 | COMPUTER SCIENCE, INFORMATION SYSTEMS | 4.3 | 0.7 | 0.154 | 62.5 | 4.5 |
| 112 | COMP. SC., INTERDISCIPLINARY APPLICATIONS | 5.7 | 0.6 | 0.099 | 56.6 | 6.3 |
| 113 | COMP. SCIENCE, SOFTWARE ENGINEERING | 3.7 | 0.4 | 0.114 | 65 | 3.5 |
| 114 | COMPUTER SCIENCE, THEORY & METHODS | 2.9 | 0.4 | 0.130 | 65.6 | 2.8 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 115 | MATHEMATICAL & COMPUTATIONAL BIOLOGY | 9.8 | 0.5 | 0.047 | 49.7 | 12.2 |
| | **C. OTHER NATURAL SCIENCES** | | | | | |
| | **XII. ENGINEERING** | | | | | |
| 116 | ENGINEERING, ELECTRICAL & ELECTRONIC | 4.8 | 0.4 | 0.077 | 63 | 4.7 |
| 117 | TELECOMMUNICATIONS | 3.7 | 0.5 | 0.147 | 63.6 | 3.8 |
| 118 | CONSTRUCTION & BUILDING TECHNOLOGY | 3.5 | 0.3 | 0.088 | 65.5 | 3.2 |
| 119 | ENGINEERING, CIVIL | 3.4 | 0.3 | 0.087 | 66.3 | 3.2 |
| 120 | ENGINEERING, ENVIRONMENTAL | 9 | 0.3 | 0.034 | 62.5 | 8.7 |
| 121 | ENGINEERING, MARINE | 1.5 | 0.3 | 0.210 | 71.5 | 1.4 |
| 122 | TRANSPORTATION SCIENCE & TECHNOLOGY | 2.1 | 0.5 | 0.233 | 70.9 | 1.9 |
| 123 | ENGINEERING, INDUSTRIAL | 3.3 | 0.3 | 0.088 | 66.2 | 3.0 |
| 124 | ENGINEERING, MANUFACTURING | 3.6 | 0.3 | 0.087 | 65.3 | 3.2 |
| 125 | ENGINEERING, MECHANICAL | 4 | 0.2 | 0.060 | 63.9 | 3.8 |
| 126 | MECHANICS | 5.2 | 0.3 | 0.049 | 63.4 | 4.9 |
| 127 | ROBOTICS | 3.7 | 0.3 | 0.069 | 65 | 3.5 |
| 128 | INSTRUMENTS & INSTRUMENTATION | 5.2 | 0.2 | 0.046 | 64.4 | 4.9 |
| 129 | IMAGING SCIENCE & PHOTOGR. TECHNOLOGY | 7.5 | 0.4 | 0.058 | 63.8 | 7.2 |
| 130 | ENERGY & FUELS | 5.2 | 0.3 | 0.056 | 64.5 | 4.9 |
| 131 | NUCLEAR SCIENCE & TECHNOLOGY | 4.4 | 0.3 | 0.059 | 62.9 | 4.2 |
| 132 | ENGINEERING, PETROLEUM | 1.7 | 0.4 | 0.257 | 73.5 | 1.5 |
| 133 | AUTOMATION & CONTROL SYSTEMS | 4.1 | 0.2 | 0.060 | 64.5 | 3.8 |
| 134 | ENGINEERING, MULTIDISCIPLINARY | 3.9 | 0.4 | 0.101 | 65.9 | 3.6 |
| 135 | ERGONOMICS | 4.8 | 0.4 | 0.080 | 62.4 | 4.5 |
| 136 | OPERATIONS RES. & MANAGEMENT SCIENCE | 4 | 0.2 | 0.061 | 63.9 | 3.8 |
| | **XIII. MATERIALS SCIENCE** | | | | | |
| 137 | MATERIALS SCIENCE, MULTIDISCIPLINARY | 6.5 | 0.4 | 0.061 | 60.6 | 6.6 |
| 138 | MATERIALS SCIENCE, BIOMATERIALS | 13 | 1.1 | 0.084 | 59.1 | 12.8 |
| 139 | MATERIALS SCIENCE, CERAMICS | 4.8 | 0.4 | 0.075 | 68.1 | 4.3 |
| 140 | MAT. SC., CHARACTERIZATION & TESTING | 2.2 | 0.4 | 0.189 | 69.5 | 2.0 |
| 141 | MATERIALS SCIENCE, COATINGS & FILMS | 7.5 | 0.5 | 0.065 | 61.4 | 7.2 |
| 142 | MATERIALS SCIENCE, COMPOSITES | 3.5 | 0.3 | 0.084 | 65.1 | 3.3 |
| 143 | MATERIALS SCIENCE, PAPER & WOOD | 3 | 0.3 | 0.091 | 68 | 2.6 |
| 144 | MATERIALS SCIENCE, TEXTILES | 2.9 | 0.3 | 0.089 | 65.5 | 2.7 |
| 145 | METALL. & METALLURGICAL ENGINEERING | 4.6 | 0.4 | 0.082 | 64.5 | 4.4 |
| 146 | NANOSCIENCE & NANOTECHNOLOGY | 8.2 | 0.4 | 0.044 | 59.6 | 8.4 |
| | **XIV. GEOSCIENCES** | | | | | |
| 147 | GEOCHEMISTRY & GEOPHYSICS | 9.8 | 0.6 | 0.060 | 61.7 | 9.4 |
| 148 | GEOGRAPHY, PHYSICAL | 9 | 0.8 | 0.088 | 59.9 | 8.7 |
| 149 | GEOLOGY | 8 | 0.4 | 0.055 | 62.7 | 7.6 |
| 150 | ENGINEERING, GEOLOGICAL | 3.7 | 0.3 | 0.088 | 62.5 | 3.5 |
| 151 | PALEONTOLOGY | 6.4 | 0.4 | 0.055 | 63.1 | 6.0 |
| 152 | REMOTE SENSING | 7.4 | 0.3 | 0.043 | 60.6 | 7.3 |
| 153 | OCEANOGRAPHY | 10 | 0.9 | 0.090 | 61.2 | 9.5 |
| 154 | ENGINEERING, OCEAN | 3.8 | 0.4 | 0.098 | 64.8 | 3.6 |
| 155 | METEOROLOGY & ATMOSPHERIC SCIENCES | 10.6 | 0.4 | 0.037 | 61.3 | 10.3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 156 | ENGINEERING, AEROSPACE | 2.6 | 0.2 | 0.091 | 68.7 | 2.3 |
| 157 | MINERALOGY | 7.2 | 0.4 | 0.060 | 61.7 | 6.8 |
| 158 | MINING & MINERAL PROCESSING | 4.1 | 0.3 | 0.065 | 65.8 | 3.9 |
| 159 | GEOSCIENCES, MULTIDISCIPLINARY | 7.3 | 0.4 | 0.050 | 62.6 | 6.9 |
| | **XV. AGRICULTURAL & ENVIRONMENT** | | | | | |
| 160 | AGRICULTURAL ENGINEERING | 4.9 | 0.4 | 0.072 | 62 | 4.7 |
| 161 | AGRICULTURE, MULTIDISCIPLINARY | 6.9 | 0.3 | 0.038 | 64.7 | 6.4 |
| 162 | AGRONOMY | 5.9 | 0.3 | 0.046 | 63 | 5.6 |
| 163 | LIMNOLOGY | 9.5 | 0.6 | 0.065 | 61 | 9.2 |
| 164 | SOIL SCIENCE | 6.9 | 0.5 | 0.074 | 62.1 | 6.5 |
| 165 | BIODIVERSITY CONSERVATION | 8.8 | 0.3 | 0.037 | 62.7 | 8.4 |
| 166 | ENVIRONMENTAL SCIENCES | 8.9 | 0.5 | 0.051 | 60.8 | 8.7 |
| 167 | ENVIRONMENTAL STUDIES | 4.9 | 0.3 | 0.071 | 61.7 | 4.7 |
| 168 | FOOD SCIENCE & TECHNOLOGY | 7.1 | 0.5 | 0.067 | 61.8 | 6.8 |
| 169 | NUTRITION & DIETETICS | 11.4 | 0.3 | 0.030 | 61.3 | 11.1 |
| 170 | AGRICULTURE, DAIRY & ANIMAL SCIENCE | 5.4 | 0.3 | 0.048 | 65.9 | 5.0 |
| 171 | HORTICULTURE | 6.2 | 0.3 | 0.044 | 62.9 | 6.0 |
| | **XVI. BIOLOGY (ORGANISMIC AND SUPRAORGONISMIC LEVEL)** | | | | | |
| 172 | ORNITHOLOGY | 5.5 | 0.4 | 0.077 | 59.8 | 5.4 |
| 173 | ZOOLOGY | 7.5 | 0.5 | 0.065 | 61.4 | 7.2 |
| 174 | ENTOMOLOGY | 5.5 | 0.4 | 0.067 | 63 | 5.1 |
| 175 | WATER RESOURCES | 6.2 | 0.4 | 0.068 | 62.2 | 5.8 |
| 176 | FISHERIES | 7.1 | 0.8 | 0.110 | 60 | 6.8 |
| 177 | MARINE & FRESHWATER BIOLOGY | 8.2 | 0.9 | 0.113 | 59.2 | 7.9 |
| 178 | MICROBIOLOGY | 14.3 | 1 | 0.071 | 58.9 | 14.2 |
| 179 | PARASITOLOGY | 8.1 | 0.6 | 0.072 | 60 | 7.9 |
| 180 | VIROLOGY | 18.7 | 1.5 | 0.082 | 57.6 | 18.8 |
| 181 | FORESTRY | 7 | 0.6 | 0.079 | 60.2 | 6.8 |
| 182 | MYCOLOGY | 6.8 | 0.3 | 0.046 | 62.3 | 6.5 |
| 183 | PLANT SCIENCES | 9.6 | 0.3 | 0.027 | 60.7 | 9.6 |
| 184 | ECOLOGY | 11.4 | 1 | 0.085 | 59.7 | 11.1 |
| 185 | VETERINARY SCIENCES | 5.2 | 0.3 | 0.054 | 65.4 | 4.8 |
| | **XVII. MULTIDISCIPLINARY** | | | | | |
| 186 | MULTIDISCIPLINARY SCIENCES | 4.1 | 0.6 | 0.161 | 64.2 | 4.1 |
| | **D. SOCIAL SCIENCES** | | | | | |
| | **XVIII. SOCIAL SCIENCES, GENERAL** | | | | | |
| 187 | CRIMINOLOGY & PENOLOGY | 4.9 | 0.3 | 0.065 | 66.5 | 4.5 |
| 188 | LAW | 4.4 | 0.4 | 0.083 | 64.7 | 4.2 |
| 189 | POLITICAL SCIENCE | 3.3 | 0.4 | 0.119 | 65.7 | 3.2 |
| 190 | PUBLIC ADMINISTRATION | 3.7 | 0.3 | 0.075 | 65.9 | 3.4 |
| 191 | ETHNIC STUDIES | 2.6 | 0.3 | 0.103 | 66 | 2.4 |
| 192 | FAMILY STUDIES | 5.8 | 0.3 | 0.055 | 62 | 5.6 |
| 193 | SOCIAL ISSUES | 3.6 | 0.3 | 0.088 | 65.5 | 3.4 |
| 194 | SOCIAL WORK | 3.9 | 0.3 | 0.069 | 63.4 | 3.6 |
| 195 | SOCIOLOGY | 4.2 | 0.3 | 0.067 | 65.1 | 4.0 |
| 196 | WOMEN'S STUDIES | 4 | 0.3 | 0.063 | 64 | 3.8 |

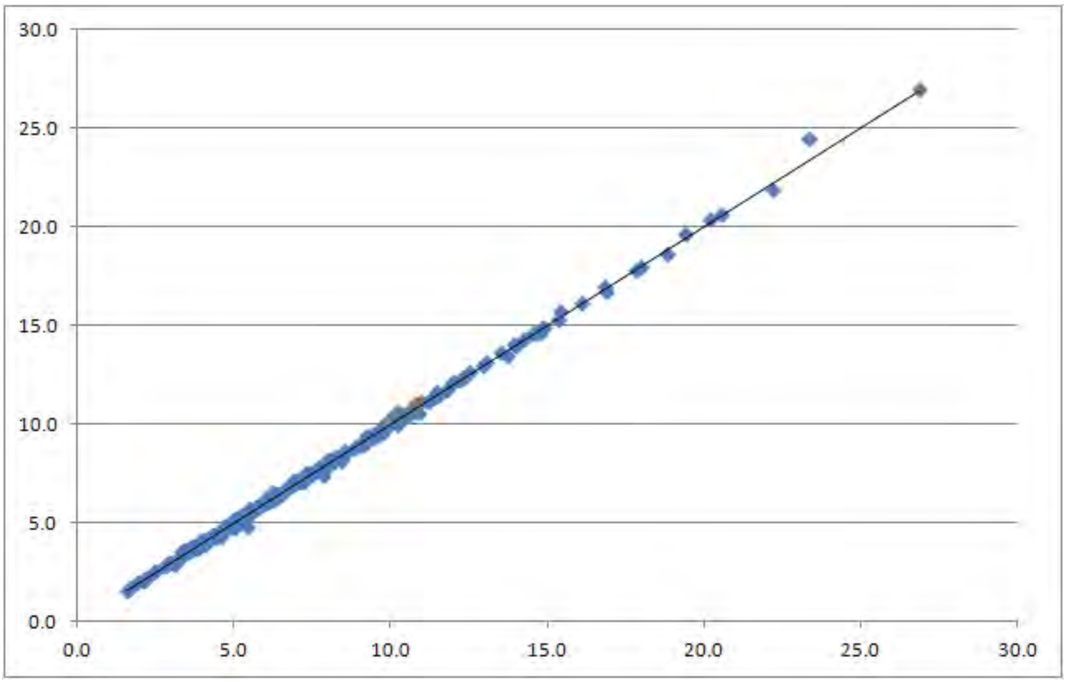
| | | | | | | |
|---|---|---|---|---|---|---|
| 197 | EDUCATION & EDUCATIONAL RESEARCH | 3.3 | 0.3 | 0.088 | 64.3 | 3.1 |
| 198 | EDUCATION, SPECIAL | 5.1 | 0.3 | 0.059 | 62.5 | 4.9 |
| 199 | AREA STUDIES | 2 | 0.3 | 0.154 | 67.4 | 1.8 |
| 200 | GEOGRAPHY | 5.8 | 0.3 | 0.054 | 60.8 | 5.7 |
| 201 | PLANNING & DEVELOPMENT | 4.3 | 0.3 | 0.060 | 62.4 | 4.2 |
| 202 | TRANSPORTATION | 5.1 | 0.4 | 0.073 | 62.2 | 4.9 |
| 203 | URBAN STUDIES | 4.3 | 0.3 | 0.064 | 62.3 | 4.1 |
| 204 | ETHICS | 3.5 | 0.3 | 0.080 | 65.3 | 3.2 |
| 205 | MEDICAL ETHICS | 5.2 | 0.4 | 0.071 | 62.1 | 4.9 |
| 206 | ANTHROPOLOGY | 4.3 | 0.3 | 0.075 | 65.9 | 4.0 |
| 207 | COMMUNICATION | 4.3 | 0.3 | 0.065 | 63.4 | 4.0 |
| 208 | DEMOGRAPHY | 5.6 | 0.3 | 0.048 | 61.3 | 5.5 |
| 209 | HISTORY OF SOCIAL SCIENCES | 2.1 | 0.3 | 0.145 | 69.1 | 1.8 |
| 210 | INFORMATION SCIENCE & LIBRARY SCIENCE | 3.9 | 0.5 | 0.127 | 64.1 | 3.8 |
| 211 | INTERNATIONAL RELATIONS | 2.9 | 0.4 | 0.140 | 65.5 | 2.9 |
| 212 | LINGUISTICS | 6 | 0.3 | 0.046 | 63.5 | 5.7 |
| 213 | SOCIAL SCIENCES, INTERDISCIPLINARY | 3.5 | 0.3 | 0.098 | 66.1 | 3.3 |
| | **XIX. ECONOMICS & BUSINESS** | | | | | |
| 214 | AGRICULTURAL ECONOMICS & POLICY | 3.8 | 0.3 | 0.073 | 63.6 | 3.6 |
| 215 | ECONOMICS | 4.6 | 0.4 | 0.077 | 62 | 4.6 |
| 216 | INDUSTRIAL RELATIONS & LABOR | 4.5 | 0.3 | 0.077 | 64.1 | 4.1 |
| 217 | BUSINESS | 6.7 | 0.4 | 0.056 | 64.3 | 6.4 |
| 218 | BUSINESS, FINANCE | 6.4 | 0.6 | 0.094 | 64.3 | 6.3 |
| 219 | MANAGEMENT | 6.4 | 0.4 | 0.061 | 63.6 | 6.2 |
| | **Mean** | | | **0.07** | **62.2** | |

**Table 5. Citation Inequality Decomposition Sat the Sub-field level. The Multiplicative Case.**

| | Quantiles | Within-group Term, $\mathbb{W}$ | Skew. of Sc. Term, $\mathbb{S}$ | $IDCP$ Term | Total Citation Inequality | Percentages In %: (1)/(4) | (2)/(4) | (3)/(4) |
|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| **A. Raw Data** | All quantiles | 0.0030 | 0.6950 | 0.1544 | 0.8524 | 0.35 | 81.54 | 18.11 |
| | [1, 660] | | | 0.0469 | | | | 5.50 |
| | [661, 978] | | | 0.0766 | | | | 8.98 |
| | [979, 1000] | | | 0.0310 | | | | 3.63 |
| **B. Sub-field $ER$** | All quantiles | 0.0030 | 0.7212 | 0.0268 | 0.7510 | 0.41 | 96.03 | 3.57 |
| **Normalization** | [1, 660] | | | 0.0160 | | | | 2.13 |
| | [661, 978] | | | 0.0023 | | | | 0.31 |
| | [979, 1000] | | | 0.0085 | | | | 1.13 |
| **C. Sub-field Mean** | All quantiles | 0.0029 | 0.7168 | 0.0243 | 0.7440 | 0.39 | 96.34 | 3.27 |
| **Normalization** | [1, 660] | | | 0.0164 | | | | 2.20 |
| | [661, 978] | | | 0.0023 | | | | 0.31 |
| | [979, 1000] | | | 0.0056 | | | | 0.76 |

**Figure 4. A Comparison at the Sub-field level of Exchange Rates in the Fractional *versus* the Multiplicative Case**

Exchange Rates. Multiplicative Case




Exchange Rates. Fractional Case