Journal of Agricultural and Resource Economics 37(3):335–348

WAEA Presidential Address Deciding Where to Publish: Some Observations on Journal Impact Factor and Article Influence Score

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This article provides the history underlying the journal impact factor and weaknesses of this measure to evaluate journal quality. The Eigenfactor and Article Influence Scores are suggested as an improved way to compare research quality and impact across disciplines. The network analysis underlying the Eigenfactor approach suggests the agricultural and natural resource economics profession can have a larger impact on the scientific community by directing more research effort towards interdisciplinary work. The Article Influence approach is used to develop a seven-tier system to evaluate research quality, to be used either to guide individual faculty about where to publish their research or to evaluate the research portfolio of a department.

Key words: article influence score, citation analysis, economic literature, impact factor, research

Introduction

The discovery of knowledge is an important charge given to faculty hired into the ranks of academia. Faculty are expected to conduct research and disseminate that research through both professional and popular outlets. Indeed, a faculty member's rewards (from tenure to merit raises) are usually tied in some way to the quality of research he or she produces. Refereed journal articles are the central measure used to evaluate research quality, because in theory they are subject to an impartial evaluation of quality by peers. Nevertheless, simply publishing in a refereed outlet is insufficient. A scholar's prestige is tied to the quality of the journals in which his or her work is published and how many times that work is cited by others. The quality of a journal, in turn, is judged by how widely its articles are read and cited within the academic community. In the end, citations are the driving force in determining the quality of particular articles and entire journals. The push for greater accountability in how public funds are used in education has only intensified the focus on citation counts to measure impact.

Young professionals are usually familiarized with these concepts while still in graduate school. Once they have started in an academic position, however, the decision about where to publish becomes central to their research effort. Targeting high-quality journals means greater risk of rejection and lower research output. Targeting low-quality journals means more publications but generates little prestige. Both low quality and low numbers can doom a faculty member seeking

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Appreciation is expressed to the department's faculty at Colorado State for feedback provided at a seminar on this topic, also to Jevin West and Martin Rosvall for help in understanding Eigenfactor analysis. Comments by anonymous reviewers also helped strengthen the document.
Review coordinated by Gary W. Brester.

promotion and tenure. Equally important, quality standards differ across faculty members and departments.

This article describes a methodology that faculty can use to evaluate potential research outlets or that can be used to evaluate research outputs generated by a department, college, or university. The approach serves not only to guide individual faculty decision-making but can be used by departments to conduct reviews of their research programs.

Citation Counts and Impact Factor

Although citation indices seem a product of the computer age, they actually predate computers by nearly a hundred years. The first, *Shepard's Citations*, was created in 1873 to allow lawyers to conduct legal searches of precedents used to establish case law (Garfield, 1979). Early attempts to index scientific literature were discipline-specific and limited to keywords. The need to search across disciplines and beyond keywords, coupled with an explosion in research output following World War II, prompted efforts to create complex index systems that could be maintained on computers.

Several pilot projects demonstrated the usefulness of creating more complex, computerized disciplinary indices of existing literature. In 1961, Garfield and his associates developed the first version of the *Science Citation Index (SCI)*. The federal government initially funded this effort but ultimately decided not to pursue it further. Garfield decided to continue the effort in the private sector by creating the Institute for Scientific Information (ISI). The *SCI* became very popular in the scientific community, leading ISI to add the *Social Science Citation Index* in 1973 and the *Arts & Humanities Citation Index* in 1978. These indices merged to form the Web of Science index, which is now owned by Thomson Reuters. As of 2012, Web of Science covered 250 disciplines and over 12,000 journals (Thomson Reuters, 2012).

Early on in this effort Garfield was faced with a decision about which journals should be included in the SCI and those that must be left out. As early as 1927, scientists argued that citation counts would be a good way to decide which journals libraries should subscribe to (Gross and Gross, 1927). Garfield found, however, that citation counts were heavily influenced by the size of the journal rather than the frequency with which each article was cited. To help with the sorting process, Garfield (2006) proposed the Impact Factor (IF). The IF is defined as:

$$IF_{ig} = \frac{\sum_{j=1}^{m}(C_{ijgk-1} + C_{ijgk-2})}{PA_{ik-1} + PA_{ik-2}}, \tag{1}$$

where C_{ijgk-1} is total journal j citations in year g to articles published in journal i and year $k-1$, C_{ijgk-2} is total journal citations in year g to articles published in journal i and year $k-2$, PA_{ik-1} is total published articles of journal i in year $k-1$, and PA_{ik-2} is total published articles of journal i in year $k-2$. As an example, the *Journal of Agricultural and Resource Economics* had a 2010 IF of 0.750. *JARE* published twenty-nine articles in 2009 and twenty-seven articles in 2008, creating a denominator of 56. Citations from all 12,000+ journals to *JARE* numbered fifteen articles in 2009 and twenty-seven in 2008, resulting in a numerator of 42 and an IF of 0.75. While it can offer a useful shorthand for journal impact, the IF has multiple problems both conceptually and in practice.

Discipline Dependent

Citation patterns vary markedly by academic discipline. For example, compare the 2010 citations for *AJAE* with those for *Journal of Virology* (figure 1). The 2010 citations from all journals to the *Journal of Virology* are highest for 2007 articles, or three years after the articles were published. By contrast, 2001 is the best year for *AJAE* citations made in 2010, or nine years after articles were published. If the IF focuses on citations from the first two years after publication, a quicker peak in citations will translate to a higher IF number. A recent study by Fok and Franses (2007) found

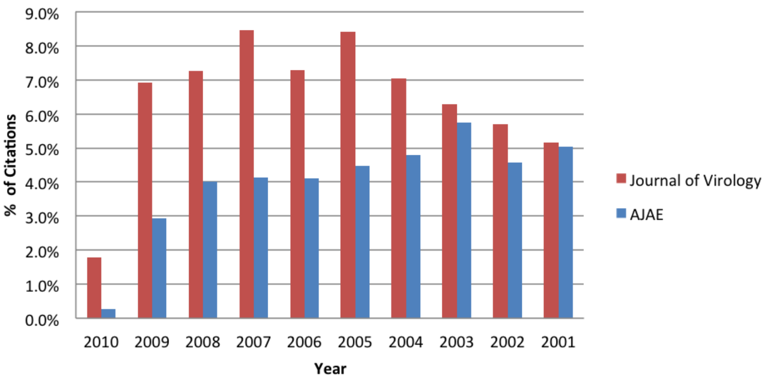

Figure 1. Comparison of Citation Patterns by Year for *Journal of Virology* and *AJAE*

that citations in medical and physics journals tend to peak much sooner than those in statistics and economics.

Another difference between disciplines is how articles are written. Table 1 summarizes important measures for various agriculture- and natural-resource-related journals for 2006, including average number of authors, average article length, average number of citations per article, and 2006 Impact Factors. The table entries were presorted based on average number of citations or references listed at the end of each article. There is a strong, statistically significant correlation between the IF for each journal and the average size of the reference list for articles published in that journal. Economics journals tend to have much shorter reference lists than articles written in the biological and physical sciences. A professional culture of greater reference use creates more citations and boosts Impact Factors in those disciplines. Articles in economics also tend to have the fewest number of authors and are longer. Again, the differences reflect different academic cultures. Lab-based researchers tend to produce many shorter articles and award co-authorship to many lab personnel.

Editorial Policies

Disciplinary issues influence the numerator in equation (1), but how the denominator is determined is also important. Journals can publish many items in addition to refereed articles. Items such as editorials, reviews, letters, comments, and rebuttals typically attract fewer citations (often none at all), so should these be included in the total article count? However, these nonresearch articles do attract some citations, so dropping them from the denominator may distort the IF number as much as leaving them in.

Then there are the more questionable methods journals can use to boost citations. Research has demonstrated that review articles generate more citations than original research (Garfield, 2005). By including a review article in every issue, editors can boost total citations and the IF. Some journal editors encourage or even pressure authors to add more citations to their journal in the reference list (Arnold and Fowler, 2010), a practice referred to as coercive self-citation. Authors' attempts to voluntarily boost citation counts can create the same outcome. For example, I can add another citation to the *JARE* count and raise the IF by about 0.02 for the next two years by citing the WAEA Presidential Address from 2011 (Tronstad, 2011). If I add to this citations in the water resources area (Wang and Segarra, 2011; McLaughlin, 2011; Curtis and Cowee, 2010), I can bump the IF by another 0.05 or so. But one must be careful, as Thomson Reuters monitors self-citations closely. For example, editors of an obscure speech therapy journal, *Folia Phoniatrica et Logopaedica*, reacted to the excessive hype over the Impact Factor by publishing an article citing all sixty-six articles published in their journal over the previous two years. The article raised their IF from 0.655 to 1.439, but it also caused Thomson-Reuters to revoke their IF score for that year (Foo, 2011).

Table 1. Selected Characteristics of Popular Journals in Agriculture and Natural Resources for 2006

Journal Name	Average Number of Authors per Article	Average Number of Pages per Article	Average Number of References per Article	2006 Impact Factor
Ecological Applications	3.6	12.7	61.1	3.47
Journal of Virology	5.8	9.5	49.1	5.332
Biology of Reproduction	5.3	8.3	48.5	3.67
Journal of Bacteriology	4.8	8.8	44.9	4.813
Soil Science Society of America Journal	3.6	9.5	43.7	2.104
Theoretical & Applied Genetics	5.8	10.5	40.0	3.137
Applied & Environmental Microbiology	5.1	7.4	39.6	4.004
Journal American Society for Horticultural Science	3.7	7.5	35.3	0.915
Agronomy Journal	3.9	8.3	34.3	1.413
Journal of Environmental Management	3.4	10.0	33.5	1.477
Journal of Agricultural and Food Chemistry	4.6	6.8	33.4	2.322
Journal of Food Science	3.9	6.5	33.4	1.004
Journal of Animal Science	5.0	8.9	31.7	1.983
Crop Science	4.1	7.7	31.6	1.153
American Journal of Agricultural Economics	2.6	13.9	31.6	1.196
Journal of Dairy Science	4.3	9.4	31.3	2.284
Journal of Environmental Economics and Management	1.9	16.6	29.4	1.496

Other Issues

The IF was originally created because ISI only wanted to focus on the most impactful journals. As noted, Thomson-Reuters presently includes about 12,000 journals in its cadre of top-tier journals, even though they track citations from many more journals and could easily include them in their group of journals to be analyzed. Journals tracked by Thomson Reuters but not included in their impact evaluations include *Journal of Agricultural and Applied Economics*, *Agricultural Finance Review*, and *Agricultural and Resource Economics Review*. The decision to limit the number of journals was made when the SCI was first created and was based on a type of cost-benefit analysis. Costs to index each journal were not trivial, while studies have shown that the bulk of citations are concentrated in the top-tier journals (Testa, 2012). Since then, the increased sophistication of computer databases has greatly lowered the cost of producing reports on additional journals. At this point, it seems that the number of journals is restricted purely for prestige reasons.

A final criticism of the Impact Factor is that it treats all citations as being of equal importance. An article cited in *Science*, for example, is treated the same in IF calculations as one cited in *Choices*, despite the intuitive difference in impact. Network theory, by contrast, suggests that the most important people in a communications network (like academic journals) are those who have important friends (West, Bergstrom, and Bergstrom, 2010).

Despite the conceptual and practical weaknesses in the IF value, its use has become pervasive in the academic community. Not only is it being used to evaluate the relative quality of journals, but it also has been used to evaluate the quality of individual articles within a journal, the value of output from a researcher or a research program (Deutsche Forschungsgemeinschaft, 2010). That IF remains so important even when it has so many significant weaknesses is an indicator of the importance to the academic community of a measure to evaluate journal quality.

Eigenfactor and Citation Networks

An alternative measure to evaluate journal quality is the Eigenfactor Score (EF), which is based on network theory and assigns greater weight to articles cited by more prestigious journals, in much the same way that Google ranks websites (Bergstrom, 2008). Calculating the EF for 2010 involves a five-step process:

Step 1: Calculate a citation matrix $\boldsymbol{Z}$ containing elements Z_{ij}, where i is the citing journal and j is the journal cited in i. Z_{ij} is the total number of citations in the 2010 version of journal i citing articles published in journal j in 2005–09.

Step 2: Two important modifications are made to this matrix:

1. All self-citations are removed by setting diagonal entries in the matrix to zero.
2. Each Z_{ij} value is normalized by dividing all Z_{ij} by $\sum_j Z_{ij}$. This adjustment scales the citations in each journal based on the total number of citations made in that journal, thereby adjusting for disciplinary differences in citations. The resulting matrix is denoted as $\boldsymbol{H}_{ij}$.

Step 3: A new matrix $\boldsymbol{P}$ is defined as:

$$\boldsymbol{P} = \beta \boldsymbol{H}' + (1 - \beta) a.e^T, \tag{2}$$

where P is a Markov process with probability β, e^T is a row vector of all 1's, and a_i is the number of articles published over five years for the i^{th} journal such that $\sum a_i = a$. P is a random walk on a journal citation network and $(1 - \beta)$ "teleports" the user to a random journal article. This is the same equation used by Google to rank websites, with $\beta = 0.85$. One can interpret this equation to suggest that journal browsers go through six links between journal articles before switching to a completely unrelated article or completing the circle back to the original article.

Step 4: Equation (2) is solved through an iterative process to identify π^*, the influence vector.

Step 5: The Eigenfactor Score is determined by the equation:

$$EF = 100 \frac{H\pi*}{\sum_i [H\pi*]_i}. \tag{3}$$

This process causes citations to be weighted based on the influence of the citing journal. Thus, IF measures popularity of a journal whereas EF measures the prestige and trustworthiness of an individual article. Note that the Eigenfactor Scores for all journals will sum to 100. Unlike the IF value, the EF depends on the number of journals included in the analysis. Eigenfactor Scores for years up to 2010 are available for free at http://www.eigenfactor.org. The values are calculated using 10,000 journals. The highest EF in 2010 was assigned to *Nature*, with an EF score of 1.7352. By comparison, the EF for the *AJAE* was 0.006657. The relative magnitude of these scores can be illustrated with an example. Suppose someone wanted to read all 10,000 of these journals in a twenty-four-hour period. To do this would require spending eight seconds with each journal. Under the EF weighting, however, reading time for each journal could be assigned relative to cited importance in the literature. Thus, one would spend twenty-five minutes reading *Nature* and six seconds reading the *AJAE*.

Figure 2 illustrates the network of citations for the entire academic world based on the Citation Rank process embedded in the EF. Literature in the scientific world is dominated by the physical and biological sciences, specifically molecular and cell biology, medicine, and physics. Social sciences are a relatively small part of the overall academic literature. If one focuses just on the social sciences (figure 3), the literature is dominated by articles in economics, psychology, and psychiatry. Whereas psychology and psychiatry have strong ties to the medical literature, economics has weak links to medicine and physics (through mathematics) and no ties at all to molecular biology. The underlying mathematics used to calculate these figures is provided by Rosvall and Bergstrom (2011).

Using the same methodology developed by Rosvall and Bergstrom, I constructed a network for the agricultural economics literature (figure 4), which includes a number of journals not included in

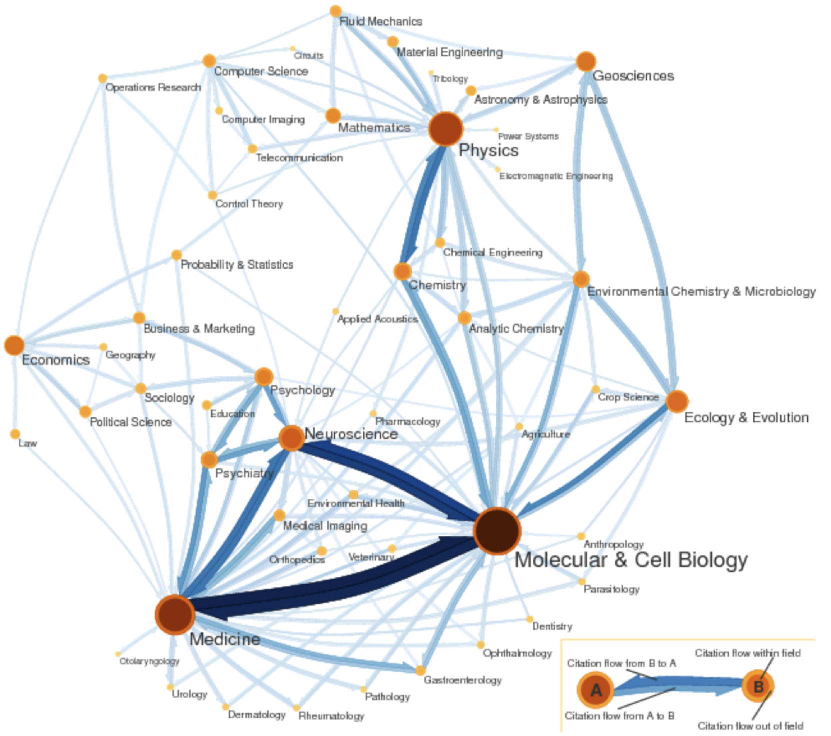

Figure 2. Map of Science and Social Science Citation Network for 2004 (Rosvall and Bergstrom, 2008)

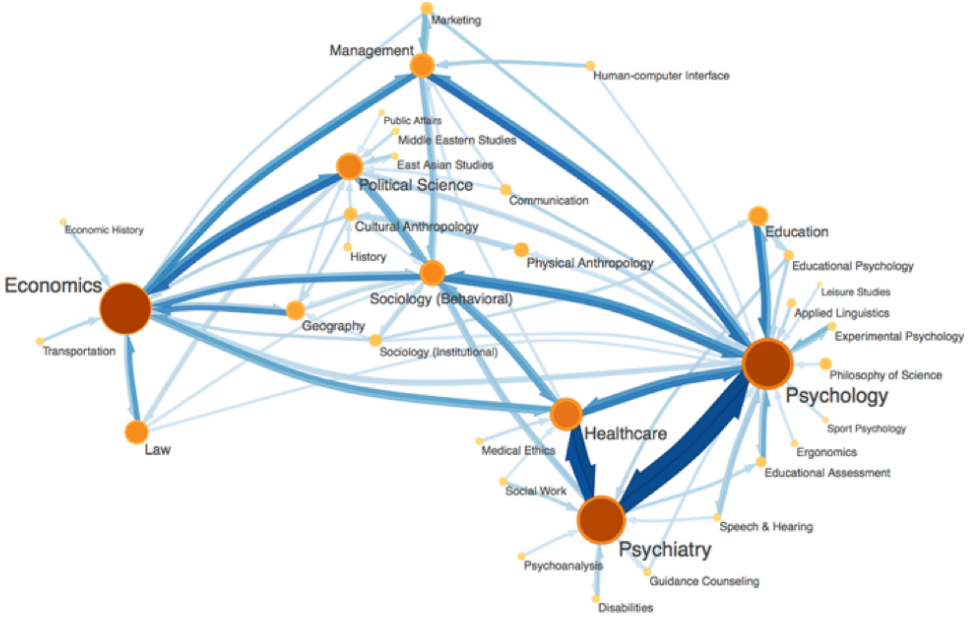

Figure 3. Map of Social Science Citation Network for 2004 (Rosvall and Bergstrom, 2008)

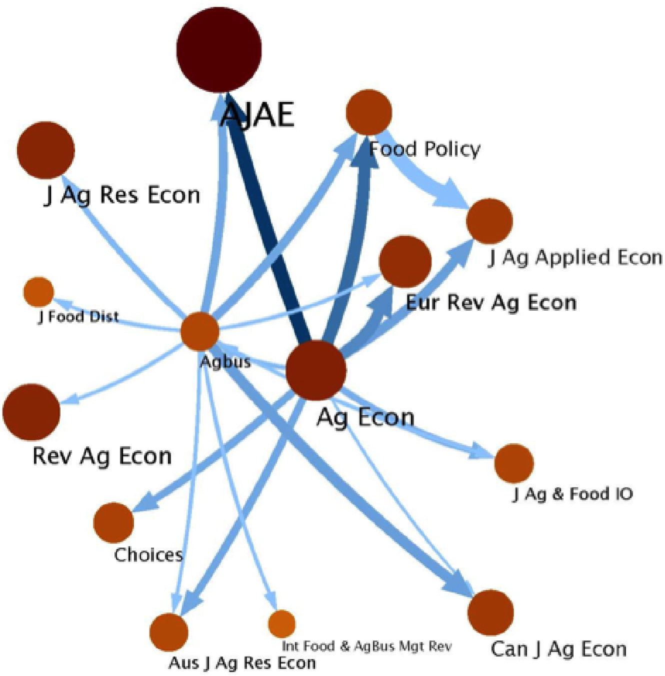

Figure 4. Citation Network for Journals in Agricultural Economics

the Web of Science list of top 12,000 journals. The relative size of the nodes indicates the proportion of time spent reading that particular journal among those included in the mix. For example, the PageRank for the *AJAE* was 19%, meaning readers of this literature would spend 19% of their time reading the *AJAE*. By comparison, readers would only spend 1.9% of their time reading the *Journal of Food Distribution Research*. The color, size, and direction of links indicate the flow of citations between journals and the direction of flow. So the wide, dark arrow from *Agricultural Economics* to *AJAE* means many *Agricultural Economics* articles cite the *AJAE*. As one moves from figure 2 to figure 3, it becomes apparent that much of the detail in figure 3 is lost when one moves to the larger fields of science represented in figure 2. In a similar manner, figure 4 contains more detail about agricultural economics than figure 3, but still omits the less important citation flows from the graph. The patterns in figure 4 place *AJAE* as the premier journal within agricultural economics, with *JARE*, *Review of Agricultural Economics*, and *Agricultural Economics* being of secondary importance. *Food Policy* is very much a second-tier journal in this literature, although its wider audience outside agricultural economics causes it to have a higher IF.

Figure 5 is a map of the network for journals in the resource and environmental economics area. Within this literature, *JARE* becomes a relatively minor journal and *AJAE* becomes a second-tier journal of comparable impact to *Environmental and Resource Economics* and *Energy Policy* when compared to first-tier journals *JEEM* and *Ecological Economics*. What is also interesting is how widely the *AJAE* cites other resource and environmental economics journals, whereas in the agricultural economics literature *AJAE* articles appear to only cite other *AJAE* articles.

Article Influence Scores

The EF and network maps are tied to journal size. For example, the importance of *Ecological Economics* in figure 5 results from the fact that it publishes three times as many articles as the *AJAE*. Scaling the score provides a better measure of the relative impact that a particular journal has

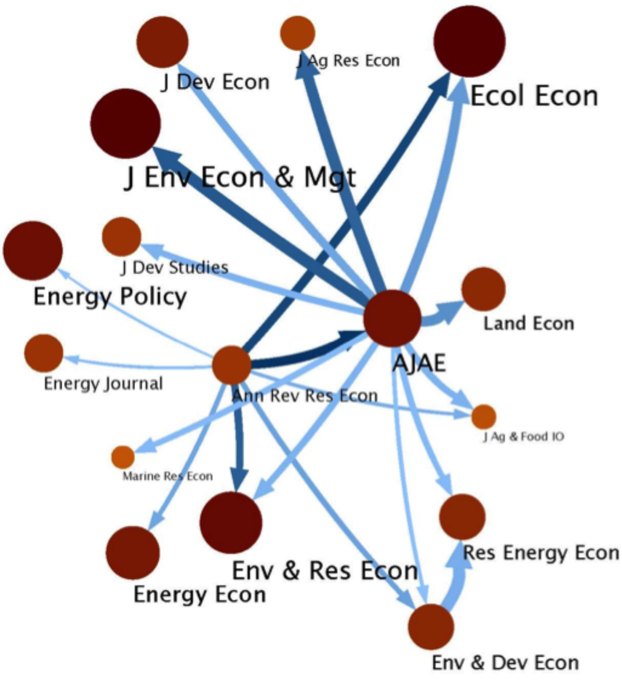

Figure 5. Citation Network for Journals in Resource and Environmental Economics

on the literature. Scaling requires a sixth step and the creation of a second score, called the Article Influence (AI) score. The AI score is calculated as:

(4)
$$AI_i = 0.01 \times \frac{EF_i}{a_i}.$$

Given that the Eigenfactor approach is conceptually and numerically different from the approach reflected in the Impact Factor, what actual difference does it make in reflecting the quality of journals? Table 2 provides a sample of major journals where agricultural economists commonly publish their work, as well as a selected set of journals from the wider academic community. These journals are sorted by the AI scores. Note that a sorting of these same journals would have placed the economics journals lower and the lab-based journals higher. Additionally, a number of interdisciplinary journals in which agricultural economists commonly publish (such as *Environmental Research*, *Soil and Tillage Review*, *Climate Research*, and *Forest Science*) rank about the same under either measure. Also, it is important to stress that, although the IF and AI methodologies produce numbers in a similar range, the scores are based on two quite different methodologies.

Creating a Tier System to Evaluate Quality

Agricultural economists publish in hundreds of journals, most of which are outside the core discipline. This fact makes it difficult to keep track of the AI numbers for these journals. A shorthand way to talk about the various journals is in terms of tiers of quality. I suggest the creation of seven quality tiers broken down as follows: Tier 1, AI of 2.0 or greater; Tier 2, AI between 1.0 and 1.99; Tier 3, AI between 0.75 and 0.99; Tier 4, AI between 0.50 and 0.74; Tier 5, AI between 0.25 and 0.49; Tier 6, AI between 0.01 and 0.24; Tier 7, any journal without an AI value. Table 2 shows the various journals that would fall into the top five tiers. These tiers were selected for ease of understanding where the breakpoints occur and because the distribution of journals across the tiers roughly approximates a normal distribution, excluding the distortion in the lower tail distribution caused by the large number of journals in Tier 7.

The AI values and tier system can also be used to evaluate research quantity and quality for a department. We can start by comparing refereed journal research output published between 2007 and 2009 by tenure-track faculty in thirty-one programs in agricultural and resource economics, including all western U.S. programs in agricultural economics plus selected programs from the rest of the United States. This time period was selected because a complete census of all tenure-track faculty positions in these programs was available for 2008. The journal articles were identified by reviewing publication lists produced by departments, summarizing publication information in faculty CVs, and by doing a search of research output on Google Scholar.

The results are summarized in table 3. Each article written by multiple faculty members within a department was counted as one article, whereas an article published by authors from different universities counted for each university involved. The 709 faculty in this study averaged 3.8 articles over this three-year period. Their articles were published in 596 journals, of which only about 50 were specifically in agricultural and natural resources. When looking at sheer research output, Colorado State has the highest output at 7.71 articles per faculty member, followed by North Dakota State and UC-Davis. Calculations were also made based on research FTE and research-plus-teaching FTE, but these changes generally did not shift the research output rankings. A couple of exceptions where notable shifts occurred were Kansas State and North Carolina State, which substantially improved under these measures, while UC-Berkeley and UC-Davis experienced a sharp drop in overall rankings.

Of course, table 3 fails to account for the quality of papers being published. A number of other studies have attempted to focus on the quality issue by limiting their analysis to *AJAE* articles (Holland and Redman, 1974; Tauer and Tauer, 1984) or by creating different groupings for disciplinary and interdisciplinary articles (Perry, 1995). As the previous sections have demonstrated, the *AJAE* is important within our profession but relatively unimportant in the larger academic community. The use of the AI scores and the tier system allows for a better evaluation of scholarship impact by agricultural and resource economists on the larger academic community.

Table 4 provides a summary of research output by quality. Sorting by quality caused Colorado State to drop to sixteenth among the departments evaluated. Cornell, UC-Davis, and UC-Berkeley were high for both quantity and quality of research output. Iowa State and Illinois were both well below average in research quantity, but ranked in the upper half in quality. A graph of quantity and quality tradeoffs among these thirty-one programs can be used to estimate an efficiency frontier for journal research. The line represents the frontier and the rough tradeoff between quality and quantity of research output. Programs on the frontier (UC-Berkeley, UC-Davis, Colorado State, Cornell, and Maryland) seem to be the most productive and can only improve quantity by reducing quality or improve quality by reducing quantity. Programs to the interior of the line can move to the frontier through some combination of increasing quantity and quality.

Summary and Conclusions

The Article Influence Score represents an improvement over the Impact Factor in comparing journal quality by correcting for self-citation bias and disciplinary differences in how citations are used. It better reflects the importance (or unimportance) of particular journals in the larger literature landscape and allows a fairer and more direct comparison of the agricultural and natural resource economics literature with that commonly published outside the discipline. The results suggest that our professional literature is in the lower strata of scholarly work, at least in terms of impact. This seems particularly true of the agricultural economics literature.

Our methods of citing research are clearly influenced by the citation culture within economics, an approach deeply embedded in our academic culture. However, most of our research is actually

Table 2. Comparison of 2010 Impact Factors, Article Influence Scores and Assigned Tiers for Selected Journals

Tier	Impact Factor	Journal Name	Article Influence
Tier 1	36.1	Nature	19.3
	31.8	Science	16.8
	31.1	Nature Biotechnology	12.24
	3.15	American Econ Rev	5.6
	2.063	J Amer Stat Assoc	3.28
	1.341	J Applied Econometrics	2.172
	4.834	Conservation Biology	2.16
	4.276	Ecol Applic	2.036
Tier 2	1.747	J Develop Econ	1.867
	2.989	J Env Econ & Mgt	1.606
	5.189	J Virology	1.597
	3.726	J Bacteriology	1.414
	3.778	App & Environ Microbio	1.34
	1.612	World Development	1.193
	2.11	Climate Res	1.043
	2.514	J Hydrology	1.037
Tier 3	2.754	Ecol Economics	0.975
	3.264	Theoret & App Genetics	0.952
	1.866	Soil Sci Amer J	0.87
	1.375	Land Econ	0.848
	1.831	Food Policy	0.83
	2.10	Soil & Till Res	0.761
Tier 4	2.597	J Environ Man	0.741
	2.816	J Ag & Food Chem	0.716
	1.233	Amer J Ag Econ	0.659
	1.373	J Amer Wat Res Assoc	0.618
	1.503	Environ Mgt	0.577
	2.497	J Dairy Sci	0.569
	1.196	Forest Science	0.568
	0.449	Econ Letters	0.556
	1.329	Ag Econ	0.548
	1.683	Precision Ag	0.525
	1.733	J Food Sci	0.517
Tier 5	1.637	J Reprod & Dev	0.416
	0.477	Can J Ag Econ	0.353
	0.75	J Ag & Res Econ	0.331
	0.905	J Am Soc Hort Sci	0.327
	0.406	Agribusiness	0.2508

Table 3. Research Output by Agricultural Economics Department in 2008–09

University	Total 2007–09 Publications	2008 Tenure Track Faculty	Publications per Faculty	Publications per Research FTE	Publications per Research/Teaching FTE
Colorado St	131	17	7.71	28.05	9.73
North Dakota St	80	12	6.67	12.31	8.89
Davis	136	25	5.44	17.62	7.12
Cornell	187	35	5.34	13.91	7.65
Ohio St	118	24	4.92	9.14	5.06
Kansas St	131	27	4.85	22.28	9.65
Berkeley	90	19	4.74	8.99	6.16
Oklahoma St	145	31	4.68	13.16	8.08
Maryland	86	19	4.53	14.88	7.23
Virginia Tech	78	25	4.46	8.93	4.41
Minnesota	163	37	4.41	11.53	6.09
Washington St	68	16	4.25	12.25	6.93
Oregon St	62	15	4.13	12.81	7.83
Wisconsin	88	23	3.83	12.24	7.44
Texas A&M	159	42	3.79	16.74	6.20
Georgia	77	22	3.50	6.53	4.61
NC State	90	26	3.46	13.74	8.00
Purdue	152	45	3.38	8.76	5.21
Iowa St	113	34	3.32	10.49	6.91
Idaho	43	13	3.31	5.19	3.91
Missouri	78	24	3.25	9.90	5.25
Nevada	29	9	3.22	5.84	4.11
Montana St	33	11	3.00	8.35	4.71
New Mexico	40	14	2.86	7.77	4.61
Utah St	31	11	2.82	16.32	5.45
Michigan St	115	41	2.80	9.77	4.83
Illinois	82	30	2.73	7.27	4.26
Arizona	31	14	2.21	3.43	2.54
Wyoming	29	14	2.07	6.12	3.39
Nebraska	40	20	2.00	4.67	2.81
South Dakota St	8	14	0.57	1.55	0.87

published outside our discipline. We would collectively have a greater impact on the academic literature if, at a minimum, we adopted the citation approach of our non-economist colleagues when publishing outside our own literature. And I don’t believe journal editors within our own profession would object to us adding more citations to economics papers.

Given this additional information, what is the best strategy for assistant professors deciding where to publish? First and foremost, a young faculty member must have a clear shared understanding with their tenure and promotion committee and department head regarding appropriate publication outlets. If the faculty want research output to have a strong interdisciplinary focus, that is where a new faculty member should target his or her research output. Second, individuals must be aware that external reviewers of promotion dossiers will be looking for evidence that they have demonstrated an ability to write to peers within the profession, so some of the research portfolio should be within the discipline. Once these two points are satisfied, a faculty member would be well served by targeting outlets where they are going to have the greatest impact. In this case, a young faculty member is probably better off sending a paper to a Tier 4 or Tier 5 interdisciplinary journal than publishing in a Tier 7 journal within the discipline.

Table 4. Analysis of Journal Quality Output by Department for 2007–09

	Number of Articles by Quality Tier								
University	*Tier 1*	*Tier 2*	*Tier 3*	*Tier 4*	*Tier 5*	*Tier 6*	*Tier 7*	**Total**	**Quality Average**
Maryland	8	16	11	27	9	6	9	86	3.78
Cornell	19	36	19	36	24	26	27	187	4.05
Berkeley	9	18	8	19	9	4	23	90	4.17
Iowa St	6	15	15	26	22	14	15	113	4.28
Virginia Tech	1	13	11	22	8	10	13	78	4.35
Arizona	3	4	6	3	4	2	9	31	4.39
Davis	6	16	13	43	19	11	28	136	4.46
Nevada	0	2	4	11	6	2	4	29	4.48
Oregon St	3	0	10	25	9	4	11	62	4.50
NC State	5	11	8	17	22	11	16	90	4.52
Illinois	0	10	11	24	12	12	13	82	4.54
Wisconsin	7	11	5	22	13	7	23	88	4.55
Ohio St	6	8	18	26	25	10	25	118	4.58
Minnesota	17	16	10	26	22	29	43	163	4.71
Mich St	3	12	12	20	26	21	21	115	4.75
Montana St	0	4	3	3	14	1	8	33	4.88
WSU	4	5	5	10	18	9	17	68	4.88
Utah St	0	3	5	6	3	6	8	31	4.90
Texas A&M	5	13	18	19	38	28	38	159	4.94
Idaho	2	5	1	7	7	9	12	43	5.02
New Mexico St	1	3	4	7	5	10	10	40	5.05
Colorado St	3	2	8	16	60	14	28	131	5.15
Purdue	3	4	10	26	36	29	44	152	5.31
Wyoming	1	0	1	10	3	3	11	29	5.31
Missouri	2	2	5	17	15	8	29	78	5.32
Oklahoma St	1	5	10	18	41	31	39	145	5.36
Kansas St	1	3	6	20	30	36	35	131	5.47
Nebraska	1	2	0	10	5	3	19	40	5.53
North Dakota St	0	2	6	8	22	16	26	80	5.53
Georgia	0	0	3	11	17	29	17	77	5.60
South Dakota St	0	0	1	0	1	3	3	8	5.88

Finally, these observations have implications for the *Journal of Agricultural and Resource Economics*. The results from the network analysis suggest that *JARE* is a second-tier journal within the agricultural economics literature and well below that in the resource and environmental literature. The heritage of the journal has been to focus on western economics issues in agriculture and natural resources, but as I have suggested elsewhere (Perry, 2010), agricultural economics is a shrinking area of research and faculty hiring, with a shift toward resource and environmental economics and agribusiness. Of course, the journal staked out this scholarly territory when it was renamed from the *Western Journal of Agricultural Economics* in 1992, but the WAEA and *JARE* have failed to take full advantage of the name change by aggressively recruiting new members from the wider pool of economists who work on resource and environmental economics issues.

With time, new journals have come into being that target the wider audience in resource and environmental economics. The opportunities are not there as they were twenty years ago, but all is not lost. The association has to decide what can be done to improve the journal's standing in the academic community and then get behind that effort. One suggestion is to begin publishing

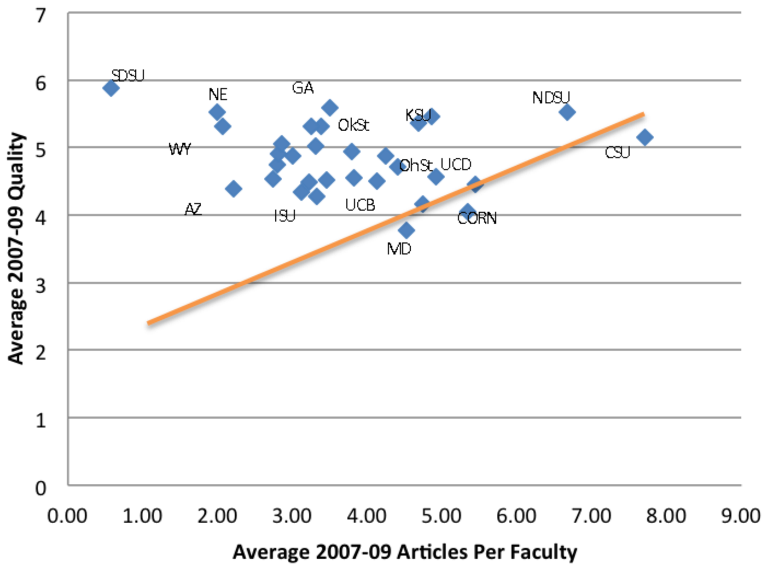

Figure 6. Quality-Quantity Trade-Offs for Ag Econ Journal Articles

a comprehensive review article each year or in each issue that summarizes the literature on an important topic area in resource and environmental economics. This type of article typically raises citation counts, which would increase both the IF and AI values for *JARE*. Equally important, it would bring resource and environmental economists from outside the association and the agricultural economics profession to our journal. By becoming aware that *JARE* exists and is a good outlet for this type of work, authors are more likely to submit their own work to *JARE*.

[Received July 2012; final revision received September 2012.]

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