

Concentration in Knowledge Output: A case of Economics Journals

Bino Paul G. D^{*}, Subash. S⁺, A. Ramanathan⁺⁺

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*Lecturer, Tata Institute of Social Sciences, Mumbai, correspondence: binogd@yahoo.com.

⁺Doctoral Researcher, Department of Humanities and Social Sciences, Indian Institute of Technology, Bombay.

⁺⁺Professor, Department of Humanities and Social Sciences, Indian Institute of Technology, Bombay.

Abstract

Journals moderate knowledge activity in economics. The activity of publishing article in professional journal forms significant part of knowledge output. Output of economics articles has been growing over the time. We examine an important question: Is there any case of institutional or location concentration in knowledge production? This paper analyses concentration indicators specific to economics journals and explores link between publication process and concentration. The analysis of various concentration measures present evidence for institutional-geographic-area-author concentration in Knowledge production in Economics. High concentration levels indicate possibility of institutional lock-in. The literature provides evidence for myopic refereeing, editorial favouritism and the presence of 'lock-in' effect. The achievement in journal publication is influenced by factors like institutional affiliation, propitious circumstances etc. Discussion carried out in this paper hints the possibility of causal link between unfair process and unfair outcome.

JEL: B4, B5

Concentration in Knowledge Output: A case of Economics Journals

1. Introduction

The activity of publishing article in professional journal belongs to the set of knowledge output. Journal publication is often cited as ‘convenient index of knowledge output’ (Lovell M C, 1973). The knowledge activity shares a few characteristics of industrial organisation. Market concentration is one of these common features. The concentration may be classified into four: geographical, institutional, area and author. Analysis of concentration in publishing may provide valuable informational clues on welfare issues pertinent to knowledge activity. Indicators of concentration may be perceived as consequence of a given process. This paper analyses concentration indicators specific to economics journals and explores link between publication process and concentration.

The data, used in this paper, consist of secondary data on institutional concentration in economics journals and literature on characteristics of economics journals, institutional concentration in economics journals, intermediation process and welfare issues. The data, downloaded from <http://www.econ.ucsb.edu/~tedb/pricing.html> (Bergstorm C. T, 2001), are used for analyzing trend and structural issues related to knowledge output in economics. Computation of concentration indicator is based on Coupe’s database. Author data, compiled from four Indian journals, form the empirical base for testing of Lotka’s law (a measure of author concentration). The paper consists of four sections. Section 2 gives overview of trend in journal publication. Section 3 focuses concentration indicators and welfare implications. Conclusion forms the content of section 4.

2. Journals in Economics: Overview of Trend

Output of economics articles has been growing over the time. Estimate presented in a well-cited study indicates that stock of articles doubles in every 13.7 year (see: Lovell M C, 1973, p. 29). There has been exponential growth in the number of journals in Economics. During 1844-2000, stock of journal has been growing exponentially. Following equation gives growth fit:

$$\ln J = \beta_0 + \beta_1 \text{Time} + u \quad (1)$$

$\ln J$ = Natural Logarithm of cumulative Number of Journals in Economics.

Time: 1844-2000

u = error

Durbin Watson d (DW) of estimate of equation 1 indicates positive autocorrelation. In the presence of autocorrelation, estimates are no longer efficient. Prais-Winsten Generalized Least Square (GLS) may be used for redressing auto correlation problem. Equation 1 may be transformed into GLS.

$$(\ln J_t - \rho \ln J_{t-1}) = \beta_0 (1 - \rho) + \beta_1 (\text{Time}_t - \rho \text{Time}_{t-1}) + \varepsilon_t \quad (2)$$

Where

$$\varepsilon_t = (u_t - \rho u_{t-1})$$

ρ is estimated from AR (1) scheme.

$$u_t = \rho u_{t-1} + \varepsilon_t$$

Table 1 outlines estimates of equation 1 and 2

Table 1: Growth in the Number of Journals Estimate of Growth Equation

Equation (1)			
	Estimate	't' value	Significance
β_0	-70.22	- 56.17	.000
β_1	0.038	59.37	.000
Adj $R^2 = 0.98$ DW = 0.24 Growth Rate = $(\exp(0.038) - 1) * 100 = 3.9\%$			
	Estimate	't' value	Significance
β_0	-57.9	- 16.07	.000
β_1	0.031	17.09	.000
Adj $R^2 = 0.80$ DW = 2.18 $\rho = 0.94$ Growth Rate = $(\exp(0.031) - 1) * 100 = 3.1\%$			

Source of Data: <http://www.econ.ucsb.edu/~tedb/pricing.html> cited in C. T. Bergstorm (2001)

Results, given in table 1, indicate that stock of journals grew at 3.1 % per annum. An important reason for proliferation of journals is increased specialization in economics. There is diversity in economics journals. Journals cater to the requirements of specific area or topics of general interest. Areas of publication range from General Economics to health (see table 2).

Table 2: Area wise (%) Distribution of Journals in Economics

General	20.8
Econometrics	2.3
Finance	7.4
Agricultural Economics	3.0
Public Finance	7.7
Area Studies	7.7
Economic History	3.0
Theory	3.4
Macro Economics	2.3
Development	5.0
Labor	2.0
Industrial Organisation	2.7
Law and Economics	1.7
Specialized	10.4
Management Science	2.3
Insurance	2.3
Urban & Regional	3.0
International	2.3
Natural Resources	2.7
Business	3.0
Inter disciplinary	2.0
Consumer Economics	1.0
Demography	1.0
Health	0.7
Total	100
Total Number of journals	298

Source of Data: <http://www.econ.ucsb.edu/~tedb/pricing.html> cited in Bergstorm, C. T (2001)

Stigler et al. say specialization in economics resembles any other economic activity (Stigler et. al. 1995). Academic economists are the major contributors to journals. Content of the journals has undergone significant changes over the years. According to a recent study on five major journals in economics, calculus or more advanced-mathematics constitutes more than 50 % of highest level of technical content of the articles and algebra and/or Econometrics form 38% of content in 1989-90 against their respective shares of 0 and 2% in 1892-93. The share of verbal technical-content in highest level of technique in articles has declined from 95 % to 5.3 % during 1892-1990 (Stigler et al 1995).

3. Institutional Concentration and Welfare Implications

Knowledge as economic activity involves production, diffusion, use and exchange of knowledge and well being of people involved in activity of knowledge. There are important economic issues like choice of method, tacitness of skill and cost and benefit of codification etc. that are related to knowledge as an Economic activity. Production of knowledge may be perceived as a set that consists of vectors of performance of skill by human and codified knowledge. Existing stock of codified knowledge and knowledge from other repositories like: institutions, conventions, collective memory etc are transformed to new codified knowledge, and human action is involved in the transformation process leading to knowledge production. Same source of knowledge enter into performance of skill. However, for skill, mapping function is different. Production of knowledge may be formally stated as:

$$K_p = [(H_p, k) / H_p(k_c, k_r, H) \rightarrow H_p \text{ and } k(k_c, k_r, H) \rightarrow k; H_p \in H \text{ and } k \in K] \quad (3)$$

- K_p = Knowledge Produced
- H_p = Performance of skill by human
- k = Codified knowledge produced
- k_c = Existing codified knowledge
- k_r = Knowledge from other repositories of knowledge
- $k(.)$ = Mapping function for codified knowledge
- $H_p(.)$ = Mapping function for performance skill
- H = Labour
- K = Stock of knowledge
- \rightarrow Mapping \in =subset of

Above formulation may be explained with some examples from economics. An economist who investigates determinants of capital formation conjectures a set of causal relationships. For this act, he reads literature or 'k_c' (books and journal articles), he tries to build semantic clarity, and may find some ambiguities in present literature. His labour or 'H' is involved in the process of conceptualization. He discusses his observation with peer group and gets some useful comments and some articles express similar concern over semantic ambiguity; these constitute 'k_r'. Finally, he publishes a paper on this issue or 'k'. He attends an important conference and presents the paper; this is an 'H_p'. Above activity may be called 'K_p' or knowledge produced.

Equation (3) assumes that there is no transaction cost in knowledge activity; the formulation identifies input-output transformation as knowledge activity. However, in reality, intermediaries and institutions influence knowledge activity. Individual, using her capability and other inputs (codified and tacit knowledge), produces output. The change from output (K_p) to published knowledge output (K_p^{*}) is subject to the constraint of publication. The act of publication links K_p^{*} and consumers (readers). The consumer base consists of fellow producers and final consumers, and K_p^{*} is used for producing knowledge and reading. There is an important question: How do we distinguish K_p and K_p^{*}? It may be noted that all produced knowledge need not be published knowledge output i.e. $K_p \geq K_p^*$. This inequality may be due to two factors: (a) a part of K_p does not satisfy the publication constraint (b) no motivation for changing K_p to K_p^{*}. Former factor seems to be more important since publication and related benefits are often perceived as incentives to author, and individual's response to incentives is one of the characteristics of rational behaviour. Publication constraint implies that individual's publication opportunities are limited. Journals, Publishers and various institutions provide opportunities for publication. A significant portion of publication happens through journals. Journal publication may fetch benefits to author. The set of benefits consists of extrinsic rewards (e.g. career promotion, salary hike, awards, citation by other authors) and intrinsic reward (utility). Extrinsic reward, from journal publication, may be referred as achieved functioning of the author. Above discussion may be symbolically stated as:

$$\max V_{bi} = V_{bi}(K_p(H_p, k) \rightarrow K_p^*) \quad (4)$$

st

$$K_p - K_p^* \geq 0$$

V_b = Value of Extrinsic rewards from publication

$V_b(.)$ = Function converting publication to value

K_p = Knowledge Produced

H_p = Performance of skill by human

k = Codified knowledge produced

$K_p(.)$ = Mapping function for publication

K_p^* = published knowledge output

i = Individual

→ Mapping \max Maximize st Subject to constraint

Journals intermediates the exchange of produce between author and reader. The exchange involves three steps: (a) Author submits article to journal (b) journal assesses characteristics of article and matches them against journal's expectation (*assessment is often based on external expert or referees valuation*) (c) Compatibility with journals expectation results in publication of the article or incompatibility leads to rejection. Exchange, mentioned above, may look simple. However, a closer examination of the exchange unravels questions related to cost of exchange and fairness of assessment. Transaction costs related to journal publication consists of monetary costs (e.g. assessment charge) and non-monetary costs (e.g. publication lag, lag in communication). Issues related to fairness of assessment include refereeing standards (e.g. neutrality), editorial preferences (e.g. favoritism) and institutional concentration in publication.

Like commodities, author and article have several characteristics. Article has characteristics like field of study, Language/method used, school of thought, style inheritance, quality of idea etc. Some of these characteristics are relatively more apparent than others. Author's characteristics include institutional background (e.g. Ph D institution, current affiliation), access to editors and reputed authors, access to infrastructure and individual capability. Publication of knowledge output may be

influenced by characteristics of author and article, if journal recognizes these characteristics as signals of journal-author compatibility. Institutional background is an important source of journal-author compatibility. Good institutions provide incentives, knowledge (*tacit and codified*), infrastructure and social capital required for knowledge production. Given same capability level, individuals from reputed institutional background, compared to individuals from lower institutions or individual without institutional background may have better likelihood of achievement in knowledge output. Individual and institution are interdependent on each other. The doctoral student who enrolls for Ph D in an institution acquires knowledge from various repositories (e.g. Library, teacher, fellow students, alumni etc.). Using various inputs, including his capability, other institutional inputs and other sources, student produces knowledge, and may be publishing in one of the journals. Along with individual, institution also receives benefits from her publication (*benefits range from quality rating to monetary incentives*). The cycle, involving individual, institution and journal, is given below:

Institution → Individual → Individual's journal Publication → Institution
 → Provides Knowledge, incentives and support

Above discussion indicates possible impact of individual-institution-journal linkage on well being of individuals involved in knowledge activity. Characteristics of individual and article are often transformed to achievement, and transformation resembles Sen's (1987) goods-characteristics-capabilities-functionings link. Similar link may be specified for stating individuals achievement in publishing, and the link may be called author/article-characteristics-capabilities-functioning link. The transformation process is symbolically stated as follows:

$$b_i = f_i (c_i (x_i), a) \quad (5)$$

- i = author 'i'
- b_i = achieved function
- $c(.)$ = Function converting a article vector into a vector of characteristics
- $f_i(.)$ = a personal utilization function of author i

x_i = vector of articles communicated for publication by author i .
 a = characteristics of author i

The achieved function 'b_i' implies author's compliance to journals expectations and, therefore, publication. Publication is followed by 'j' readers' valuation (e.g. citation). The valuation function $v_j(\cdot)$ is capable of describing values of well being that an author can possibly achieve, and the valuation is expressed as:

$$v_j = v_j (f_i (c(x_i), a)) \quad (6)$$

$v_j(\cdot)$ = valuation of function of 'j' readers

Institutional background and individual capability seem to have better link with achievement than other characteristics. Economics has experienced significant growth in knowledge production, and it is identified as leading knowledge producer among social sciences. It may be noted that 1/4th of social science publications and 1/3rd of citations are from economics (Ingwersen et al, 2001). Siegfried and Stock (1999) note economics is one of the highly paid professions. Nobel prize is one of the indicators of growing recognition of economics. A relevant question linked to the progression of economics is if the growth accompanies equity? Quite a few economists complain that institutions and existing arrangements related to knowledge production result failure of individual functioning; individual capability need not be transformed to potential achievement. Individual capability, along with institutional background, seems to have greater impact on knowledge activity in economics.

We need to examine an important question: Is there any case of institutional or location concentration in knowledge production? On the issues related to above question, quite a number of articles have been published in various journals. Table 3 outlines literature on institutional and regional concentration in journal publication in Economics. Literature indicates temporal stability in institutional distribution of knowledge output during 1950-2001. Leading American institutions (i.e. Harvard, Stanford, MIT, Chicago, Yale)

continue hegemony in journal publication, and U.S.A claims more than 3/4th of publications. Hodgson and Rothman give strong indication of institutional oligopoly. To quote them (Hodgson and Rothman 1999 p 172-174):

“Overall, strong evidence has been presented of the domination of journal articles and editorships in economics by just a few U.S. academic institutions. Clearly, this evidence raises disturbing questions about the existence of an ‘oligopoly’ of U.S. institutions dominating leading journals in economics and economics research throughout the world... There is strong evidence here of the domination of publications in 30 leading economics journals by authors coming from, or located in, relatively few U.S. academic institutions.”

Hodgson and Rothman have explored three potential reasons for institutional oligopoly: editorial favoritism, path dependent processes and increasing language compatibility and agreement within departments. They are not confident about explanatory power of editorial favoritism in reasoning institutional oligopoly.

Table 3: An Outline of Literature on Institutional and Regional Concentration in Economics Journals

Institutional Concentration			
Sl No	Authors	Methodology	Top Ten Institutions
1.	Cleary and Edward (1960)	Number of pages contributed to American Economic Review during 1950-1959 (100 pages and above)	U.California, MIT, Stanford, Chicago, Michigan, Federal Reserve Systems, John Hopkins, UCLA, Harvard, Yale
2.	Yotopoulos (1961)	Number of pages contributed to American Economic Review, Quarterly Journal of Economics and Journal of Political Economy (combined) during 1950-1959 (300 pages and above)	Harvard, Chicago, UC-Berkely, MIT, Stanford, Columbia, Michigan, U Wiscosin, Federal Govt, Carnegie-Mellon
3.	Siegfried (1972)	Number of pages contributed to American Economic Review, Quarterly Journal of Economics and Journal of Political Economy (combined) during 1960-1969 (1 % and above)	Chicago, Harvard, MIT, Yale, UC-Berkely, Penn, Stanford, Princeton, Carnegie-Mellon, Columbia
4.	Lovell (1973)	Ph D Origin of cited authors in American Economic Review, Quarterly Journal of Economics, Journal of Political Economy and Econometrica (combined)	Harvard, Chicago, Columbia, Yale, Princeton, Michigan, MIT, UC-Berkely, Wiscosin, John Hopkins
5.	Greaves, Marchand and Thompson(1982)	a. AER equivalent sized pages in the top 24 journals (1974-78) b. Pages per Economics department faculty in the top 24 journals (1974-78), 240 institutions	Chicago, Harvard, Stanford, Wiscosin-Madison, Penn, MIT, Yale, UCLA, UC-Berkely, Princeton
6.	Davis and Papanek (1984)	a. Total Number of Citations b. Rank by mean number of citation (a, b for 122 institutions) c. Number of citation controlling for age and dispersion d. Rank controlling only for age e. Rank controlling for dispersion (c, d, e for 40 institutions)	Chicago, Harvard, MIT, Stanford, Princeton, Yale, Penn, Wiscosin-Madison, Columbia, UC-Berkely
7.	Hirsch, Austin, Brooks and Moore (1984)	Total pages (1978-83) 240 institutions (Methodology of Greaves, Marchand and Thompson (1982))	Chicago, Harvard, Stanford, London School of Economics, Penn, Yale, North- Western, MIT, Wiscosin-Madison, UC-Berkely
8.	Hogan (1984)	a. Total Pages by current faculty b. Total Pages by listed affiliation (50 institutions)	Harvard, Princeton, MIT, Yale, Chicago, Stanford, Wiscosin-Madison, Minnesota, UCLA, Penn
9.	Liebowitz and Palmer (1988)	a. Citation based on various weighting schemes b. Citation based on publications (60 institutions)	Chicago, MIT, Harvard, Stanford, Princeton, UCLA, Minnesota, Yale, Columbia, North- Western
10.	Scott and Mitias (1996)	a. Ranking based on flow of pages 1984-93 (240 institutions)	Harvard, Chicago, Penn, MIT, North- Western, Stanford,

		b. Departmental Stock Ranking of Pages in top 36 journals (80 institutions) 1984-93 (Methodology of Greaves, Marchand and Thompson (1982)	Princeton, Michigan, UC-Berkely, UCLA
11.	Dusansky and Vernon (1998)	a. Aggregate adjusted pages b. Adjusted Pages per faculty (80 institutions)	Princeton, Harvard, MIT, Penn, North- Western, Newyork U, Boston, Yale Stanford, U C San Diego
12.	Kalaitzidakis, Mamuneas and Stengos (1999)	a. Ranking Based on total AER standardized pages b. Ranking based on total unadjusted pages (198 institutions)	Chicago, Harvard, MIT, North-Western, Princeton, Penn, Stanford, Yale, Columbia, UC-Berkely
13	Hodgson and Rothman (1999)	a. Institutional origin (Ph D School) and Current affiliation of authors b. Institutional origin (Ph D School) and Current affiliation of Editors (30 journals)	Harvard, MIT, Chicago, Stanford, U. Michigan, UC Berkeley, Princeton, Yale, U. Wisconsin, Columbia
13.	Thursby (2000)	Performance perception (104) institutions	Harvard, Stanford, Chicago, MIT, Princeton, Yale, UC-Berkely, Pennsylvania, North- Western, Minnesota
14.	Coupe (2000)	Ranking on the basis of citation and publication counts (200 institutions) 1969-2000	Hardvard, Chicago, Pennsylvania, Stanford, MIT, UC-Berkely, North- Western, Yale, U Mi Ann Anbor, Columbia
Regional Concentration			
1	Hodgson and Rothman (1999)	Regional Distribution of Institutional origin (Ph D School) and Current affiliation of authors (30 journals) and Editors	U.S.A 's share is in the range of 65-83%
2	Kocher and Sutter (2001)	Regional Distribution of Institutional origin (Ph D School) and Current affiliation of authors (15 journals, 1977-1997)	U.S.A 's share is in the range of 65-85%

However, they point out the significance of a study on editorial favoritism by Laband and Piette (1990). Laband and Piette specified citation as function of characteristics of journal, gender, author-editor institutional connection and authors stock of citation. Author-editor connection refers to similar Ph D institutional roots of author and editor. Both OLS and Ordered Probit results show author-editor connection has statistically significant and positive relationship with citation

The second factor 'path dependence' refers to situations like institution with early advantage in terms of concentration of editors and authors gain from abilities like ability

to attract research grants, capacity to recruit leading scholars, reputation, enhancing knowledge production. This early advantages act as barriers to entry and prevent new ideas and players to compete. Hodgson and Rothman reflect the concern (1999 p 182). To quote them:

“The danger with such a high degree of institutional concentration in the editors and authors of journals- as is evidenced by the 1995 data- is that it may be difficult for further change to take place. ‘Lock-in’ may occur, where specific institutions defend specific, and possibly outdated, ideas and approaches. In these circumstances, it would be quite difficult for alternative or innovative approach to establish themselves.”

The final factor ‘language compatibility and agreement’ denotes agreement in theoretical and methodological assumptions. Institutions are known for disagreeing on policy issues. However, there seems to be lesser disagreement among institutions on language of formalism. One proxy for this trend is increasing penetration of mathematical methods and econometrics in technical content of the journals.

Geographical and institutional concentration in knowledge output evokes empirical issues pertinent to fairness. Apart from regional-institutional concentration, area concentration seems to be a vital informational clue in exploring fairness aspects linked to knowledge activity. Herfindahl-Hirschman Index (HHI) may be used for measuring concentration (Hirschman, 1964). HHI accounts for the number of firms, as well as concentration, by incorporating the relative size (i.e. market share of all journals in the market). Squaring the market shares of all firms and then summing the squares, as follows, calculate it:

$$HHI = \sum_{i=1}^n (MS_i)^2 \quad (7)$$

Where MS_i represents the market share of firm i and there are n firm in the market.

The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases, and this may be stated as:

$$HHI = \sum_{i=1}^n (MS_i)^2,$$

$$HHI = \sum_i^n \left(\frac{1}{n_i} \times 100 \right)^2 = \left(\frac{1}{n_1} \times 100 \right)^2 + \left(\frac{1}{n_2} \times 100 \right)^2 + \dots + \left(\frac{1}{n_n} \times 100 \right)^2,$$

$$\frac{1}{n_1} = \frac{1}{n_2} = \dots = \frac{1}{n_n},$$

$$\sum_i^n \left(\frac{1}{n_i} \times 100 \right)^2 = n \times \left(\frac{1}{n} \times 100 \right)^2 = \frac{10000}{n}$$

If $n = 1, HHI = 10000 \Rightarrow$ Monopoly

If $n \rightarrow \infty, HHI \rightarrow 0 \rightarrow$ Perfect Competition

We make use of HHI for understanding area concentration and geographic concentration. The computation is based on data from Coupe's database. The database contains data on 704 journals. The data include regional and area distribution (based on Journal of Economic Literature classification i.e *JEL*) in each journal. HHI is classified into three: (a) unconcentrated (HHI below 1000), (b) moderately concentrated (HHI between 1000 and 1800), and (c) highly concentrated (HHI above 1800) (*U.S. Department of Justice and the Federal Trade Commission, 1992*). Table 4 gives distribution of HHI. Two-thirds of journals report high area concentration. Interestingly, all journals have high geographical concentration. It may be noted that top three institutions contribute more than one-fifth of articles in nearly half of the journals. High area concentration indicates the presence of entry barriers to competing fields, and the trend is apparent in areas like financial economics. Above discussion seems to corroborate Hodgson and Rothman's concern of lock-in in knowledge production.

Table 4. Herfindahl-Hirschman Index (HHI) and Contribution of Top 3 Institutions

Area (Based on JEL Classification)				
HHI	Number (N=704)	Percent	Mean	Standard Deviation
<1000	34	4.8	904.9	59.0
1000-1800	193	27.4	1343.3	220.7
> 1800	477	67.8	3924.8	1570.5
Geographic				
<1000	-	-	-	-
1000-1800	-	-	-	-
> 1800	704	100	6163.01	2256.44
Contribution of Top 3 Institutions				
Proportion	>20	>40	>60	>80
%	46.9	18.6	8.4	4.3
Number	330	131	59	30

Source: Computed from <http://homepages.ulb.ac.be/~tcoupe/ranking.html>

There seems to be a relation between institutional concentration and Geographic Concentration (This is the only relation which satisfies criteria like statistical significance, no misspecification, homoscedasticity). Contribution of top 3 Institutions and HHI represent these two variables respectively. Following equation specifies relation:

$$Y = \beta_0 + \beta_1 X + u \quad (8)$$

Y = HHI in respect of Geographic Concentration

X = Contribution of top 3 Institutions

β_0, β_1 = Parameters, u = error

Table 5: Ordinary Least Square (OLS) Estimate of Equation

	Estimate	't' value	Significance
β_0	4890.3	40.19	0.000
β_1	49.05	13.39	0.000
$R^2 = .20, F=179.2 (0.000)$			
Functional Form (Ramsey's RESET Test):			
LM= 13.63 (0.07), F= 3.63 (0.057)			
Result accepts the null hypothesis of no misspecification			
Heteroscedasticity:			
LM =0.278 (0.598), F=0.277 (0.599)			
Result accepts the null hypothesis of homoscedastacity			

OLS estimate indicate causal relation between institutional concentration and regional concentration in journal publication. Former seems to be an important determinant of the latter.

The other important approach in assessing concentration in knowledge production is the empirical verification of Lotka's law (Subramanyam (1979), Chung and Cox (1990) Cox and Chung (1991)). Lotkas law states that the number of authors publishing n papers is the ratio of number of authors publishing one paper to square of n. Lotka specifies following equation for describing concentration in publication:

$$a_n = \frac{a_1}{n^2}, \quad n = 1,2,3,\dots \quad (9)$$

a_n = Number of authors publishing n papers

a_1 = Number of authors publishing 1 paper

Cox and Chung (1991) argues that Lotka's law, in comparison with other approaches on concentration, is more capable of analyzing issues like likelihood of multiple publications in the economics literature and the extent of author concentration among different journals. For empirical testing, Lokta's law is specified as (Cox and Chung 1991):

$$a_n = \frac{a_1}{n^c} \quad n = 1,2,3,\dots \quad (10)$$

$c = \text{constant}$

Equation (10) may be written as:

$$\log \left(\frac{a_n}{a_1} \right) = -c \log n, \quad n = 1, 2, 3, \dots$$

Cox and Chung (1991) specify following regression equation for estimating equation (10):

$$\text{Log} \left(\frac{a_n}{a_1} \right) = \beta \log n + e, \quad (11)$$

The parameter β (modulus value) indicates the degree of author concentration among different journals. Smaller β implies higher author concentration, and lower concentration is indicated by higher β . Estimates are given in table (6). The period of analysis is 1963-1988. The $|\beta|$ lie in the range of 2.04, for brooking papers, to 3.11, for quarterly journal of economics. It may be noted that all journals taken together show a relatively high degree of concentration ($|\beta| = 1.84$). Estimates presented in table 6 exhibit high degree of concentration, for specialized or narrow field journals like Journal of Financial Economics, Journal of Finance, Brooking papers etc. Interestingly, general interest journals (e.g. Quarterly Journal of Economics, Economic Journal) show low author concentration.

Table 6. Lotka's Law and Author Concentration among Journals

Journal	β Value *	Ranking of Author Concentration
American Economic Review	-2.31	04
Journal of Political Economy	-2.66	13
Econometrica	-2.35	05
Journal of Monetary Economics	-2.50	08
Journal of Economic Theory	-2.46	06
Review of Economic Studies	-2.58	10
International Economic Review	-2.86	18
Bell Journal of Economics	-2.74	15
Journal of Finance	-2.23	03
Journal of Econometrics	-2.47	07
Scandinavian Journal of Economics	-2.69	14
Brookings Paper	-2.04	01
Journal of Public Economics	-2.56	09
Journal of Financial Economics	-2.20	02
Review of Economics and Statistics	-2.95	19
Journal of American Stat Asso	-2.75	16
Quarterly Journal of Econ	-3.11	20
Journal of Human Resources	-2.59	12
J. of Economic Literature	-2.59	11
Economic Journal	-2.84	17
All Journals	-1.84	

* All values are significant at the 1% level

Source: Cox and Chung (1991) p 743

This study tests prevalence of Lotka's law in a few Indian Economics journals. Testing consists of two steps: (a) testing the significance of χ^2 of theoretical distribution and observed value (acceptance of null hypothesis implies the presence of lotka's law in a particular journal) (b) Estimation of Cox-Chung model (slope give concentration indicator).

Step (1)

$$a_n = \frac{a_1}{n^2} \Rightarrow \sum a_i = a_1 \sum \left(\frac{1}{i^2} \right)$$

In order to evaluate $\sum\left(\frac{1}{i^2}\right)$

Fourier series for periodical function (Niles and Haborak, 1971, Cox and Chung, 1991)

$f(t) = 0$, When $-\pi < t < 0$ and

$$f(t) = \begin{cases} 0, & -\pi < t < 0, \\ t^2, & 0 < t < \pi, \end{cases} \text{ Period } 2\pi$$

$$f(t) = \frac{\pi^2}{6} - 2\left(\cos t - \frac{1}{4}\cos 2t + \frac{1}{9}\cos 3t + \dots\right) + \left(\frac{\pi^2 - 4}{\pi}\sin t - \frac{\pi}{2}\sin 2t + \frac{9\pi^2 - 4}{27\pi}\sin 3t + \dots\right)$$

If $t = \pi$, all the sine terms will disappear

$$f(\pi) = \frac{\pi^2}{2} = \frac{\pi^2}{6} - 2\left(\cos\pi - \frac{\cos 2\pi}{4} + \frac{\cos 3\pi}{9} - \frac{\cos 4\pi}{16} + \dots\right) + 0,$$

$$\frac{\pi^2}{2} = \frac{\pi^2}{6} - 2\left(-1 - \frac{1}{2^2} - \frac{1}{3^2} - \frac{1}{4^2} + \dots\right),$$

$$\frac{\frac{\pi^2}{2} - \frac{\pi^2}{6}}{2} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots,$$

$$\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots,$$

$$\sum\left(\frac{1}{i^2}\right) = \frac{\pi^2}{6}$$

$$\frac{a_2}{a_1 \sum\left(\frac{1}{i^2}\right)} = \frac{6}{\pi^2} \left(\frac{1}{2^2}\right) = 0.152$$

$$\frac{a_3}{a_1 \sum \left(\frac{1}{i^2} \right)} = \frac{6}{\pi^2} \left(\frac{1}{3^2} \right) = 0.0675$$

$$\frac{a_n}{a_1 \sum \left(\frac{1}{i^2} \right)} = \frac{6}{\pi^2} \left(\frac{1}{n^2} \right)$$

Following table outlines theoretical distribution:

Table 7: Theoretical Distribution

Frequency Distribution (No of Authors)	$\frac{a_n}{a_1 \sum \left(\frac{1}{i^2} \right)} \times 100$ (Theoretical Distribution)
1	60.8
2	15.2
3	6.8
4	3.8
5	2.4
6	1.7
7	1.2
8	0.9

Step (2):

Following equation represents Cox-Chung model:

$$\text{Log} \left(\frac{a_n}{a_1} \right) = \beta \log n + e$$

Table (8) outlines results of step 1 and step 2. It may be noted that Journals other than Indian Journal of Agricultural Economics do not follow Lotka's law. However, β values,

for all journals, are negative and significant. Indian Journal of Economic and Social History record lowest author concentration and Indian Journal of Agricultural Economics has highest value. This study is preliminary, and the study may be extended over more period and more journals.

Table 8. Estimates of Cox and Chung Model and χ^2 for Indian Journals

			Estimates of Cox and Cheung Model					χ^2 Results	
Journal	Number of Authors	Time Period	β	t	p	R^2	F	χ^2	p
Indian Journal of Agricultural Economics	278	1990-2002	-2.61	-33.7	0.00	0.99	1134.53	8.33*	0.30
Indian Economic Review	178	1990-2002	-3.06	-14.9	0.00	0.98	224.5	14.58	0.002
Indian Journal of Economic and Social History	182	1992-2002	-3.08	-89.0	0.00	0.99	7925.0	15.43	0.004
Indian Journal of Economics	375	1990-2002	-2.86	-56.36	0.00	0.99	3176.92	16.63	0.019

*Acceptance of the Null Hypothesis of Prevalence of Lotka's Law

Cox and Chung do not associate any welfare issues with institutional concentration in knowledge production. Two competing views, institutional oligopoly and welfare issues like 'lock-in' and welfare-neutrality of concentration, pinpoint a critical question: Is concentration due to institutional excellence? Or are there are other determinants. Consideration of this question requires reflection on role of journal in knowledge activity.

Journal, as an institution, intermediates between knowledge producer and consumer. Majority of consumers of journals want to produce knowledge at some point of time.

There is incentive for knowledge production. Journal publication is often given higher valuation as achievement indicator by knowledge community. Editors do not publish all submitted articles. Normal publication process runs as follows: Referees appointed by journal review the article and value if it is worth publishing article. On basis of referee's comments, editors decide if article should appear in the journal. Publication lag has increased over years in economics journal publication. Refereeing seems to be a major determinant of publication lag. Literature indicates journal's resistance to innovative ideas. Editors and referees often reject novel ideas. A major consequence of imperfections in publishing process is that new ideas are being sacrificed for polish. Following tables summarise literature pertinent to publication process in Economics.

Table 9: An outline of literature on Publication Process

Author	Summary of findings
Publication Lag	
Ellison (2000), Sample: 5500 articles	Increase in publication lag not due to increase in revision cost, Resistance to ideas, Polish is preferred over ideas, Less democratisation in revising
Trivedi (1993) Sample: 7 Journals	Progressive increase in Publication Lag
Mason (1992) Sample: 281 (questionnaire)	Refereeing responsible for publication lag
Refereeing	
Hamermesh (1994)	Incentive can reduce the publication lag
Blank (1991) Sample: 39 Journals	Comparison between double blind and single blind, Both systems have little impact on institutional concentration
Rejection of Path breaking Works	
Gans & Sheperd (1994)	Editors and Referees resisted innovative ideas (e.g. Keynes rejected Bertil Ohlin's factor proportion theorem) See Table 10

Table 10: Rejected Papers*

Authors Name	Rejected Paper: Title
Akerlof, George	The Market for Lemons
Arthur W Brain	Competing Technologies, Increasing Returns, and Lock-In by Historical Events
Becker Gary S	Competition and Democracy
Becker Gary S	A Theory of the Allocation of Time
Bhagwati, Jagdish	Immiserizing Growth: A Geometrical Note
Black, Fisher, and Myron Scholes	The Pricing of Options and Corporate Liabilities
Buchanan, James M	External and Internal Public Debt
Chichilnisky, Graciela	Basic Goods, Commodity Transfers and the New International Economic Order
Corden, W. Max	The Structure of a tariff System and the Effective Protective Rate
Debreu, Gerard	Numerical Representations of Technological change
Fisher, Franklin M, Zvi Griliches, Karl Kaysen	The Costs of Automobile Model Changes Since 1949
Friedman Milton	Professor Pigou's Method for Measuring Elasticities of Demand from Budgetary Data
Harrod, Roy	The Law Decreasing Costs
Hotelling, Harold	The Economics of Exhaustible Resources
Jonung, Lars	Ricardo on Machinery and the present Unemployment: An Unpublished Manuscript by Knut Wicksell
Kalecki, Michal	A Theorem on Technical Progress
Krugman, Paul	Increasing Returns, Monopolistic Competition, and International Trade
Krugman, Paul	Target Zones and Exchange Rate Dynamics
Lazear Edward P and Sherwin Rosen	Rank-Order Tournaments as Optimal Labour Contracts
Lucas Robert E	Expectations and the Neutrality of Money
May, Robert, and John Beddington	Nonlinear Difference Equations: Stable Points, Stable Cycles, Chaos
May, Robert	Simple Mathematical Models with Very Complicated Dynamics
Modigliani Franco	Fluctuations in the Savings-Income Ratio: A Problem in Economic Forecasting
Ohlin, Bertil	Interregional and International Trade
Scitovsky, Tibor	A Reconsideration of the Theory of Tariffs
Sharpe, William	Capital Asset Prices: A Theory of Equilibrium Under Conditions of Risk
Stolper, Wolfgang, and Samuelson, Paul A.	Protection and Real Wages

*These articles were later published in other journals.

Source: Gans and Shepherd (1994 p 167)

4. Conclusive Remarks

Journal publication is one of the achieved functionings in the knowledge activity related to Economics. Not all authors are successful in getting their articles published in journals. The achievement in journal publication is influenced by factors like institutional affiliation, propitious circumstances etc. The data and literature, analysed in this paper, provide evidence for institutional-geographical-area-author concentration. It may be noted that concentration levels seem to have crossed fairness limits. The link among publication-institutional affiliation has apparent implication that institution exerts greater impact on transforming capability into achievement. It may be noted that even better intermediation standard, like double blind refereeing, has no impact on institutional concentration. Ellison's (2000b) argument that the polish is replacing quality of ideas in the content of economic journal may be linked to institutional concentration. Most of the editors and authors have done Ph D from top ranked institutions, language and style they practice may be interpreted as 'standard of polish', and authors from top ranked institutions often imbibe the standard. The authors, from top ranked institutions, are likely to be more fluent in journal standard than the authors from low ranked institutions, due to formers' cognizance about editors likes and dislikes. The information about editorial preferences often percolates to authors through institutions. However, some authors from top institutions dare to write in language inviting editors' dislike; their works are turned down or delayed.

High concentration levels indicate possibility of institutional lock-in. Sustaining lock-in is capable of blocking the entry of innovative ideas into Economics. The analysis of welfare effects of lock-in calls for exhaustive information on institutional characteristics of knowledge production and appropriate institutional modelling. This paper initiates an important question: Do imperfections in process explain unfair outcome? Discussion carried out in this paper hints the possibility of causal link between unfair process and unfair outcome. Future research may unravel process-consequence link.

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