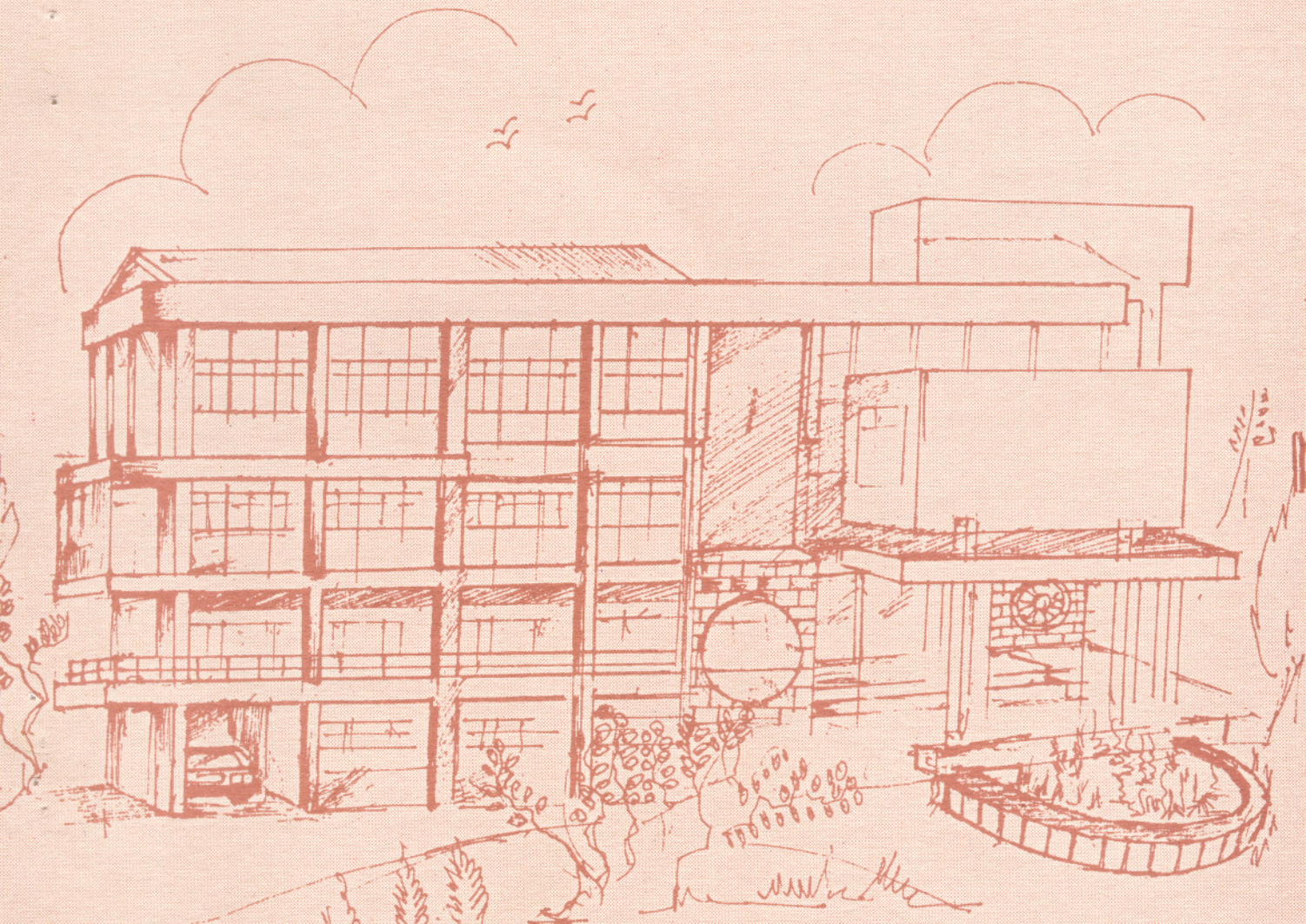




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## Working Paper Series

### An Enquiry into the Scientific Activity in Economics



# **An Enquiry into the Scientific Activity in Economics**

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# An Enquiry into the Scientific Activity in Economics<sup>+</sup>

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## Abstract

This paper, by conducting a review of literature, examines the salient features of the knowledge activity in economics. The investigation covers four aspects: Earl's behavioural theory of economists' behaviour (Earl, 1983), institutional concentration in journal publication, doctoral education in economics and state of scientific activity in economics. An economist's behaviour as a knowledge producer is not significantly different from that of other professionals. They also, generally, yearn for the recognition, prestige and other rewards. They often make the choices that maximize their interests than the knowledge per se. In the provision of the publication opportunities, a few institutions have advantage over a large majority. This phenomenon is not an instantaneous one. In fact, it is a regular process, which has tended to span over the last five decades. As a result, the institutional arrangement in the economics research resembles the oligopolistic behaviour. The literature and data, related to the United States of America (USA), indicate that the Ph D curriculum is not up to the expectation of the labour market and academia. There are serious skill deficiencies. Moreover, there is a tendency for the geographic and institutional background of the persons increasing the likelihood of the achievement in the knowledge activity. There is crisis in the economic theory. Two reasons account for this trend: (i) excess use of mathematics (ii) hegemony of neoclassical economics. The situation calls for appropriate institutional changes. There are alternatives, which may improve the current state; there are signs of change too. For instance, the alternative methodologies (e.g. Evolutionary Economics) are gaining popularity among economists. Further, the desirable institutional change does not necessarily mean the radical change, but rather what is called for is the cooperation between the neoclassical theory and its alternatives.

**Key words: Knowledge Activity, Institutional Concentration, Crisis in Economics**

JEL Code: A11, B40

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## 1. Introduction

What are the similarities between science and economic activity? Although the scholarly pursuit of this question may vary in scope, it is important to examine the features that integrate science and a typical economic activity. Science resembles an ordinary economic activity in many respects such as incentives, institutions, competition, concentration, strategies and so on\*. However, the human behaviour in science is far more complex than the representative human behaviour that is used in neo-classical economic models. Moreover, there are active debates about the characteristics of knowledge; one prominent debate is about whether it is public or private good (Arrow, 1962). The range of debate varies from overly simple notion of knowledge being a public good to more realistic view of knowledge as the body of codified knowledge that approximates a public good and tacit knowledge which resembles a private good (Cowan et al., 2000) †. Given the complexity of science, as a human activity, the scope of enquiry may give better insights if the reality is described than merely represented by the deductive reasoning; it is far more desirable to describe the process than showing a representative behavior by abstracting from reality. In this paper, we take economics as a case of scientific activity.

The ideal existence is a core theme of mainstream economics; there are examples such as perfect competition, rational choice, general equilibrium etc. However, the knowledge activity‡ in economics presents several cases of non-fulfillment of ‘ideal’; this is a case of inconsistency between preach and practice. These inconsistencies are quite apparent in the following (i) the institutional order, (ii) the professional hierarchy, and (iii) the type of methodology chosen for a given research. Contemporary thinking in the philosophy of science, for example ‘Scientific Research Programmes’ (Lakatos, 1970) ‘paradigms’ (Kuhn, 1970), and anarchy (Feyerabend, 1975), observe the knowledge activity as the historical and

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\*Dasgupta and David (1994) outline the scope of economics of science (also see Klamer and Van Dalen, 2002)

†For instance, a formula is a codified knowledge, but in using it for finding a solution depends upon users competence, and it is relatively tacit in person. It is noteworthy that knowledge of  $(a+b)^n$  can be used as an input for computing the output for different values of  $n$  without incurring additional cost (see Cowan and Foray, 1997 for a discussion on related issues).

‡ Scientific activity may be perceived as a subset of the knowledge activity. The knowledge activity refers to the production, diffusion, use and exchange of the knowledge. It has the sources and the end. For instance, the existing knowledge stock, the institutions, and the individuals form the source. On the other hand, newly produced knowledge is the end. The knowledge is classified into tacit and codified. The former is open ended, whereas the latter is subject to the rules of language.

behavioural process. Therefore, understanding the history and characteristics of the institutions and methodology is important for gaining insights into the knowledge activity.

Like many other activities, the *self* seems to be a major objective in pursuing the economics profession. Economists not only seek knowledge, but they look for recognition and many other benefits. The journals, in any academic discipline, play a crucial role by facilitating the exchange of knowledge, and thereby contributing to the overall expansion of knowledge. An article, published in a journal, is often referred to as an item of knowledge output (Lovell, 1973); it provides a variety of benefits to its author. Naturally, a typical researcher will try to publish her papers in reputed journals. It is quite likely that there is an excess demand for such opportunities. The degree of scarcity is more severe in the prestigious journals. Unlike simple market clearing, the exchange between authors and a journal is more complex. In such an exchange, norms play a significant role. Each journal has its own norms. However, a few norms such as the degree of formalism are common across economics journals<sup>§</sup>. Moreover, the decisions by a journal's editors and referees are often sensitive to such norms. The norms, which the journals adopt, have specific cultural contexts. In many instances, the norms evolve in the universities and schools of thought, and later the journals adopt them. Reflecting on this cue, we can say that such institutions have a role in the publication process. An author has to comply with the norms for getting her article published while many lack the skills to fulfill them. The institutions often act as the conduits through which the authors get acquaintance with these norms.\*\* Such norms often constrain the chances of an author, who is less familiar with the skills specific to these norms, from publishing her article. It is quite likely that the authors from the institutions, which have expertise in such skills, tend to have more publications. However, there is no convincing evidence that shows the direct link between institutional hegemony and scientific progress. Given the above background, we discuss the literature on different aspects of knowledge activity such as economists' behaviour, journal publication, doctoral education, and scientific progress.

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<sup>§</sup> See Ellison (2002) for a discussion on norms.

\*\* Doctoral training is an example for this.

The contents of this paper are as follows: Section 2 gives the summary of Earl's behavioural theory of economists' behaviour. Section 3 deals with the institutional concentration in journal publication. Section 4 describes the salient features of doctoral education. Section 5 critically examines the state of scientific activity in economics. Section 6 concludes the paper.

## **2. Economists' Behaviour: Earl's Theory**

Earl (1983) proposes a behavioural theory of economists' behaviour. The theory examines the strategic aspects related to economists' behaviour. Earl observes (1983, p 119-120) "We have taken the position that an academic worker is no fundamentally different from any other workers, since the products of academic labour are both monetary and psychic income, while the incumbent of an academic job inevitably faces anxiety as to whether she is going about it the right way and as to how her peers will view what she does." The pursuit of the knowledge activity, for example in economics, is significantly influenced by the strategic behavior of the economists. The strategic behaviour, which is prevalent in the economic profession, involves following: (i) objective of the participation in the knowledge activity; (ii) the screening mechanisms that determine the publication. According to Earl, the factors that guide the choice of the research include risk aversion, time saving, faster career progress, and minimization of the transaction costs. For example, the choice of the neo-classical methodology for the research seems to be a major risk coping strategy. Such choices enhance the career possibilities, which include job, publication etc. Earl (p 95) notes potential risks with the choice of an unorthodox research methodology for pursuing the research "The economist who does not conform to mainstream economists' images of an economic scientist is in great danger of being swept aside as one whose values are rubbish, and may find her self unemployed as a result."

In comparison with the alternative methodologies, for example behavioural economics, the neoclassical style of research is more economical in terms of the effort. The behavioral economics requires in-depth case studies and primary data for conducting the research, and the requirement makes the approach more time consuming than the approaches like neo-classical. So, it is quite likely that a neoclassical economist has more knowledge output than a behavioral economist has. Therefore, choice of the research methodology may have

impact on the career progress. Another major advantage with the affiliation with the dominant research methodology is the minimization of transaction costs (e.g. costs due to publication lag) related to the journal publication. Strict adherence to the orthodox methodology enhances the likelihood of the acceptance of the articles, which are submitted to the journals for publication. Pursuing the knowledge activity for career progress may be at the cost of the scientific interests persons have<sup>††</sup>. The papers that emerge from the knowledge activity have to go through the ‘publication screen’ for attaining the status of ‘publication’. The journals intermediate the publication process. Attaining the publication is often influenced by the characteristics of the author, article and editorial process. These characteristics include institutional background of the author, language used in the article, and article’s compatibility with the interests of referees and editors. Incompatibility between the article and journal implies that the article is turned down by the journal. So, to fulfill the screening constraint, the authors choose the topic and research methodology that is compatible with the journal’s expectation. The screening is normally sensitive to the language. Even if an article has path breaking ideas, its publication depend upon the article’s compliance to the language that the journal considers as standard. There are instances when the article has innovative ideas are turned down by the journals by citing inappropriate language as a reason (Gans & Shepherd, 1994)<sup>‡‡</sup>.

### **3. Institutional Concentration in Journal Publication**

The institutions have significant role in the allocation of the opportunities for the publication (i.e. knowledge output) among the participants in the knowledge activity. The allocation is often influenced by a variety of institutional factors and the norms. For example, the institutional background of the author and author’s adherence to the norms (e.g. language compatibility) determine the allocation. As a result, the knowledge output tends to be concentrated among a few persons who share similar institutional and geographic background. These consequences are referred as the institutional or geographic concentration in the knowledge output. Understanding the trend and the nature of the

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<sup>††</sup> The trade-off between quality of idea and formalism may be the result of survival instincts of older generation, who are afraid of the obsolescence of own research. Frey (2003) shows how academic prostitution evolves in response to scarcity of publication opportunities. Some of the authors, according to Frey, are born or learned academic prostitutes, who learn likes and dislikes of referees and editors.

<sup>‡‡</sup> George Akerloaf, who won Nobel Prize, is a classic case for such phenomenon (Gans & Shepherd, 1994).

concentration in the allocation of the knowledge output may provide better understanding of the knowledge-well-being link. A number of studies, varying in scope, have looked into the phenomenon of the concentration in the journal publication in Economics.

Hodgson and Rothman (1999) noted the presence of the phenomenon of institutional oligopoly in the journal publication in economics. They studied thirty 'most visible' economics journals; the degree visibility was measured by citation impact of the journal<sup>§§</sup>. To examine the concentration in the knowledge output, they studied following variables: institutional origin of the authors, current institutional affiliation of the authors, institutional origin of the editors of the sample journals, institutional location of editors, editor impact score and author impact score. The institutional origin refers to the institution where author or editor obtained Ph D or other highest degree. The institutional location is the current affiliation of the editor or author. The editor impact score is the ratio of the editor count weighted by citation impact factor to total number of editors for each journal. Author impact score is obtained by weighting author count by citation for each journal (Hodgson and Rothman, 1999).

There is geographic concentration in the distribution of the knowledge output in the economics. The indicators, given in table 1, point out that the affiliation to institutions in United States of America (USA) may enhance the achievement possibilities in the knowledge activity. More than 80 % of the authors and editors have done their Ph D from the US based institutions. However, the concentration in respect of the institutional location shows slight difference from the figure with respect to the institutional origin. The USA's share in institutional location of authors is almost 66 %, and the figure, for editors, is around 71 %. United Kingdom (UK) is the distant runner up in the chase for publication in economics. The USA has significant impact over the entire domain of knowledge activity, and the impact score supports the argument. It may be noted that the USA's share in author and editor impact is above 70 %.

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<sup>§§</sup> The citation impact is measured by impact factor. The impact factor is calculated by dividing the total number of cites for the previous two years by the total number of articles published in that journal over the previous two years.



**Table 1: Institutional Concentration (1995): Top 30 journals**

	United States of America (USA)	United Kingdom (UK)	Rest of the World	Total
Figures in %				
Institutional origin of Authors	83.3	09.1	07.6	100
Institutional Location of Authors	65.7	11.3	23.0	100
Institutional origin of Editors	83.8	09.7	06.5	100
Institutional Location of Editors	70.8	11.4	17.8	100
Author impact score: Institutional Location	70.6	08.9	20.5	100
Editor impact score: Institutional Location	77.0	11.7	11.3	100

Source: Compiled from Hodgson and Rothman (1999)

The indicators related to the geographical concentration present a macro view of the concentration in the knowledge activity. However, further enquiry into the knowledge activity entails disaggregating the geographical unit into institutions. The figures presented in table 2 reveal that the reputed institutions dominate the knowledge activity. One third of the authors have done Ph D from five USA based universities. Harvard's share in institutional origin is higher than the rest of the world excepting the USA and UK. Half of the editors are Ph Ds from USA based universities. It may be noted that the number of editors having done Ph D from the institutions other than those belonging to USA and UK is three fifth of the editors having roots in the Harvard. The variables related to location and impact show lesser degree of concentration than the institutional origin. However, the institutions like Harvard, MIT, Chicago, and Stanford etc. are ahead of the other institutions in achieving the visibility in the knowledge activity. Hodgson and Rothman (1999) observe the phenomenon of 'institutional oligopoly' in the allocation of the publishing opportunities in the economics. To quote them (Hodgson and Rothman 1999, pp. 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." The authors identify the following reasons for the issue: editorial favouritism, path dependent processes, and increasing language compatibility within the institutions. As observed by them, the editorial favouritism

does not adequately explain the concentration. However, Laband and Piette (1994) find editorial favouritism as a significant determinant of citation<sup>\*\*\*</sup>. The second factor, ‘path dependence’, refers to the long survival of an institutional order, which has a few institutions at the top. If such a situation prevails, the journals may tend to show resistance to new ideas. The third factor denotes that the institutions and journals agree on certain theoretical and methodological assumptions as the norms for publishing the articles. For instance, it is known that most of the institutions and journals agree on using the neoclassical models as the theoretical frame. Besides, there seems to be lesser disagreement among the institutions on the norms such as the degree of formalism. An appropriate proxy, for this factor, may be the trend towards increasing use of mathematics in economics (Stigler et al., 1995)<sup>†††</sup>.

**Table 2: Institutional Concentration: Major Universities**

	Author			Editor		
	IO	IL	IS	IO	IL	IS
	N = 868	N = 1962	S = 3018.4	N = 463	N = 691	S = 43.18
Figures in %						
Universities in USA						
Harvard	9.0	2.9	3.5	11.2	5.5	06.4
MIT	8.3	1.4	1.9	11.7	2.9	03.5
Chicago	5.8	2.5	2.9	09.9	4.8	10.0
Stanford	5.8	2.0	2.3	05.6	4.8	05.1
U Michigan	4.4	1.5	1.6	02.2	1.7	02.1
UC Berkeley	4.0	1.7	1.7	05.2	2.9	03.1
Princeton	3.8	1.4	1.6	05.4	2.3	03.6
Yale	3.5	1.2	1.4	04.3	2.2	02.6
U. Wisconsin	2.9	1.8	2.1	02.8	3.2	02.2
Columbia	2.2	0.9	1.0	02.6	1.2	01.2
U. Pennsylvania	2.1	2.3	2.9	01.5	2.3	02.8
North western	2.0	1.8	2.5	01.5	2.9	02.2
United Kingdom						
Oxford	2.5	1.0	0.8	03.2	1.4	01.3
LSE	2.0	1.2	1.2	01.7	1.2	01.0
Cambridge	1.5	0.7	0.9	01.5	0.9	02.0
Others (not USA/UK)						
	7.6	22.9	20.5	06.5	17.8	11.3

<sup>\*\*\*</sup> Laband and Piette (1994) specified citation as function of characteristics of journal, gender, author-editor institutional connection and authors stock of citation (see Laband and Piette (1994), p.197 equation 1).

<sup>†††</sup> As regards the technical content in journal articles, as shown by Stigler et al. (1995), the mathematics has clear dominance over the natural language such as English.

IO: Institutional Origin, IL: Institutional location, IS: Impact Score, N = Total Count, S\* = Total Impact Score. Source: Compiled from Hodgson and Rothman (1999)

The previous discussion described the recent pattern of allocating the publication opportunities. However, understanding the extent of the concentration involves tracking the trend of the phenomenon under reference (Kocher and Sutter, 2001). Table 3 captures the trend of indicators related to institutional concentration. It is apparent from the table that Herfindahl indices, in respect of institutional origin and current affiliation, show gradual decline during 1977-1997. The concentration, for the country level distribution of the authors, is much higher than the same at the institutional level. The geographical concentration shows apparent US dominance in the distributions of the knowledge output (see Table 4). In respect of institutional affiliation, US share has varied in the range of 75 to 85 percentages, and, for institutional location, the share has been in the range of 66 to 77 percentages. Cleary and Edwards (1960), Yotopoulos (1961), and Siegfried (1972) give evidence for institutional concentration in three important journals. Percentage of pages contributed was the unit of measurement for these studies. Major institutions like Chicago, Harvard, MIT, UC Berkeley etc. are top contributors to these journals. One significant change happened during 1960-69 was decline in UC Berkeley's share in QJE; the share declined from 7.2 to 4.1 percentage. Siegfried (1972) studied author concentration in five journals and a sample of fifteen journals. Percentage of pages contributed was the unit of measurement for these studies. Major institutions like Chicago, Harvard, MIT, UC Berkeley etc. are the top contributors to these journals.

The literature and data reveal the regularity of the institutional and regional concentration in the distribution of knowledge output during 1950-2000. Another major finding emerging from the discussion is the stable institutional order that prevails in economics; top institutions remain top. The 'lock-in' theory seems to explain the phenomena like regularity in the concentration and stable institutional order. The norms prevalent in the knowledge activity often lead to the 'lock-in'. The norms, which permeate the knowledge activity, are fairly static, and the notion is supported by the literature with regard to the economic methodology.

**Table 3: Concentration indices of ‘Top 15’ Economics Journal Authors**

	Year				
	1977	1982	1987	1992	1997
Institutional Level					
Herfindahl Index*: Ph D origin (IO) of authors	0.0513	0.0452	0.0453	0.0457	0.0385
Herfindahl Index*: Current affiliation (IL)	0.0135	0.0123	0.0143	0.0131	0.0122
Share of top 10 institutions (IO) (in %)	57.8	53.9	54.5	56.6	50.5
Share of top 10 institutions (IL) (in %)	28.2	26.3	30.2	27.7	26.3
Country level					
Herfindahl Index*: Ph D origin (IO) of authors	0.7284	0.6545	0.6688	0.6912	0.5863
Herfindahl Index*: Current affiliation (IL)	0.5300	0.5393	0.6040	0.5577	0.4531

\* Herfindahl Index is the sum of square of the ratio of institutional output to total output.  
Source: Compiled from Kocher and Sutter (2001)

**Table 4: Geographical Concentration of ‘Top 15’ Economics Journal Authors**

	Year				
	1977	1982	1987	1992	1997
Institutional Affiliation (IO) %					
USA	84.9	79.9	81.1	82.5	74.9
UK	8.4	12.3	10.2	10.2	15.4
Canada	0.2	1.4	1.1	1.6	1.7
Israel	0.7	1.2	0.8	1.4	0.2
Australia	0.5	0.6	1.1	0.3	0.6
Europe (excl UK)	4.6	4.0	5.0	3.7	7.1
Rest	0.6	0.5	0.6	0.5	0.1
Institutional Location (IL) %					
USA	71.9	72.3	77.1	73.9	65.8
UK	9.5	11.0	8.3	9.2	13.1
Canada	5.4	5.6	3.7	5.1	3.8
Israel	2.5	2.6	2.9	1.8	0.8
Australia	2.2	1.8	1.0	0.8	1.1
Europe (excl UK)	5.5	4.8	5.1	6.0	10.2
International. Org	1.3	0.5	0.5	1.4	2.7
Rest	1.7	1.3	1.3	1.8	2.5

Source: Compiled from Kocher and Sutter (2001)

#### 4. Doctoral Education in Economics

The doctoral qualification is often considered as a subset of the knowledge production, and is one of the entry norms for a career in academic economics. The process of the doctoral training usually consists of the coursework, conduct of guided and independent research, and preparation and defense of the dissertation. The knowledge activity involved in doctoral degree may be classified into three: (i) learning the codified knowledge (e.g. journal articles, formal language, computation algorithms etc.) (ii) acquiring the knowledge specific to the institution, and (iii) producing the knowledge output. Hansen (1991) describes a set of capabilities that are to be imparted by a doctoral curriculum. The capability set consists of knowledge and skill. The knowledge under reference is predominantly codified, and the coverage includes economic theory, econometrics, economic institutions and history, economic literature, applied economics, and empirical economics. The skill set is formed by critical judgment, analytics, applications, mathematics, computation, communication and creativity. The course work is generally based on codified knowledge. Hansen (1991) observes that there is similarity in the doctoral course work across American universities. However, the similarity in the coursework does not imply that all the doctoral programmes get same valuation. For example, the labour market often considers the institutional background as a signal of the quality. Significant proportion of the students also responds to the signals from the labour market. So, they prefer top institutions for the pursuit of the doctoral degree. Another important reason for the difference in the valuation is that the top order institutions, in comparison with the low order counterparts, have more endowment of the tacit knowledge. The tacit knowledge flows from the sources like illustrious professors and scholastic heritage<sup>##</sup>. It is quite unlikely that the students who meet the entry level criteria of top institutions choose to pursue their doctorate in the bottom tier institutions. In many instances, the student preference is sensitive to the institutional reputation, and the factors in relation to the knowledge output, particularly the state of art academic infrastructure and the faculty with extraordinary scholastic credentials are often secondary considerations. At the same time the data on the knowledge output and the personal laurels

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<sup>##</sup> The Graduate Record Examination (GRE) scorers prefer the institutions belonging to the top tier of the quality. Cut-off GRE scores varies across the institutions; institutions of repute set higher cut-off scores (Hansen, 1991)

clearly show that the Ph D alma mater impacts the personal achievement in the economics. Table 5 indicates that the graduates from the top schools have better likelihood of achieving the knowledge output than the persons from less reputed institutions. The students, in search of the reputed institutions, migrate to green pastures from the native region. The USA seems to be green pasture for the students who look for reputed Ph D institutions. Table 6 gives the BA and Ph D background of top 300 and 100 economists respectively. There is clear evidence for the phenomenon “All roads leads to USA”. A significant percentage of the top economists, after their BA, have migrated to USA for Ph D. The proportion of US BAs, compared to proportion of US Ph Ds, is much lesser in both the samples. Interestingly, more than three fourth are employed in USA. It may be noted that more than one third of the graduate students, after the completion of the Ph D, joined the faculty of the alma mater (see Table 7). The data seem to show the role institutions play in individuals search for opportunities in a scientific activity like economics.

**Table 5: Ph.D. Institutions of top economists by publication:  
Top 10 Institutions**

Top 300 Economists*		Top 100 Economists**	
Institution	Share (%)	Institution	Share (%)
Massachusetts Institute of Technology (MIT)	16.0	Massachusetts Institute of Technology (MIT)	23
Harvard	10.0	Harvard	12
U. Chicago	6.3	Princeton	8
Princeton	5.3	U. C. Berkeley	7
Stanford	4.7	U. Chicago	7
U. C. Berkeley	3.7	U. Yale	5
U. Yale	3.0	Columbia U.	3
London School of Econ.	2.7	London School of Econ.	3
U. Minnesota	2.7	U. Cambridge	3
U. Cambridge	2.0	U. Minnesota	3
Total	56.3	Total	74

Source: Coupe (2001) p \* 96, p \*\* 94

**Table 6: Educational background of Top Economists:  
Inter Regional Comparison**

Region	Top 300 Economists*			Top 100 Economists**		
	BA	Ph D	Employment	BA	Ph D	Employment
	(percentage distribution)			(percentage distribution)		
USA	54.7	84.7	78.5	56.7	87.6	88.4
Europe	27.4	13.2	16.3	25.4	11.2	9.5
Asia	5.3	0.0	0.4	4.5	0.0	0.0
Australia	1.6	0.0	0.0	1.5	0.0	0.0
Canada	5.8	2.1	3.8	7.5	1.1	2.1
Latin America	2.6	0.0	0.0	3.0	0.0	0.0
Middle East	2.6	0.0	0.8	1.5	0.0	0.0

Source: Coupe (2001) p\* 97, p\*\* 95

**Table7: Proportion of Domestically Placed Graduates**

Institutions (Quality Tier)	Domestically Placed Graduates (% of Total Graduates)
1 <sup>st</sup>	39
2 <sup>nd</sup>	31
3 <sup>rd</sup>	29
4 <sup>th</sup>	35

Collins et al. (2000) p 360.

However, the state of art of the Ph.D. programme seems to be not successful in meeting the expectation of the labour market and academia. There is an important question related to the state of art: Should the Ph D training be insulated from changes or be restructured? Hansen (1991) unravels this question. According to him significant proportion of the faculty, students and employers (in the range of 47 to 77 percent) express the need for the change in the Ph.D. curriculum. A major concern shared by the faculty is that the creativity (i.e. conceiving interesting research questions, finding new ways of analyzing topics etc.) seems to be awfully low in the dissertations. A significant percentage of them think that the creativity should be one of the components of the skill set for the dissertation work. One fifth of the faculty in the sample thinks that the dissertations were significant contributions to the knowledge. On the other hand, 80 percent think the dissertations were just training

instruments. The perceptions such as lack of creativity and insignificant contribution to knowledge may have link with the nature of the doctoral training. So, a large percentage of students think that the course work did not impart the skills for conducting the independent research or applying the theory to real world problems. The over emphasis given to the mathematics and computation in the doctoral curriculum seems to be an important cause that explains the weak base of creativity. It may be noted that just 11 percent of the faculty think that the computation and mathematics need more representation in the curriculum. Hansen (1991) grades the use of the mathematics in economics, and the study reports that the required level for the pursuit of the doctorate is slightly above three. The curriculum that puts much emphasis on the mathematics seems to incur the opportunity cost of the foregone creativity. At the same time, the training of mathematics, as observed by Hansen, has no major impact on the doctoral thesis. The employers are seemingly unhappy over their Ph.D. recruits' lack of the depth knowledge about the institutional aspects and data related to the economy. To quote Hansen (1991 p 1085): "New Ph D's were viewed as less trained in the fundamentals of economics, less able to carry out empirical research, not much interested in conducting policy-relevant research, and unable to communicate effectively their knowledge of economics and particularly the nature and results of their research. Employers expressed dismay that new Ph D's possessed so little institutional knowledge of the economy. They also commented on their weak knowledge of economic data, its quality, and its interpretation." Colander (1991) also shares similar perspective on the lack of interest in the knowledge related to the economy. Colander reflects (1991 p 48): "There was a strong sense that economics was a game and that hard work in devising relevant models that demonstrated a deep understanding of institutions would have a lower pay off than devising models that were analytically neat; the façade, not the depth of knowledge, was important."

It may be concluded from the previous discussion that the institutional background seems to have serious limitation as a signal that represents the quality of labour. However, the literature and data, under reference, are specific to the US. So, the conclusion drawn from the discussion has very limited scope for the generalization. However, this conclusion may be defended on two grounds: (i) the foreign students constitute more than half of the doctoral student population in the USA (Siegfried and Stock, 1999), and (ii) the USA



dominates the knowledge output in the economics and has made substantial global impact on the economics curricula.

## **5. State of Scientific Activity in Economics: An Enquiry**

The long extant institutional equilibrium in the Economics may be put to an assessment. The magnitude of the inequality may prima facie qualify as a theme of such investigation. However, the task involves the exhaustive information, which varies from the history of the institutions to a thorough understanding of the biographies. At the same time, there are a few relevant questions that do not require vast information as in the case of the magnitude of the inequality. These questions may be put as follows: Is the progress of economics, as a scientific discipline, affected by the inequality? If the answer is yes, are there any alternatives? As shown by Kuhn (1970), the knowledge is a social process. Like other aspects of the society, the knowledge activity is also subject to the welfare assessment. In the case of economics, there are imperfections in the knowledge activity; and the phenomena have a variety of effects ranging from the inequality at personal level to the crisis in the subject. It may be noted that, the defenses like 'personal inequality is quite natural' may reduce the phenomena like institutional concentration to a truism. However, such defenses lose relevance, if the knowledge activity fails to achieve the progress; the activity has no realistic solutions for the complex issues. "Economics is in crisis" is a well-cited notion in the literature on the methodology of the economics. This notion is not confined to the authors who specialize in the methodology, but the economists from the other sub-fields also share the same. However, the notion 'crisis' is not well received by a large section of economists. At least, the notion has been gaining more currency among the economists and philosophers. The sources of the crisis may be classified into the language related and the methodology based. The language mix of the leading journals has undergone the structural change; the mathematics and the econometrics form more than 90 percent of the content, whereas the natural language had a similar share in 1892-93 (Stigler et al. 1995). The trend 'the mathematics replacing the natural language' is often referred as the mathematization of the Economics. The change of the language brings gradual institutional changes; it has welfare implications. Persons, who subscribe to the dominant language, may experience the capability enhancement. At the same time, the users of the replaced language are likely to

have the capability loss. The change in the language is a major source of the change in the rules of a discipline or a methodology. To many authors, choosing a methodology for the conduct of the research is the part of the strategy for the publication. The neoclassical economic theory is often identified as the most popular methodology in economics by the researchers and the journals. Therefore, choosing this methodology may have advantages like the better chances of the acceptance for publication and the likelihood of high citation. Because of the sheer size of the user network of the neoclassical economics, the alternative methodologies have no significant presence in economics. It is also quite likely that some of the practitioners of the dominant methodology pose the stiff resistance to the alternatives. However, the alternative methodologies (referred as Heterodox) have been challenging the neo-classical orthodoxy for years.

The term mathematization means the increasing prevalence of mathematical economics in the knowledge output (Beed and Kane, 1991). Mirowski (1991) identifies three phases in the history of mathematical expression in the economic analysis: the Pre Neo Classical, initial phase of the Neo Classical, and the Sophistication phase of Neo Classical. Applications of the rational mechanics form the subject matter of the Pre-Neoclassical Mathematical Economics. Mirowski notes the nature of the Pre-Neo classical mathematical economics (p 147) “Without exception, all of these so-called “precursors in mathematical economics” looked to the physics of motion, referred to as “rational mechanics” in the 18<sup>th</sup> century, to provide them with the analogies needed to guide them in their conceptualization of value.”

Second half of nineteenth century witnessed a significant shift in the subject matter of the mathematical economics. Equilibrium in a field of force became the popular metaphor among the economists. This shift may be the starting point of the neo-classical economics. Mirowski points out the role of mathematical economics in bringing commonness in neoclassical thought (p 47-48) “Hence the key to the rise of neoclassical economics, which is coextensive with the institution of the first ongoing program of mathematical economics, is not the fact that an analogy was drawn from physical theory –all precursors of mathematical economics engaged in that endeavor- but rather that a critical mass of theorists each (independently or not) adopted the same mathematical metaphor.

Since there finally was a shared language and a shared metaphor, serious discourse concerning the implications of the construct could begin in earnest”

Lack of sophistication is the hallmark of initial phase of neo classical mathematical economists. There was long lag between the state of art in mathematics and the application in the economics.

The decade 1925-1935 witnessed a quantum leap in the application of mathematical discourse to the economic theory. This phase is characterized by significant number of economists with formal training in physics and mathematics. Mirowski explores the history of the second phase (p 151-153):

What accounts for this second rupture? Full exploration of this question would demand extensive historical illustration; for present purpose we shall simply state a few stark theses. By the 1920s, the neoclassical research program was in trouble in most academic contexts. Few economists placed much credence in the concept of utility... Moreover, since most of the second generation of neoclassical theorists were not as well-versed in mathematics or physics as their predecessors, their defenses of the program grew more and more inconsistent and idiosyncratic, primarily because they had no conception of what neoclassical theory ruled out and what it permitted... After 1917, Marxism loomed on the horizon as something more than an irrelevant fringe doctrine... Into this unstable situation, propelled largely by contracting opportunities in the physical sciences, but sometimes also by a fervent desire to apply the scientific method to the social betterment of mankind, came an unprecedented wave of trained scientists and engineers into economics... The net result was a new discourse self-consciously patterned upon the rhetoric of the scientific research report, shifting the intellectual center of gravity from the book or essay to the journal article constructed around a mathematical “model”, eschewing the earlier discursive mode of expression accessible to economist and non-economist alike. The calling card of the new, improved neoclassical program was the mathematics of someone trained in physics circa 1935; if mathematics were indeed a language, neoclassical economics at this time was a local dialect.

The crisis in the neoclassical research program and the influx of the trained mathematicians and the physicists into economics produced the ‘quantum leap’ during the third phase; mathematics became the language of neoclassical economists.

Katouzian (1980) identifies three sources of the demand for mathematical economics; they include: (i) shift of the emphasis from a partial to general equilibrium

analysis, (ii) an upsurge of interest in the theories of growth, technical progress and other economic dynamics, and (iii) a revolution in the techniques of applied economics. According to a prevalent notion (Debreu, 1984), since commodity space exhibits the properties of vector space, the commodity space is amenable to mathematical treatment (this compliance is known as isomorphism). Interestingly, the isomorphism is the pivot of the criticism against mathematical economics. Critics question the plausibility of isomorphism, if the algebraic structure of commodity measurement is fixed by the nature. It may be noted that the variant measure of value is a historical fact. Mirowski (1991) reflects on the limitation of the quantification in economics (p 155):

Quantification is itself not an invariant in human history, even within the more limited subset of market organized structures. Prices in modern markets obviously conform to specific algebraic structures. Prices in modern markets obviously conform to specific algebraic structures, but they are not the a priori products of nature or of the individual mind (through projection of completeness, reflexivity, transitivity, and so on upon preference structures); rather, they are provisional invariances imposed upon the motley variety of human perception by various conventions and social structures... If this be the case, then the argument becomes stronger that the mathematization of economic discourse should not be traced to natural quantification of commodities, but rather should be explained empirically by changing social perceptions of the symmetries and invariances read into market activities through the instrumentality of social institutions.

Debreu (1991), giving a historical sketch of mathematical economics during 1933-1990, defends the mathematization of the economic theory. The literature and the magnitude of the profession of mathematical economics and econometrics registered phenomenal growth during 1933-1990. Increasing use of mathematics had impact on the economics profession. For instance, graduate level mathematical competence has become inevitable for the entry to the international labor market of economists. Most of the institutions responded to this situation; the graduate level mathematics became the integral part of the doctoral curriculum. Debreu, admitting the inability of economics to have the grand unified theory, is upbeat about the discipline's ability to provide solutions to the problems like resource allocation, equalizing supply and demand for commodities, preventing the formation of destabilizing coalitions etc. Debreu expresses his optimism (p 3):

A global view of an economy that wants to take into account the large number of its commodities, the equally large number of its prices, the multitude of its agents, and their interactions requires a mathematical model. Economists have successfully constructed such a model because the central concept of the quantity of a commodity has a natural linear structure. The action of an agent can then be described by listing the quantity of its input or output for each commodity. That list can be treated as the list of the coordinates of a point in the linear commodity space. Similarly, the price system of an economy can be treated as a point in the linear price space, whose dimension is also the number of commodities. In those two linear spaces, the stage was set for sometimes dazzling mathematical developments that began with the elements of differential calculus and linear algebra and that gradually called on an ever broader array of powerful techniques and fundamental results offered by mathematics. Thus, the three roles of prices given earlier as instances were illuminated by basic mathematical theorems: the first, the achievement of an efficient use of resources, by results of convex analysis; the second, the equalization of supply and demand for commodities by results of fixed point theory; the third, the prevention of the formation of destabilizing coalitions, by results of the theory of integration and of nonstandard analysis. In those three cases, the lag between the date of a mathematical discovery and the date of its application to economic theory decreased over time.

However, Debreu does not hide his concern about the discordance in the economics profession. He admits that significant part of the mathematical economics is incomprehensible to a majority of the profession, and he expresses his concern (p 6) “The spread of mathematized economic theory was helped even by its esoteric character. Since its messages cannot be deciphered by economists who do not have the proper key, their evaluation is entrusted to those who have access to the code... Diversity is strained by the increasing impenetrability to the overwhelming majority of our association of the work done by its most mathematical members.”

Beed and Kane (1991) complain that the advantages of the mathematical economics are taken for granted by the economists, and the authors put forth seven criticisms against the mathematization of economics (Table 8).

**Table 8: Criticisms against Mathematization of Economics**

Sl no	Criticism
1.	The axioms of mathematical economics do not correspond with real world behaviour
2.	The number of empirically testable hypotheses generated by mathematical economics is small compared with the volume of mathematical economic analysis
3.	Some/much of economics is not naturally quantitative and therefore does not lend itself to mathematical exposition
4.	The translation of the description of economic processes from a natural language to mathematics can be naïve and illegitimate
5.	There is no objective way to gauge whether mathematical economics is more precise than less mathematical economics
6.	There is no one 'best' system of mathematical logic
7.	Because each of all the above problems, mathematics is often an unnecessary adornment to economic discovery about the real world, but serves other purposes

Source: Beed and Kane (1991, p 583)

*Axiom and Reality:* An axiom refers to the statement that is accepted as true without further proof or argument, and they form assumptions of economic theories like rational choice. Significant proportion of the mathematical models in economics is subject to the axioms, which are not congruent with the reality. Scholars like Friedman (1953) rules out the incongruity between the axioms and the reality as the potential reason for the rejection of a theory; he sets the analytical relevance, even at the cost of descriptive accuracy, as the essential qualification of a theory. Friedman reflects on the significance of analytical relevance of the assumptions (p 15):

The relevant question to ask about the “assumptions” of a theory is not whether they are descriptively “realistic”, for they never are, but whether they are sufficiently good approximations for the purpose in hand. And this question can be answered only by seeing whether the theory works, which means whether it yields sufficiently accurate predictions.

Friedman expresses his sarcasm about the notion of ‘realistic’ assumptions (p 41):

Complete “realism’ is clearly unattainable, and the question whether a theory is realistic “enough” can be settled only by seeing whether it yields predictions that are good enough for the purpose in hand or that are better than predictions from alternative theories. Yet the belief that a theory can be tested by the realism of its assumptions independently of the accuracy of its predictions is widespread and the source of much of the perennial criticism of economic theory as unrealistic. Such criticism is largely irrelevant, and, in consequence, most attempts to reform economic theory that it has stimulated have been unsuccessful.

Friedman's defense of 'analytical relevance and neglect of descriptive accuracy' gained currency among most of the neoclassical economists. However, Friedman's 'defense' offers fertile ground for criticisms, and his notion of instrumentalism (i.e. view that theories are tools for predictions) has been a major theme of the criticism. Commenting on irrelevant theories, Leontief (1982) does not hide embarrassment over neglect of reality (p 104):

Not having been subjected from the outset to the harsh discipline of systematic fact-finding, traditionally imposed on and accepted by their colleagues in the natural and historical sciences, economists developed a nearly irresistible predilection for deductive reasoning. As a matter of fact, many entered the field after specializing in pure or applied mathematics. Page after page of professional economic journals are filled with mathematical formulas leading the reader from sets of more or less plausible but entirely arbitrary assumptions to precisely stated but irrelevant theoretical conclusions. Nothing reveals the aversion of the great majority of the present day academic economists for systematic empirical inquiry more than the methodological devices that they employ to avoid or cut short the use of concrete factual information. Instead of constructing theoretical models capable of preserving the identity of hundreds, even thousands, of variables needed for the concrete description and analysis of a modern economy, they first of all resort to "aggregation".

Alternative schools, particularly critical realists, reject the instrumentalism. The approach 'realism' insists correspondence between theory and reality (Bhaskar 1989, Hausman 1989, Lawson 1997). Lawson (2001), a prominent realist, rejects Friedman's notion that the accuracy of prediction as the criterion for goodness of the model, and cites instances of forecasting failures. It may be noted that Realism is fast gaining ground in the Philosophy of Science. Interestingly, the number of empirically testable theories generated by mathematical economics is small compared to the volume of mathematical economics. Leontief (1982) and Morgan (1988) provide evidence for a large percentage of the articles containing mathematical models without any data (42-52 %), and this weakens Friedman's notion. Beed and Kane (1991) raise a fundamental question: Is much of economics naturally quantitative? This question emerges from Samuelson's (1952) contention that economics is naturally quantitative. Beed and Kane (1991) reflect on this issue (p 590) "If some/much of mathematical economics rests on empirically invalid assumptions and if some/much does not yield empirically testable predictions, it may be a reasonable presumption that theories of mathematical economics have not captured complexities of the real world. Perhaps the

complexity derives from factors impinging on economic processes that cannot be expressed in mathematical symbolism.”

*Mathematics and Natural Language:* According to a prevalent notion, there is a strong correspondence between mathematics and language (Samuelson 1952). A study (Dennis, 1982) cited by Beed and Kane (1991) indicates the incongruities between mathematical presentation and its verbal translation. According to Dennis (1982), the disparity between natural language and mathematics is due to the domain differences of both. The domain of natural language consists of use of signs for expressing the feelings and ideas, whereas mathematics mainly caters to the inferential processes. There is no consensus on whether mathematical economics is more precise the less-mathematical economics. Opposite views held by Samuelson (1947), who is in favour of the former, and Stigler (1949), who is skeptic of the correlation between clarity and mathematical economics, present an example of discordance. Beed and Kane (1991) express (p 594-595) “There is no objective definition of any of these terms; they are in the eye of the beholder. Certainly, an arbitrary definition could be constructed, but any judgment would only be as valid as the arbitrary definition on which it rested. There may well be economic processes analysed more adeptly (another value judgment) by maths than less maths. But, like vernacular thinking, mathematical thinking can also be subject to disputation within its framework, to contested logic and to subjective definition.”

The belief that the mathematics being certain knowledge is not a realistic one. There are contrasting approaches in mathematics. For instance, the conflict between the intuitionist approach and logicism over the link between logic and mathematics is quite pervasive; the former treats mathematics and logic as disjoint sets whereas the latter considers the mathematics as a subset of logic. Incongruous approaches in mathematics imply doubts on the ‘claims of certainty’. Beed and Kane (1991) express their concern over uncertain base of mathematical economics (p 60) “Expression of ideas in mathematical form carries with it a higher degree of uncertainty than was recognized before the 1930s. Unfortunately, mathematical economics has given little weight to the discussion of these philosophical issues.”



Is mathematics indispensable for economics? There seems to be no vivid answer to this question. McCloskey (1986) had showed the effective verbal exposition of the Muth's theory of rational expectation. According to her, the rhetoric is a competent mode of expression, which can even replace the modes like mathematical expression. An instance may be drawn from McCloskey (1986 p 93):

Muth's version: "The hypothesis asserts three things: (1) Information is scarce, and the economic system generally does not waste it. (2) The way expectations are formed depends specifically on the structure of the relevant system describing the economy. (3) A "public prediction," in the sense of Grunberg and Modigliani, will have no substantial effect on the operation the economic system (unless it is based on inside information). This is not quite the same thing as stating that the marginal revenue product of economics is zero, because expectations of a single firm may still be subject to greater error than the theory."

Rhetoric version: "In other words, I'm saying that people take appropriate care with their guesses, and economists should credit them with such caretaking. If people take care in guessing, talk about the future will be pointless: people will have allowed for the effects being talked about. For instance, declarations that prosperity is just around the corner will have no impact, unless the declarer really does know something we all don't know. Economists do know something, though not as much as their present notions about guessing imply: they know that a bunch of guesses by individuals' average out over a large group to less quirky guesses."

Beed and Kane (1991) explore the explanations for the mathematization of economics. According to them, the phenomenon is explained by the factors such as rent seeking by profession and hierarchy of prestige. There seems to be apparent link between the progress in academic career and the background in mathematical economics. Katouzian (1980, p 165-166) reflects on this relation "Many economists tend to hold their mathematical colleagues either in awe or in admiration, simply on account of their mathematical skills. The main reason for this is sociological: the 'invisible college' of the economic profession has become more and more dominated by mathematical economists has tended to become the safest route to 'success'. It is worth emphasizing that there is no formal ideological division over this issue. In particular, there are both neo-classical and Marxist mathematical economists; just there are both neo-classical and Marxist critics of the 'mathematical revolution'." Critics of 'mathematization' do not rule out the use of mathematics in economics. Rather, the focus of criticism is on misuse of mathematics. Blatt (1983) shows

misuse of optimal control theory for modeling dynamic relations. Sacrifice of complexity is a prerequisite for the application of mathematical models to economic problems that are complex. This type of knowledge activity will have lesser representation of reality than a theory would have had. Moreover, mathematics in economics seems to be a source of pervasive inequality than the catalyst to scientific progress. Katouzian (1980, p 71-72) expresses his disappointment “ Economic science can afford mathematical economics in a ‘peaceful coexistence’ or even ‘détente’ with other approaches. What it cannot afford is the professional hegemony of mathematical economics especially if this is effected by a combination of chauvinism and professional power-politics.” Hierarchy of prestige and rent seeking attitude exert greater influence on the pace of ‘mathematization’, and this trend is the major source of ‘lock-in’ in knowledge activity of economics. The ‘lock-in’, in the present context, implies long survival of institutional hegemony. Language bias is a prominent feature of this institutional arrangement. Absence of plural language base may lead to the extinction of alternatives, and this situation is akin to that of economics. Linguistic diversity seems to be a serious option for reducing ill being from ‘lock-in’. However, there are signs of the institutional change. Myerson (1999), citing the history of the Nash Equilibrium, showed the possibilities of the cooperation between the mathematics and the other languages.

#### *Hegemony of Neoclassical Economics:*

The neoclassical economics is frequently identified as the mainstream economics (Blaug, 1980). Colander (2000) investigated the evolution of the word ‘Neo Classical’, and he identified two phases of the evolution i.e. ‘classical’ and ‘classical to neoclassical’. The term ‘Classical’ indicates economics during 1776 and 1870. To cite Colander (2000, p 130) “Various writers used the “Classical” terminology and, as they did, the term eventually became a general classifier for the economics of the period running somewhere between 1776 and 1870.” The temporal span of neoclassical economics is a debatable theme. There is overlap between the modern and neoclassical economics. Scholars like Colander (2000) distinguish the modern and the neoclassical economics whereas most of the heterodox economists treat the neoclassical as an aggregate, which also includes the modern economics. The neoclassical economics has the following attributes (Table 9):

**Table 9: Attributes of the Neoclassical School**

Sl. No	Attributes	Background
1.	Neoclassical economics focuses on allocation of resources at a given moment in time.	This attribute is embodied in Lionel Robbin’s definition –the allocation of scarce resources among alternative ends- which became the standard definition of neoclassical economics
2.	Neoclassical economics accepts some variation in utilitarianism as playing a central role in understanding the economy	The movement to demand and subjective choice theory, and away from supply considerations, was a hallmark of neoclassical thought. While initially the focus was almost entirely on utilitarianism and demand, the focus quickly evolved to a view that demand was only one blade of the scissors.
3.	Neoclassical economics focuses on marginal tradeoffs.	Neoclassical economics came into existence as calculus spread to economics, and its initial work was centered around the marginal tradeoffs that calculus focused on.
4.	Neoclassical economics assumes farsighted rationality.	In order to structure the economic problem within a constrained maximization framework, one has to specify rationality in a way consistent with constrained optimization. Specific rationality assumptions quickly became central to the neoclassical approach.
5.	Neoclassical economics accepts methodological individualism.	This assumption, like the two before it, is closely tied to the constrained maximization approach. Someone must be doing the maximizing, and in neoclassical economics it was the individual. One starts with individual rationality, and the market translates that individual rationality into social rationality.
6.	Neoclassical economics is structured around a general equilibrium conception of the economy	This last attribute is more debatable than the others. Schumpeter made the general equilibrium conception of the economy central to his definition of neoclassical economics

Source: Colander (2000, p 134-35)

In brief, the neoclassical economics has six major characteristics, which include the optimal resource allocation, the utilitarianism, the marginal tradeoffs, the rationality, the methodological individualism, and the general equilibrium, and these are predominantly naturalistic. The methodologies may be classified into two i.e. naturalism and non-naturalism. The naturalistic methodology is rooted in the natural sciences. For instance, the comparative static model of the human behavior is a naturalistic methodology. This approach is supposed to be value free. However, the values have a major role in the non-naturalistic methodologies. Information base of the non-naturalism consists of the values, judgments, individual insight, and interpretation of the meaning. This classification is not an exhaustive one. The school of critical realism raises questions on the naturalistic-non-naturalistic schism. However, the ‘dichotomy’ seems to have relevance in economics. Beed and Beed (1996, p 1089) express “ It [Dichotomy] is still particularly relevant in economics because the dominant neoclassical approach is one of traditional naturalism.” (p 1078) “Contemporary academic economics has made a majority choice that naturalistic

philosophy/methodology reveals truth more clearly than non-materialistic. Economics is nearly monopolized by neo-classical naturalism, while non-materialistic alternatives are all but ignored.”

The principle of the methodological individualism has significant role in neoclassical economics. Pursuit of the same method for the entire natural and the social sciences forms the core of the methodological individualism (Popper, 1957). Zealous following of this principle partly explains the hegemony of neoclassical economics. Blaug (1980, p 51) notes the limitations of methodological individualism “In effect, it [methodological individualism] would rule out all the macroeconomic propositions that cannot be reduced to microeconomic ones, and since few have yet been so reduced, this amounts in turn to saying goodbye to almost the whole received macroeconomics. There must be something wrong with a methodological principle that has such devastating implications.”

The relationship between the progress of economics and hegemony of neoclassical school seems to be ambiguous. The logical positivism, a naturalist methodology, forms the core of the neoclassical economics. According to this philosophy, the progress of a theory to science requires its empirical verification through the induction. This approach rejects the theories that are rooted in the metaphysics. Katouzian (1980, p 49) describes the process of verification “The main principle of logical positivism may be described as follows: The process of scientific discovery begins by partial observation or sense-experience. Such observations are formulated into primary hypotheses which through logical analysis give rise to general theories. These theories are then put to test by an appropriate method of observation (or experimentation) in order to verify their implications. If the tests succeed in verifying a theory then it should be accepted; otherwise it should be discarded. It follows that if a theory is to claim scientific status it must be verifiable... Metaphysical statements are those which defy empirical verification; they are therefore meaningless.” Popper (1959) exposes weakness of the verification criterion. According to him, induction suffers from “affirm the consequent” or fallacy of induction and it involves fallacious inference. An example will demonstrate the point: If ‘x’ is a driver, she knows rules of driving; She knows rules of driving, therefore ‘x’ is a driver (in reality, she is not). Katouzian (1980) outlines the distinct features of logical positivism and falsification (Table 10).

**Table 10: Logical Positivism versus Popper's Falsification**

Sl No.	Logical Positivism	Popper's Falsification
1.	Primary Hypothesis to be formed by immediate sense experience or direct observation	Initial hypothesis is a conjecture. It is logically impossible to arrive at any hypothesis by direct observation.
2.	A statement is scientific if and only if it is verifiable.	A statement is scientific if and only if it is falsifiable. (What is verifiable is also falsifiable; but what is falsifiable may not be verifiable)
3.	All unverifiable –metaphysical or normative- are meaningless.	Unfalsifiable statements can be meaningful and contain significant knowledge, but they cannot be described as scientific knowledge unless and until they become falsifiable.
4.	Verification by empirical tests.	Falsification by rational and/or empirical criticism.

Source: compiled from Katouzian (1980) p 72-73

Most of neoclassical economic theories are neither falsifiable nor verifiable. Blaug (1980) gives a methodological appraisal of neoclassical economics. His research covers theory of consumer behaviour, theory of the firm, general equilibrium theory, marginal productivity theory, theory of capital, heckscher-ohlin theory of international trade, Keynesian versus monetarists, human capital theory, and new economics of the family (Table 11).

**Table 11: Methodological Aspects of the Neoclassical Economics**

Sl. No.	Theory	Appraisal
1.	Theory of consumer behaviour	Feeble relation between theory and empirical research, empirically nonfalsifiable because it relies on unrestricted universal statements.
2.	Theory of the firm	Theory has little predictive power outside agriculture and the stock market, and it is inapplicable to situations of oligopoly
3.	General equilibrium theory	Endless formalization of purely logical problems without the slightest regard for the production of falsifiable theorems about actual economic behaviour .
4.	Marginal productivity theory	“Marginal productivity theory is fairly successful in correctly predicting extremely long-run changes in inter industry and inter occupational wage differentials; on the other hand, it is singularly unsuccessful in correctly predicting short-run movements in wage differentials.” (Blaug, 1980 p 201)
5.	Theory of capital: Switching, Reswitching etc.	There is no conclusive empirical evidence.
6.	Heckscher-ohlin theory of international trade,	Most of the empirical studies refute Heckscher-ohlin theory. The theory does not rest on strong empirical foundations.
7.	Keynesian versus Monetarists,	“Freidman failed to explain how price and quantity decisions are actually reached in an economy such as that of the United States, and in that sense he failed to provide any theory of how the effects of monetary changes are divided between variations in real output. In consequence, the suggestion that the dynamics of “the transmission mechanism” between money and activity holds the key to the dispute between Keynesians and monetarists is untestable” (Blaug, 1980 p 219-20)
8.	Human capital theory	“There are certainly grounds of thinking that the human capital research program is now in something of a “crisis”: its explanation of the private demand for education has yet to be convincingly corroborated” (Blaug, 1980 p 237-38)
9.	New economics of the family	Complex social interactions are beyond the scope of neoclassical economic theory.

Source: Compiled from Blaug (1980)

Appraisal of a sample of neoclassical economic theories, as outlined in table 11, conveys that most of the theories do not satisfy criteria of scientific progress. Blaug (1980, p 259) concludes “[Mainstream neoclassical economists] preach the importance of submitting theories to empirical tests, but they rarely live up to their declared methodological canons. Analytical elegance, economy of theoretical means, and the widest possible scope obtained by ever more heroic simplification have been too often prized above predictability and significance for policy questions. The working philosophy of science of modern economics may indeed be characterized as “innocuous falsificationism.”

Neoclassical methodology is an important source of inequality in knowledge activity of economics. Methodological individualism and language bias are the salient features of this school, and factors such as hierarchy of prestige, incentives, and rent-seeking behaviour explain them.

*Evolutionary Economics as an Alternative:*

There are convincing reasons for a change in economics. Hodgson (1992) notes three major exclusions from neoclassical theory: cumulative causation, path-dependency, and irreversibility. Cumulative causation involves anti-equilibrium forces. Path dependency refers to the situations when small events and chance circumstances moderate solutions, and these solutions sustain long. Human activities are often irreversible. These exclusions limit the scope of neoclassical economics. According to Hodgson (1992, p 760), evolutionary approach is more appropriate to modeling the complexity, and it has merits over neoclassical economics. He expresses:

Arguably, the application of an evolutionary approach to economics offers a number of improvements over the orthodox and mechanistic paradigm. For instance, it emphasizes the concept of irreversibility, or the 'arrow of time'. It instates a concept of process rather than comparative statics, and it includes disequilibrium as well as equilibrium situations. It embraces phenomenal diversity and qualitative as well as quantitative change. It involves systematic and persistent error making, and not simply optimizing, behaviour. Because of an increasing awareness of the limitations of the mechanistic paradigm in economics, it has been argued that the biological analogy, as used by many institutionalists, has a great deal to offer, on this basis, there has been a burgeoning development of evolutionary economic theory of various kinds in recent years. Evolutionary theory is not a panacea. However, it does offer a metaphor for economics that is superior to the mechanistic model of neoclassicism. It offers a hope that economics will come to incorporate the temporal as well as the moral aspects of all economic activity.

Evolutionary approach in economics has a lineage of more than a century. A book titled "An Evolutionary Theory of Economic Change" (Nelson and Winter, 1982) is a watershed, which has significantly contributed to the progress of this approach. The work develops an evolutionary theory, which explains the sources of complexity in economic behaviour, and the authors demonstrate the application of the model to forecast economic change.

According to this approach, simulations form the core of forecasting methodology; this is a major departure from neoclassical mechanistic paradigm. Neoclassical economists like Friedman (1953, p 22) consider no scope for an entity ‘evolutionary economics’. According to him, the evolution is implicit in neoclassical theory. He states:

Let the apparent immediate determinant of business behavior be anything at all –habitual reaction, random choice or what not. Whenever this determinant happens to lead to behavior consistent with rational and informed maximization of returns, the business will prosper and acquire resources with which to expand; whenever it does not, the business will tend to lose resources and can be kept in existence only by the addition of resources from outside. The process of “natural selection” thus helps to validate the hypothesis.

Nelson and Winter (2002, p 25) respond to Friedman:

Friedman’s argument has served as an instrumental myth, encouraging neoclassical theorists to get on with their business and discouraging the pursuit of any more unified approach to firm and industry behaviour, evolutionary or otherwise.

The possibility of ‘neoclassical theory consistent with evolutionary approach’ depends upon assumptions like variety, behavioural continuity, profit-induced growth, limited path dependence etc. However, the plausibility of such ‘compatible’ model is weak. Evolutionary approach, put forth by Nelson and Winter (1982, 2002), rests on “competence Puzzle”. The puzzle stems from a question: How ‘bounded rational’ individuals perform complex tasks? Authors examine answers to this question. Table 12 clarifies the question.

**Table 12: Competence Puzzle**

		Performance of a task	
		Simple	Complex
Competence	Limited		<b>Competence Puzzle</b>
	Unlimited		

Bounded rationality (Simon, 1979) implies individual’s limited competence to compute possible outcomes of an event. The combination of limited competence and performance of



a complex task represents 'competence puzzle'. The performance-competence matrix is unfamiliar to the neoclassical theory. Uncertainty is an important feature of complexity. Moderating uncertainty is key to the performance of a complex task. The question is: How to moderate uncertainty? According to Nelson and Winter (1982, 2002), 'routines' regulate uncertainty. They define routine as regular and predictable behaviour pattern of an activity. Nelson and Winter answer the puzzle (2002, p 29) "In the evolutionary view, the key to puzzle lies in the contrasting demands of different types of situations. High competence is often achievable where skills and routines can be learned and perfected through practice."

Routine may have positive or negative impact on performance. Routines, as sources of memory, conflict resolution and control, contribute to the performance of complex tasks. However, routine, as a source of resistance, may adversely affect performance. There is apparent distinction between neoclassical and evolutionary approaches. Modeling is an important source of distinction. For instance, characteristics like assumption of bounded rationality, use of dynamic equation, interdisciplinary dialogue etc. explain the distinction. Nelson and Winter (2002) reflect:

Formal evolutionary models assume "bounded" rationality, at least in the sense that actors are assumed to have accurate foresight. (P 39-40)... Most of the economic evolutionary models are sufficiently complicated so that the modeler or anyone else would have great difficulty in deducing optimizing strategies for all the actors. It is a basic premise of economic evolutionary theory that this state affairs accurately reflects the problem facing real-world economic actors... These models generally take the form of dynamic equations that determine the time paths of firm characteristics and actions taken, as well as the consequences of those actions. Many of them take the form of random walk (Markov) processes, in high dimensional state spaces, and often with some time varying parameters. (p 40)

The question of superiority of an approach is peripheral to the main concern of 'alternatives'. The evolutionary economics is an alternative to neoclassical school. "Should former replace latter" has no unambiguous answer. However, there is not a plausible case for neoclassical hegemony in economics.

## 6. Conclusion

Over a quite long time (i.e. during the last five decades), the referred to concentration levels remain high. At the same time, the journal publication has become essential for the survival in academic career. The magnitude of scarcity, in terms of publishing opportunities, has tended to increase during the period under reference. Most of the journals screen the articles before the publication, and the process leads to the acceptance/rejection decision. The literature shows that the institutional background of the author often influences the screening in journals of repute. The institutional background of an author, apart from own competence, also contributes to the fitness of his career. So, the effects of institutional concentration percolate down to the individual level. The authors from the lesser-known institutions are at disadvantage when it comes to the attainment of journal publications. They either publish discreetly or give up mid way. At the same time, it is found that their counterparts from the institutions of repute achieve the publication at much younger age, and also maintain a steady pace. The scenario under mention may be partly explained by the differences in personal ability. However, the advantages that flow from the institutions of repute to the authors seem to have significant impact over the attainment of journal publication. An important reason that states why the screening process values institutions of repute is they impose certain constraints on their members' knowledge production in such a way that the same fulfills the screening by the journal. Both the journals and institutions under reference often share their culture. For example, editors of the journal carry the culture of their alma mater. This cultural exchange may survive long. Moreover, such an institutional equilibrium may take the form of institutional oligopoly. Both the codified and tacit knowledge go into the production of the knowledge output. It is quite usual in the knowledge production that the use of codified knowledge depends upon the tacit knowledge. For instance, a lot of skill is required for deciphering the language in which the code is written. The tacit knowledge seems to have prominence over the codified knowledge in the journal publication. It may be noted that the institution is a major source of the tacit knowledge. In many instances, the tacit knowledge is quite unique to institution. So, the uniqueness of tacit knowledge may have active role in the institutional concentration in journal publication.

'Top remains top' is a salient feature of the order of the institutional performance as regards the knowledge output. The literature provides evidence for the institutional order that has been sustaining for a few decades. This phenomenon puts binding on the performance of their lesser-known as well as new counterparts. Therefore, unless there is a significant institutional change, the lesser-privileged institutions will continue to lag behind the top ones. A few institutions fail to come out of the 'low performance trap'. The authors who spend significant proportion of their life cycle with the said institutions are at a disadvantage, even if they are as talented as their counterpart from the institutions of repute. Stagnant institutional order seems to discourage low tier institutions from exploring new horizons. They may prefer to remain passive, and imitate what the top institutions do. In other words, the phenomenon of 'stable institution order' can lead to the social costs that arise from the underutilization of human capital. Moreover, such institutional arrangements, which involve a few dominant institutions and many passive but low performing ones, may lead to the situation 'lock-in'.

Akin to the axiom of monotonicity that says 'more the better', preference for the institutions follows 'more reputed the better'. It is quite apparent from the literature that the top achievers are invariably from the top institutions. In the normal circumstances, a person does not dare to sacrifice the institution of his choice because he values the institutional background; sometimes it is valued higher than own competence. Why students give higher valuations to top order institutions. It is obvious that choosing an institution for pursuing Ph D is the outcome of a search process. While searching for doctoral schools, students tend to compare likelihood of success that each institution has. At the end of the search, students may choose the institute that fits to their expectations. As shown in table 7, top order institutions are choosier about students, and they set higher cut off GRE scores as the entry criterion; higher cut off may have reasons such as sensitivity to quality and higher valuations by students. The second factor appears to be more convincing since the quality is a highly subjective phenomenon; there is always some degree of uncertainty about it. On the other hand, when there are more seekers for an opportunity, it is important to screen the seekers by applying relatively objective criterion such as GRE. Sequel to this reasoning, disparity in personal achievement seems to have strong link with a scientist's institutional background. However, the advantages that flow from the institutions to a person are not usually

considered for comparing personal achievement. An effort to decompose the sources of personal achievement into institutional and personal is by no means a straight task. Or, those who are deprived of initial advantages should be given the level playing field. But, such compensatory opportunities are really rare. The progress to higher achievement level also depends on the access to the advantages, which emerge from the institutional background. Academic labour market often sees the institutional background as a signal of the quality of labour. So, the institutions are perceived as signals that minimize the information asymmetry, and lead to efficient hiring. Even though the literature shows some evidence for growing discontent about the signal 'institution', it seems the dissent has not really percolated down to the micro units.

As shown by the literature, a major part of the research in economics follows the neoclassical approach. It is also pointed out that the choice of the neoclassical method is often influenced by the self seeking behaviour. There are instances when the alternative approaches, even though they are quite appropriate to the research problem, are discarded by the authors. At the same time, they choose neoclassical approach in place of possible appropriate alternatives. The said choice is quite appealing to the authors because it increases the likelihood of a journal, which follows the neoclassical approach, accepting the articles. The welfare issue, in the present context, is that the neoclassical theory is even used for the understanding the issues which are, otherwise too complex, for it do so. Therefore, the quality of the research is affected, and the progress of economics as a subject is questioned. The rules, which emerge from the neoclassical economics, are quite different from the alternative approaches. For instance, the former has greater emphasis on the formal representation of the ideas. It may be noted that mathematics is the preferred way of formal representation. In the process of the publication, the mathematics gets more attention than the quality of the idea. The neoclassical approach, due to its preference for formalism, is not suitable for understanding quite a number of phenomena in human life. The reason is that it does not give due importance to the factors like history, culture, knowledge etc. On the other hand, alternative approaches, for example the evolutionary economics, to a greater extent, are supposed to, a significant extent, fill said gaps. They give importance to the aspects like modeling the complexity of human behaviour, closeness to the reality etc. Therefore, an institutional arrangement, which gives overemphasis to the neoclassical

economics, results in the inappropriate solutions for a variety of complex issues. Mathematics forms a major part of the codified knowledge in economics (e.g. Journals, text books etc.).

It makes little sense if the phenomenon of the institutional dominance is shown as the inevitable condition for the progress of the economics as a scientific discipline. The premise for the said observation is that the discipline is yet to achieve the maturity to deal with the complexity. It may be noted that the main stream economics has no solutions that are quite appropriate to a region or a culture. Two major features of the neoclassical economic theory, which forms the main stream in the economics, largely account for the handicaps the discipline has. First, the mathematization of the economics has made the subject more abstract; and unsuitable for explaining the complex behaviour. The benefits from the use of mathematics in the economics are often glorified. But, an examination of the literature on methodology reveals that the mathematics has no major advantages over the natural languages. For example, the stability in the meaning is often shown as the property of the mathematics. However, the debate between intuitionists and formalists shows that stability is not always the case of the mathematical economics. Second, the methodological individualism has made the scope of the subject narrow. However, there are alternatives, which may improve the 'state of crisis'. There are signs of change. For instance, the alternative methodologies (often called heterodox school) are gaining momentum in economics. Further, the desirable institutional change does not necessarily mean the radical change, but rather what is called for is the cooperation between the neoclassical theory and the alternatives.

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