ECON 6255
Philips 108
M 19:10 – 21:00
Fall 2014

Nicholas S. Vonortas
1957 E Str., N.W., Suite 403
Tel: (202) 378-6230
E-mail: vonortas@gwu.edu

Economics of Technological Change and Innovation

Introduction

This course provides an overview of important issues related to technological change that have attracted the attention of economists up to the present time. Among all social sciences, economics may be argued to have taken the longest and broadest interest in technological advancement and innovation. The specific assumptions and methodologies of mainstream economic analysis have, however, been vigorously criticized more recently for failing to deal with the sources of technological advance. Criticism has basically coalesced on two fronts. First, it is argued that mainstream economics has not paid adequate attention to the institutional setup supporting innovation and economic growth. Second, it is argued that an overly mechanistic approach has failed to take into account the evolutionary processes involved in scientific and technological advancement. This course attempts to provide a balanced view, taking into account both mainstream and neo-institutional/evolutionary approaches as well as expanding to the appraisal of the sources of new technology.

The learning objective of the course is to assess the economic concepts regarding:
(a) the origins of new technology and its market introduction (innovation);
(b) the process of technological advancement and differences between sectors;
(c) the dissemination of innovations within and across firms, industries, and countries;
(d) the impacts – economic benefits and costs – of innovation on individual organizations and on society at large;
(e) policy concerns.

The course makes extensive use of case study material to underline the differences between technologies, industries, and organizations involved in scientific and technological advance, including companies, universities, and government agencies. The discussion flags the currently “hot” topics of research internationally and assists in the delineation of topics for further in-depth research by the students.
Course Requirements

The final grade for the course will be a weighed average of your grades on a term paper, a group presentation and in-class participation, and a take-home final examination. The term paper will account for 50%, in-class participation/presentation for 20%, and the final examination for the remaining 30% of the grade.

i. Term paper. Work individually. Within certain parameters, you will choose a topic that best suits your research interests. You can take a theoretical approach, an empirical approach, a policy approach, or any combination of these. In case that you choose to create a case study of technological development (products or processes), you must try to apply some of the concepts discussed in class. It is advisable that you choose your topic as soon as possible and communicate with me before you start.

An approach that has worked well in the past for several course participants has been to select a term paper that surveys a particular subject. Such surveys are supposed to consult much broader literature than our syllabus and synthesize it in a creative way. Possible area topics are listed at the end of this syllabus. You are, however, free to venture outside this list.

Papers are due at the last class meeting.

ii. In-class participation. This refers to:
   (a) A student’s general standing in class. You are expected to read regularly the assigned material before a lecture and participate in the general discussion during the lecture.
   (b) The class meeting of October 27 will be devoted to short presentations and discussion. Class participants will be divided into three teams, each responsible for a short presentation (30’) on a pre-assigned sector. The purpose of the presentation will be to summarize the evolution of technological advancement in the respective sectors and the identification of important issues that would be of interest to economists dealing with systems of sectoral innovation. The rest of the class meeting will be devoted to debate among all members of the class on the topics proposed for discussion by the presenting team. During the last few minutes, the presenting teams will wrap up the discussion pointing out the generic similarities and differences across the examined sectors – in terms of the process of technological advance, firm characteristics, market structure, and user characteristics – that would be of interest to an economist trying to capture the essence of the underlying conditions to build generic models.

Team coalitions should emerge through self-selection. Presentation teams will be finalized during the third class meeting.

iii. Final examination. The questions for the take-home final examination will be distributed during the last meeting of the class. Answers will be due a week later.
Class Policies

Class attendance is expected. There will be no allowance for late work, except by prior arrangement with the instructor. Arrangements for make-up work must be made with the instructor. The instructor has the discretion to grant or refuse requests for late work or make-up work.

Professor Vonortas’ Policy on Grade Contestation: Students wishing to contest a grade are required to write a professional memo outlining their case, along with supporting examples from the submitted assignment.

Academic Integrity. Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For the remainder of the code, see: http://www.gwu.edu/~ntegrity/code.html

Religious Holidays. Religiously observant students should notify the instructor the first week of classes regarding any session that will be missed; the courtesy of an absence without penalty will be extended.

Accommodation for Students with Disabilities. To receive accommodations on the basis of disability, a student must give notice and provide proper documentation from the Office of Disability Support Services, Rome Hall. Accommodations will be made based upon recommendations of the DSS Office.
Readings

There are two basic textbooks for the course:


The list of readings is supplemented by composed of a number of articles and chapters from books and reports as referenced in the following section. An asterisk (*) denotes required reading material. No asterisk means recommended reading material. A WB denotes available on the web.

Several books and monographs are excellent sources of information for various sections of the course. They include:


Students are advised to purchase the two basic textbooks. They should be available at the University bookstore, the one in electronic form. They can also easily be accessed at Amazon and elsewhere. The instructor will provide access to all other required reading material (book chapters and articles) and a significant part of the supplementary, recommended material through Blackboard.
Schedule of Meetings and Readings
Core readings are marked with an asterisk (*)

8/25

I. INTRODUCTION

A. Science, Technology and Innovation in Economic Analysis


* Freeman, Chris and Luc Soete (1997) The Economics of Industrial Innovation, 3rd ed., The MIT Press. [Ch 1]
[1] “Introduction”

B. Innovation in Historical Perspective

Hall, Bronwyn H. and Nathan Rosenberg (eds) (2010) Handbook of the Economics of Innovation, Elsevier. [Ch 2]

II. THE NATURE OF INVENTION AND INNOVATION

9/8

A. Research and Development – Allocation of Resources

http://www.nsf.gov/statistics/seind14/


B. Agents and Process of Technological Advancement


Hall, Bronwyn H. and Nathan Rosenberg (eds) (2010) Handbook of the Economics of Innovation, Elsevier. [Chs 5, 6, 8]


III. MICROECONOMICS OF TECHNOLOGICAL ADVANCEMENT

A. Background – Production Function, Scale and Scope in R&D

[4] “Returns to Scale, Economies of Scale, Economies of Scope, and Learning”


B. Innovation, Firm and Market Characteristics

**Schumpeterian Hypotheses**


* Freeman, Chris and Luc Soete (1997) *The Economics of Industrial Innovation*, 3rd ed., The MIT Press. [Ch 9]

[9] “Innovation and the Size of the Firm”

**C. Firm Strategy, Technology Markets**

* Freeman, Chris and Luc Soete (1997) *The Economics of Industrial Innovation*, 3rd ed., The MIT Press. [Ch 11]


**C. Firm Strategy, Networks**


D. The Diffusion (Dissemination) of New Technology

* Hall, Bronwyn H. and Nathan Rosenberg (eds) (2010) *Handbook of the Economics of Innovation*, Elsevier. [Chs 17, 18]
  [18] Bresnahan, Timothy “General Purpose Technologies”

  [17] Hall, Bronwyn H. “Innovation and Diffusion”


IV. SECTORAL SYSTEMS OF INNOVATION


A. Sectors

* Hall, Bronwyn H. and Nathan Rosenberg (eds) (2010) *Handbook of the Economics of Innovation*, Elsevier. [Chs 11, 12, 22]
  [22] Pardey, Philip G., Julian M. Alston and Vernon W. Ruttan “The Economics of Innovation and Technical Change in Agriculture”

  [16] Miles, Ian “Innovation in Services”

Additional readings to be provided by the presenting teams
B. Manufacturing


VI. THE MACROECONOMICS OF INNOVATION

11/10

A. Technology, Economic Growth, Jobs

* Fagerberg, Jan, David C. Mowery and Richard R. Nelson (eds.) (2005) *The Oxford Handbook of Innovation*, Oxford University Press. [Ch 18]
  [18] Verspagen, Bart “Innovation and Economic Growth”

  [8] “Models of Economic Growth”

  [20] Fagerberg, Jan, Martin Schrolek and Bart Verspagen “Innovation and Economic Development”

11/17

B. International Aspects, Trade


* Swann, G. M. Peter (2009) *The Economics of Innovation*, Edward Elgar. [Ch 17]
  [17] “Innovation and Trade”

VII. MEASUREMENT OF INNOVATION

  [23] Hulten, Charles R. “Growth Accounting”


Several chapters of the book by Albert O. Link and Nicholas S. Vonortas (2013) are relevant.

XIII. POLICY


Final Examination Deadline
Note: Due to time limitations, the material on this syllabus does not cover comprehensively either all topics of interest to economists in the study of technological change and innovation or the available readings in each covered topic. For example, there is relatively little here on the formal industrial organization approach to R&D and technological innovation, or on technology and the environment, or on technology and employment. Students are very welcome to consult additional sources to cover various sections of the course, and strongly encouraged to do so in writing their term papers.
Possible Topic Areas for Survey Papers

1. Markets for Technology
   Reasons for failure and remedies – appropriability, spillovers (different kinds of) – technological opportunity – modern concepts of knowledge and technological knowledge communication (systems of innovation, networks).

2. Theory of the Firm
   Transaction costs – asset specificity – ownership – incomplete contracts for technology and opportunist behavior – the boundaries of the firm: markets, hierarchies, and alternative (intermediate) organizational forms for promoting technological change and innovation.

3. Neo-Schumpeterian Hypotheses
   Schumpeter and his early followers – firm size and innovation – industry concentration and innovation – long stream of empirical evidence.

4. Industrial Expenditures on Research and Development
   Tournament models of R&D – non-tournament models of R&D – asymmetric models – uncertainty and factor indivisibilities – technology option models.

5. Returns to R&D: Private and Social
   R&D and productivity: empirical results and measurement issues – alternative research paradigms, including the production function model at the firm and industry levels – private returns – social returns – various kinds of knowledge and the size of the gap between private and social returns.

6. Technological Change and Industry Entry and Exit
   Entry and exit models – the role of small firms in innovation – industry evolution through time – technological change and industry evolution.

7. Industry Concentration

8. Intellectual Property Rights: Appropriating Knowledge
   The special role of IPRs in inducing innovation – various means for appropriating technological knowledge – the economics of the patent system – industry and regional differences – empirical results and case studies.

9. Technology Diffusion
10. Measurement of Technology and Innovation
Input indicators – output indicators – technology indicators – innovation indicators and two Oslo (OECD) manuals – historical evolution of indicator formation and links to theoretical developments – usefulness for research.

11. International Considerations, Technology Transfer
Multinational corporations (MNCs): theory and evidence – MNCs and technological advance in home countries – MNCs and technological advance in host countries – technology and international trade: main theoretical views and empirical evidence.