

SYLLABUS

ApEc 5721: Economics of Science and Technology Policy

Instructor	Philip Pardey	Fall 2007
Office	218j Classroom Office Building	
Phone	(612) 625-2766	
E-Mail	ppardey@umn.edu	
Office Hours	After class or by appointment	
Lecture Hours	Tuesday and Thursday 8.45-10.00 am	
Classroom	VoTech R385, St Paul campus	

Course Description

This course is designed to impart a working knowledge of economic principles and practices on a range of topics pertaining to science and technology policy. The course will include the economics of productivity, growth, and technical change; the generation and diffusion of technologies; methods for evaluating the impact of R&D; and an investigation of some contemporary policy issues, including the economics of intellectual property rights.

The course assumes a working knowledge of microeconomics at the 5000 level (master's level).

The books for this course are:

Required

Julian Alston, George Norton, and Philip Pardey. *Science Under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting*. Wallingford: CAB International, 1998.

Vernon Ruttan. *Technology Growth and Development: An Induced Innovation Perspective*. New York: Oxford University Press, 2001.

All other readings will be on reserve at Waite Library (room 232 Classroom Office Building). For some topics "additional resources" are indicated and most are held on reserve in the Waite Library. Students are encouraged but not required to access this additional material, it is included in the syllabus for those who are particularly interested in a given topic.

Prerequisites, Course Requirements, and Grading

Prerequisite. Required: ApEc 5151 (applied microeconomics) or concurrent enrollment in 5151, PA 5022, or instructor's consent.

Past or concurrent enrollment in ApEc 5031 (methods of economic data analysis) or an equivalent course is strongly recommended.

Course Requirements. This course will have a mid-term examination and a final examination. In addition, students will write a paper (10-15 pages) on a topic of their choice. Students will also present their papers in class.

Grading. The final grade will be a weighted average of four separate components:

Midterm exam (in class)	25%
Final exam	35%
Paper	30%
Class presentations and participation	10%

Term papers must be turned in by 4.30 pm Friday 14th December. Papers that are late will be marked down by 1/3 of a grade (for example, a B+ becomes a B) per day. There will be no make-up exams for the midterm or for the final exam. Instead, the average will be taken of the other items and then 1/3 of a grade will be subtracted from this average. These penalties may be waived, at the discretion of the instructor, if evidence of a serious illness or a family emergency is presented.

Lecture Schedule

I. Introduction (2 lectures)

1. Science and technology in an economic context

What is “science and technology policy”? Why is there a role for government? What are the important policy issues? How do economists think about these issues? Domestic and international dimensions.

Readings: Alston, J.M. and P.G. Pardey. 1999. “The Economics of Agricultural R&D Policy.” Chapter 2 in J.M. Alston, P.G. Pardey and V.H. Smith. *Paying for Agricultural Productivity*, John Hopkins University Press, Baltimore.

World Bank. *Knowledge for Development*. World Development Report 1998/9. Washington, D.C.: World Bank, pp. 1-14.

Additional resources: Barfield, Claude E. 1997. “Introduction and Overview.” Chapter 1 in C.E. Barfield, *Science for the 21st Century: The Bush Report Revisited*. Washington D.C.: American Enterprise Institute Press,

World Bank. 2007. “Innovating Through Science and Technology.” Chapter 7 in *World Development Report 2008*. Washington, D.C.: World Bank, draft.

FAO. 2004. *The State of Food and Agriculture: Agricultural Biotechnology—Meeting the Needs of the Poor*. Rome: UN Food and Agriculture Organization. (Available on line at http://www.fao.org/es/esa/en/pubs_sofa.htm).

2. Economic facts and perspectives about science and technology

- historical investment trends, international comparisons, institutional details

Readings: National Science Board. 2006 “Overview.” *Science and Engineering Indicators 2004, Vol. 1*. Arlington: National Science Foundation, pp. 1-23.

Pardey, P.G., N.M. Beintema, S Dehmer and S. Wood. 2006. *Agricultural Research: A Growing Global Divide?* IFPRI Food Policy Report. Washington, D.C.: International Food Policy Research Institute.

Additional resources: www.asti.cgiar.org (data and publications regarding agricultural R&D worldwide)

www.oecd.org (see science, technology and industry directorate)

www.nsf.org (U.S. National Science Foundation)

II. Productivity, Innovation and Technical Change (8 lectures)

3. Measuring productivity and technical change

- aggregating inputs and outputs
- technical change and input substitution
- rates of change and factor biases
- data and measurement issues

Readings: Alston, Norton and Pardey, pp. 120-142.

Ruttan, 2001. *Technology Growth and Development*, chapter 2.

Schultz, T.W. 1956. “Reflections on Agricultural Production Output and Supply.” *Journal of Farm Economics* 38:748-762.

- Griliches, Zvi. 1963. "The Sources of Measured Productivity Growth: Agriculture, 1940-1960." *Journal of Political Economy* 71(4):331-346.
- Griliches, Zvi. 1994 "Productivity, R&D and the Data Constraint." *American Economic Review* 84(1): 1-23.
- Acquaye, A.K.A., J.M. Alston, and P.G. Pardey. 2003. "Post-War Productivity Patterns in U.S. Agriculture: Influences of Aggregation Procedures in a State-Level Analysis." *American Journal of Agricultural Economics* 85, 1 (February): 59-80.
- Additional resources:** Griliches, Z. and D.W. Jorgenson. "The Explanation of Productivity Change." *Review of Economic Studies* Volume 34(3) (July 1967): 249-283.
- American Agricultural Economics Association Task Force on Measuring Agricultural Productivity. 1980. *Measurement of U.S. Agricultural Productivity: A Review of Current Statistics and Proposals for Change*. ESCS Technical Bulletin No. 1614, USDA.
- Andersen, M.A, J.M. Alston, P.G. Pardey. "Capital Use Intensity and Productivity Biases." Department of Applied Economics Staff Paper No. P07-06, St Paul, University of Minnesota, April 2007.

4. Induced technical change—Vernon Ruttan

- Readings:** Ruttan. 2001. *Technology Growth and Development*, chapter 4.
- Hayami, Yujiro and Vernon Ruttan. 1985. *Agricultural Development: An International Perspective*. Baltimore: Johns Hopkins University Press, chapter 4.

5. Technology adoption, diffusion and transfer

- Readings:** Ruttan. 2001. *Technology Growth and Development*, chapter 5.
- Griliches, Zvi. 1957. "Hybrid Corn: An Exploration in the Economics of Technological Change." *Econometrica* 25(4): 501-522.
- Additional resources:** Sunding, David and David Zilberman. 2001. "The Agricultural Innovation Process: Research and Technology Adoption in a Changing Agricultural Sector." Chapter 4 in B. Gardner and G. Raussler, eds. *Handbook of Agricultural Economics Volume 1A*. Elsevier Science, Amsterdam.

III. Estimating the Economic Effects of R&D (10 lectures)

6. Economic surplus approaches

- The basic (single product, closed economy) model, common simplifying assumptions and their implications

Readings: Alston, Norton and Pardey, sections 2.2.1, 2.2.2, and 4.1.1.

Additional resources: McAfee, R.P. 1983. "American Economic Growth and the Voyage of Columbus." *American Economic Review* 73,4 (September): 735-740.

Midterm: Around October 30

- Horizontal market models, with and without technology spillovers

Readings: Alston, Norton and Pardey, section 4.2.1

- R&D in the presence of policy distortions

Readings: Alston, Norton and Pardey, parts of section 4.4.1.

- Summary indicators of the effects of R&D; present value measures, internal rates of return, cost-benefit ratios

Readings: Alston, J.M., C Chan-Kang, M.C. Marra, P.G. Pardey, and T.J. Wyatt. 2000. *A Meta Analysis of Rates of Return to Agricultural R&D: Ex Pede Herculem?* IFPRI Research Report No 113, chapter 3.

7. R&D, production function and supply models

Readings: Alston, Norton and Pardey, parts of section 3.1.1

Cassels, J.M. 1933. "The Nature of Statistical Supply Curves." *Journal of Farm Economics* 15:378-387.

Colman, D. 1983. "A Review of the Arts of Supply Response Analysis." *Review of Marketing and Agricultural Economics* 51:201-230.

Mundlak, Y. 2001. "Production and Supply." Chapter 1 in B.L. Gardner and G.C. Rausser eds. *Handbook of Agricultural Economics: Volume 1A, Agricultural Production*. Amsterdam: Elsevier.

Additional resources: Huffman, W.E. and R.E. Evenson. 2006. "Research Contributions to Agricultural Productivity." Chapter 8 in *Science for Agriculture: A Long-Term Perspective*. Second Edition. Ames: Iowa State University Press.

IV. Other Topics (5 lectures)

8. R&D spillovers and attributing research benefits

Readings: Alston, J.M. and P.G. Pardey. 2001. "Attribution and Other Problems in Assessing the Returns to Agricultural R&D." *Agricultural Economics* 25(2-3): 141-152.

Alston, J.M. 2002. "Spillovers." *Australian Journal of Agricultural and Resource Economics* 46(3)(September):315-346.

Pardey, P.G., J.M. Alston, C. Chan-Kang, E. Magalhães, and S. Vosti. "International and Institutional R&D Spillovers: Attribution of Benefits Among Sources for Brazil's New Crop Varieties." *American Journal of Agricultural Economics* 88(1)(February 2006): 104-123.

Additional resources: Griliches, Z. 1992. "The Search for R&D Spillovers," *Scandinavian Journal of Economics* 94 (Supplement): 29-47.

Jaffe, A.B. 1989. "Characterizing the 'Technological Position' of Firms, with Application to Quantifying Technological Opportunity and Research Spillovers." *Research Policy* 18(2): 87-97.

Thanksgiving vacation (November 24 and 25)

9. From revolutionary to mature technologies—Vernon Ruttan

V.W. Ruttan. 2005. *Military Procurement and Technology Development*, New York: Oxford University Press.

10. Technology and the environment

Readings: Alston, Norton and Pardey, section 4.5.1

Ruttan. 2001. *Technology Growth and Development*, chapter 12.

Additional resources: The Economist. “How Many Planets? A Survey of the Global Environment” July 6, 2002.

Wood, S., K. Sebastian, and S. Scherr. 2000. “Agroecosystems: Executive Summary” in *Pilot Analysis of Global Ecosystems: Agroecosystems*, IFPRI and WRI.

11. Innovation incentives

Readings: Wright, B.W., P.G. Pardey, C. Nottenburg and B. Koo. 2007. “Agricultural Innovation: Investments and Incentives.” Chapter in R.E. Evenson and P. Pingali, eds. *Handbook of Agricultural Economics: Volume 3* Amsterdam: Elsevier.

Maskus, K. 2000. *Intellectual Property Rights in the Global Economy*. Institute for International Economics, Chapter 3.

Nottenburg, C., P.G. Pardey, and B. Wright. 2002. “Accessing Other People’s Technology for Non-Profit Research.” *Australian Journal of Agricultural and Resource Economics* 46, 3 (September):389-416.

Additional resources: Griliches, Z. 1990. “Patent Statistics as Economic Indicators: A Survey.” *Journal of Economic Literature* 24: 1661-1707.

WIPO. 2007. *WIPO Intellectual Property Handbook: Policy Law and Use*. Geneva: World Intellectual Property Organization. Available on line at <http://www.wipo.int/about-ip/en/iprm/index.html>

Wright, B.D. and P.G. Pardey. “The Evolving Rights to Intellectual Property Protection in the Agricultural Biosciences.” *International Journal for Technology and Globalization* 2 (1/2)(2006): 12-29.

Student Term Paper Presentations: Tuesday, December 11 and Thursday, December 13

Final Exam: Scheduled day is Saturday, December 17