Spring 2010

ETH Zurich
Department MTEC

Economics of Sustainable Development

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CER-ETH Doctoral Programme
Thursday 10-12
ETH ZUE G1

Course Objective

The course covers major economic theories and empirical applications, which are relevant for the current sustainability debate. Efficiency and intergenerational equity, natural resource depletion, harvesting renewable resources, endogenous (induced) capital and knowledge accumulation, pollution dynamics and abatement, population growth, trade, and similar issues are the focal points of the lecture. The course applies basic methods of modern intertemporal economics and statistics to an increasingly active research field. The results of applying both neoclassical and new growth theory are presented and extensively discussed.

Course Structure

The course is designed around eight chapters. Students are expected to solve three problem sets and to participate in classroom discussions.

Course Requirements

The course is on the PhD level but open for master students. Successful completion of the course is equivalent to 3 ECTS points. Credits and the grade will be based on the problem sets (30%) and the performance during the final exam (70%), which takes place on 3 June, 2009. Regular attendance is compulsory.

Chapters

1. Development and Sustainability
2. Intertemporal Approach
3. Sustainable Use of Non-Renewable Resources
4. Sustainable Use of Renewable Resources
5. Pollution Dynamics
6. Resources and Endogenous Growth
7. Further Topics
8. Empirics of Sustainable Development

Detailed Topics

1. Development and Sustainability
    - · Observations and Trends
    - · Sustainability Principles
2. Intertemporal Approach
    - · Dynamics of Resource Use
    - · Capital-Resource Economies
3. Sustainable Use of Non-Renewable Resources I
    - · Resource Extraction
    - · Resources and Consumption
    - · The Dasgupta-Heal-Solow-Stiglitz Model
    - · Exogenous Technical Progress
4. Sustainable Use of Renewable Resources
    - · Fisheries
    - · Forestry
    - · Renewable Energy
5. Pollution Dynamics
    - · Abatement Technologies
    - · Environmental Kuznets Curve: Theory
6. Resources and Endogenous Growth
    - · Endogenous Growth Theory
    - · Extended Dasgupta-Heal-Solow-Stiglitz Model
    - · Two-Sector Models
    - · CES Production Functions
7. Further Topics
    - · Poor Input Substitution
    - · Population Growth
    - · Trade and Environment
8. Empirics of Sustainable Development
    - · Resource Curse
    - · Energy Prices and Growth
    - · Environmental Kuznets Curve: Evidence

Recommended Reading

Andreoni, J. and A. Levinson (2001): The Simple Analytics of the Environmental Kuznets Curve, Journal of Public Economics, 80, 269-286.

Antweiler, W. , B.R. Copeland, and M.S. Taylor (2001): Is Free Trade Good for the Environment? American Economic Review, 91 ,4, 877-908.

Barbier, E.B. (1999): Endogenous Growth and Natural Resource Scarcity, Environmental and Resource Economics, 14, 1:51-74.

Bovenberg, A.L. and S. Smulders (1995): Environmental Quality and Pollution-augmenting Technological Change in a Two-sector Endogenous Growth Model, Journal of Public Economics, 57, 369-391.

Bretschger, L. (1998): How to Substitute in order to Sustain: Knowledge Driven Growth under Environmental Restrictions, Environment and Development Economics, 3, 861-893.

Brock, W.A. and M.S. Taylor (2005): Economic Growth and the Environment: A Review of Theory and Empirics, in: Handbook of Economic Growth, S. Durlauf and P. Aghion eds., North Holland.

Clark, C.W. (1979): Mathematical Models in the Economics of Renewable Resources, SIAM Review, 21, 1, 81-99.

Dasgupta, P.S. and G.M. Heal (1974): The Optimal Depletion of Exhaustible Resources, Review of Economic Studies, 41, 3-28.

Gradus, R. and S. Smulders (1993): The Trade-Off between Environmental Care and Long-term Growth—Pollution in three Prototype Growth Models, Journal of Economics, 58, 1, 25-51.

Grimaud A. and L. Rougé (2003): Non-renewable Resources and Growth with Vertical Innovations: Optimum, Equilibrium and Economic Policies, Journal of Environmental Economics and Management, 45, 433-453.

Groth, C. (2007): A New-Growth Perspectives on Non-Renewable Resources, in: Bretschger, L. and S. Smulders (eds.): Sustainable Resource Use and Economic Dynamics, 127-163, Springer.

Groth, C. and P. Schou (2002): Can Non-renewable Resources Alleviate the Knife-edge Character of Endogenous Growth?, Oxford Economic Papers, 54/3, 386-411.

Hartwick, J. M. (1977): Intergenerational Equity and the Investing of Rents from Exhaustible Resources, American Economic Review, 67/5, 972-74.

Hotelling, H. (1931): The Economics of Natural Resources, Journal of Political Economy, 39, 2, 137-175.

López, R., G. Anríquez and S. Gulati (2007): Structural Change and Sustainable Development, Journal of Environmental Economics and Management, 53, 307-322.

Popp, D. (2002): Induced Innovation and Energy Prices, American Economic Review, 92/1,160-180.

Romer, P.M. (1990): Endogenous Technical Change, Journal of Political Economy, 98, S71-S102.

Scholz, C.M. and G. Ziemes (1999): Exhaustible Resources, Monopolistic Competition, and Endogenous Growth, Environmental and Resource Economics, 13, 169-185.

Smulders, S. (2000): Economic Growth and Environmental Quality, in: H. Folmer and L. Gabel (eds.): Principles of Environmental Economics, Cheltenham UK: Edward Elgar, chapter 20.

Solow, R.M. (1974): Intergenerational Equity and Exhaustible Resources, Review of Economic Studies, 41, 29-45.

Stiglitz, J.E. (1974): Growth with Exhaustible Natural Resources: Efficient and Optimal Growth Paths, Review of Economic Studies, 41, 123-137.

Stokey, N. (1998): Are There Limits to Growth? International Economic Review, 39, 1-31.

Tsur Y. and A. Zemel (2005): Scarcity, Growth and R&D, Journal of Environmental Economics and Management, 49/3, 484-499.

Xepapadeas, A. (2006): Economic Growth and the Environment, in: K.-G. Mäler and J. Vincent (Eds.), Handbook of Environmental Economics, Elsevier Science, Amsterdam.

Books

Bretschger, L. (1999): Economic Growth and Sustainable Development, Edwar Elgar, Cheltenham.

Clark, C.W. (2005): Mathematical Bionomics, Optimal Management of Renewable Resources, 2nd ed., Wiley, Hoboken.

Conrad, J.M. (1999): Resource Economics, Cambridge University Press, Cambridge.

Dasgupta, P.S. and G.M. Heal (1979): Economic Theory and Exhaustible Resources, Cambridge University Press.

Hanley, N., Shogren, J.F., and B. White (2007): Environmental Economics in Theory and Practice, 2nd edition, Palgrave Macmillan, Houndmills.

Heal, Geoffrey (1998): Valuing the Future: Economic Theory and Sustainability, Columbia University Press, New York.

Pittel, K. (2002): Sustainability and Endogenous Growth, Cheltenham, UK and Northampton, MA, US: Edward Elgar.

Perman, R., Ma, Y., McGilvray, J, Common, M. (2003): Natural Resource & Environmental Economics, 3d edition, Longman, Essex.

Further Reading

Asheim, G., W. Buchholz, J.M. Hartwick, T. Mitra, and C. Withagen (2007): Constant savings rates and quasi-arithmetic population growth under exhaustible resource constraints, Journal of Environmental Economics and Management, 53, 213-229.

Bretschger, L. (2005): Economics of Technological Change and the Natural Environment: How Effective are Innovations as a Remedy for Resource Scarcity?, Ecological Economics, 54 (2-3): 148-163.

Bretschger, L. (2008): Population growth and natural resource scarcity: long-run development under seemingly unfavourable conditions, Economics Working Paper Series 08/87, ETH Zurich.

Bretschger, L. (2008): Energy Prices, Growth, and the Channels in Between: Theory and Evidence, Economics Working Paper Series 06/47, ETH Zurich.

Brunnschweiler, C. N. and E.H. Bulte (2008): The resource curse revisited and revised: A tale of paradoxes and red herrings, Journal of Environmental Economics and Management 55 (3): 248-264.

Di Maria, C., Valente, S. (2008). Hicks Meets Hotelling: The Direction of Technical Change in Capital-Resource Economies. Environment and Development Economics, 13, 6, 691-717.

Ehrlich, P. (2008): Key Issues for Attention from Ecological Economists, Environment and Development Economics, 13, 1-20.

Grey, L.C. (1914): Rent under the Assumption of Exhaustibility, Quarterly Journal of Economics, 28, 3, 466-489.

Groth and Schou (2007): Growth and non-renewable resources: The different roles of capital and resource taxes, Journal of Environmental Economics and Management, 53, 1, January, 80-98.

Mehlum, H., K. Moene and R. Torvik (2006): Institutions and the Resource Curse, Economic Journal, 116, 1-20.

Pittel, K. and L. Bretschger (2010): The Implications of Heterogeneous Resource Intensities on Technical Change and Growth, forthcoming in: Canadian Journal of Economics.

Sachs, J. and A. Warner (2001): The Curse of Natural Resources, European Economic Review, 45, 827-838.

Smulders, S./de Nooij, M. (2003): The Impact of Energy Conversation on Technology and Economic Growth, Resource and Energy Economics 25, 59-79.

Valente, S. (2009): International Status Seeking, Trade, and Growth Leadership, Canadian Journal of Economics, 42, 2, 554-589.