14.452: Introduction to Economic Growth

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This half semester class will present an introduction to macroeconomic modeling, focusing on the theory of economic growth and some of its applications. It will introduce a number of models of nonstochastic and stochastic macroeconomic equilibrium. It will use these models to shed light both on the process of economic growth at the world level and on sources of income and growth differences across countries.

The course has a number of objectives: the first is to familiarize you with a set of issues and questions that are central to macroeconomics, and that are also (hopefully) exciting and important; the second is to develop some of the most important tools of dynamic economics useful in macroeconomics as well as in a number of other subdisciplines of economics including general equilibrium theory, political economy, industrial organization and contract theory; and final objective to provide you with a number of workhorse models useful in multiple areas of macroeconomics.

The main textbook is *Introduction to Modern Economic Growth*, Princeton University Press, 2009.

Course details:
My e-mail: `daron@MIT.edu.`
Lectures: TuTh 1-2:30, E51-151.
Recitation: F 1-2:30, E51-151.
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Syllabus

Lecture 1: Stylized Facts of Economic Growth and Development

This lecture will give a brief overview of the stylized facts of economic growth and show the large disparities in income per capita across countries. It will also discuss briefly how the world distribution of income across countries has come to be so unequal.

1. *Introduction to Modern Economic Growth*, Chapter 1.

2. Helpman, Elhanan (2005) *Mystery of Economic Growth*, Harvard University Press, Cambridge MA

3. Quah, Danny (1997), "Empirics for Growth and Distribution: Stratification, Polarization and Convergence Clubs," *Journal of Economic Growth* vol. 2, pp. 27-60.

4. Jones, Charles (1997), "On The Evolution of the World Income Distribution," *Journal of Economic Perspectives* vol. 11, pp. 19-36.

5. Acemoglu, Daron, Simon Johnson and James Robinson (2002): "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution" *Quarterly Journal of Economics*, November 2002, volume 117.

Lectures 2 and 3: Introduction to the Solow Growth Model

The Solow growth model is a workhorse for many macro applications, and it is the starting place for the modern theory of economic growth. Here we begin with the basics of this model, which will already be familiar to many of you.

1. *Introduction to Modern Economic Growth*, Chapter 2.

2. Solow, Robert, (1970), *Growth Theory: An Exposition,* Clarendon Press, Oxford, UK.

Lecture 4 (first part): The Solow Model and the Data; Growth Accounting, Levels Accounting and the Facts

This lecture uses the Solow growth model to interpret the stylized facts we encountered in the first lecture. In the process, we will also discuss a number of popular empirical strategies used in cross-country work and also the methodology of growth accounting.

1. *Introduction to Modern Economic Growth*, Chapter 3.

2. Mankiw, N. Gregory, David Romer, and David N. Weil (1992). "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics* 107, #2, 407-37.

3. Barro Robert and Xavier Sala-i-Martin (1995) *Economic Growth*, Chapter 10.

4. Alwyn Young (1995). "The Tyranny of Numbers"*Quarterly Journal of Economics*, volume 110, #3, 641-680.

5. Hall, Robert and Charles I. Jones (1999). "Why Do Some Countries Produce So Much More Output per Worker Than Others?," *Quarterly Journal of Economics,* 114, 1999, 83-116.

6. Klenow, Peter J. and Andres Rodriquez-Clare (1997). "The Neoclassical revival in Growth Economics: Has It Gone Too Far?," *NBER Macroeconomics Annual*, 73-103.

7. Trefler, Daniel (1993). "International Factor Price Differences: Leontieff Was Right!," *Journal of Political Economy* 101, #6 961-987.

Lecture 4 (second part): Fundamental Causes of Income Differences

This half lecture will take a step back from the discussion of the models so far and ask about the potential sources of differences in the parameters of the models. We will discuss fundamental reasons for why saving rates, human capital investments and technology may differ across countries.

1. *Introduction to Modern Economic Growth*, Chapter 4.

2. Diamond, Jared M. (1997) *Guns, Germs and Steel: The Fate of Human Societies*, W.W. Norton & Co., New York NY.

3. Acemoglu, Daron, Simon Johnson and James A. Robinson (2001) "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review*, 91, pp. 1369-1401.

Lecture 5: Foundations of Neoclassical Growth; Representative Consumers, Optimal and Competitive Allocations, Welfare Theorems

The neoclassical growth model differs from the Solow growth model in incorporating consumer optimization. This half lecture will set up the dynamic maximization problem corresponding to optimal growth in the context of the neoclassical model, and also review the first and second welfare theorems from basic microeconomics, and discuss how they apply in the dynamic, infinite-horizon models.

1. *Introduction to Modern Economic Growth*, Chapter 5.

2. Mas-Colell, Andreu, Michael D. Whinston and Jerry R. Green (1995) *Microeconomic Theory*, Oxford University Press, New York, Oxford, Chapters 4 and 16.

3. Bewley, Truman F. (2007) *General Equilibrium, Overlapping Generations Models, and Optimal Growth Theory*, Harvard University Press, Cambridge, Massachusetts.

Lectures 6-7: Neoclassical Growth

These two lectures will study the equilibria and the Pareto optimal allocations in the workhorse neoclassical growth model. They will characterize both the steady state equilibrium and the dynamic equilibrium path of the economy starting from an arbitrary level of capital stock.

1. *Introduction to Modern Economic Growth*, Chapter 8.

2. Chari, V. V., Patrick Kehoe and Ellen McGrattan (1997) "The Poverty of Nations: A Quantitative Investigation," Working Paper, Federal Reserve Bank of Minneapolis.

Lecture 8: Overlapping Generations and Dynamic Efficiency

The other workhorse model of dynamic macro is the overlapping generations model developed by Paul Samuelson and Peter Diamond. This lecture will introduce this model. It will show why there are significant differences between the neoclassical model with a representative consumer and the overlapping generations model and point out a number of applications of the overlapping generations model.

1. *Introduction to Modern Economic Growth*, Chapter 9.

2. Shell, Karl (1971) "Notes on the Economics of Infinity" *Journal of Political Economy*, 79, 1002-1011.

3. Diamond, Peter (1965) "National Debt in a Neoclassical Growth Model" *American Economic Review*, 55, 1126-1150.

4. Jones, Larry (1986) "Special Problems Arising in the Study of Economies with Infinitely Many Commodities" in *Models of Economic Dynamics* edited by Hugo Sonnenschein, Berlin, Springer-Verlag, 184-205.

Lecture 9: Neoclassical Endogenous Growth: Capital Accumulation, Externalities and Human Capital

This lecture will first present a model of sustained growth using a variant of the neoclassical growth model, then present the first example of a model with endogenous growth due to the knowledge-base or the technology stock of the society expanding over time, and finally discuss the reasons why modeling sustained economic growth the with externalities is unsatisfactory and what special set of issues emerge in modeling technological change. The lecture will also briefly discuss the role of human capital in economic growth and introduce some basic models that are useful for thinking about human capital investments.

1. *Introduction to Modern Economic Growth*, Chapters 10, 11, and 12.

2. Rebelo, Sergio (1991) "Long-Run Policy Analysis and Long-Run Growth" *Journal of Political Economy*, 99, 500-521.

3. Jones, Larry and Rodolfo Manuelli (1990) "A Convex Model of Equilibrium Growth: Theory and Policy Indications" *Journal of Political Economy*, 98, 1008-1038.

4. Romer, Paul (1986) "Increasing Returns and Long-Run Growth" *Journal of Political Economy*, 94, 1002-1037.

5. Romer, Paul M. (1993) "Idea Gaps and Object Gaps in Economic Development." *Journal of Monetary Economics*, 32, pp. 543-573.

6. *Introduction to Modern Economic Growth*, Chapter 10.

7. Ben Porath, Yoram (1967). "The Production of Human Capital Over the Life Cycle," *Journal of Political Economy*, Vol. 75, No. 4-1, pp. 352 365.

8. Nelson, Richard and Edmund Phelps (1966) "Investment in Humans, Technological Diffusion and Economic Growth." *American Economic Assocon oniation Papers and Proceedings.* 56, pp. 69-75.

9. Acemoglu, Daron (1996) "A Microfoundation For Social Increasing Returns in Human Capital Accumulation." *Quarterly Journal of Economics,* 111 (3), pp 779-804.

10. Lucas, Robert (1988), "On the Mechanics of Economic Development," *Journal of Monetary Economics* 22, 3-42.

11. Acemoglu, Daron and Josh Angrist (2000) "How Large are Human Capital Externalities? Evidence from Compulsory Schooling Laws." NBER Macroeconomics Annual 2000. MIT Press, Cambridge, pp. 9-59.

Lecture 10-11: Endogenous Growth with Expanding Input Varieties

This lecture will introduce the first models of endogenous technological change, where sustained economic growth takes place as a result of purposeful R&D-type activities.

1. *Introduction to Modern Economic Growth*, Chapter 13.

2. Romer, Paul (1987) "Growth Based on Increasing Returns due to Specialization" *American Economic Review Papers and Proceedings*, 77, 56-62

3. Romer, Paul M. (1990). "Endogenous Technological Change," *Journal of Political Economy* 98, S71-S102.

4. Jones, Charles I (1995) "R&D-based Models of Economic Growth" *Journal of Political Economy*, 103, 759-784.

Lectures 12: Interdependences: Technology Diffusion, Trade and the World Income Distribution in an Open Economy

The models discussed up to this point in the class are closed economy models. These are not good approximations to the world live in, where international trade and exchange of ideas are important. This lecture will provide an overview of major interdependences across countries that arise both because of technology diffusion and international trade. The emphasis will be on how these interdependences fundamentally affect the process of economic growth and the world distribution of income.

1. *Introduction to Modern Economic Growth*, Chapters 18 and 19.

2. Krugman, Paul (1979). "A Model of Innovation, Technology Transfer, and the World Distribution of Income," *Journal of Political Economy* 87, 253-66.

3. Acemoglu, Daron and Jaume Ventura (2002) "The World Income Distribution" *Quarterly Journal of Economics*, 117, 659-694.

4. Ventura, Jaume (1997) "Growth and Interdependence" *Quarterly Journal of Economics*, 112, 57-84.

5. Grossman, Gene and Elhanan Helpman (1991) *Innovation and Growth in the Global Economy,* Cambridge, MA, MIT Press.

Lecture 13: Directed Technical Change: Endogenous Skill-Bias and Endogenous Labor-Augmenting Technological Change

This lecture will introduce models of directed technological change, where not only aggregate technological change, but the direction of technological change is endogenous. These models will enable us to discuss why and when technological change may be skill biased (favoring more educated workers), and why we may expect technological change to be labor augmenting.

1. *Introduction to Modern Economic Growth*, Chapter 15.

2. Acemoglu, Daron (2002) "Directed Technical Change" *Review of Economic Studies*, 69, 781-810.

3. Acemoglu, Daron (2003) "Labor- and Capital-Augmenting Technical Change" *Journal of European Economic Association*, 1, 1-37.

4. Acemoglu, Daron (2007) "Equilibrium Bias of Technology." *Econometrica*, 75(5), pp. 1371-1410.

Lecture 14 (time permitting): Optimal and Competitive Growth under Uncertainty

This lecture will introduce models of stochastic growth. It will first discuss the Brock-Mirman model optimal growth under uncertainty and then show how this allocation can arise as a competitive equilibrium when the economy is endowed with a full set of contingent securities or Arrow securities. The canonical Real Business Cycle model will be discussed briefly as an application.

1. *Introduction to Modern Economic Growth*, Chapter 17.

2. Brock, William A and Leonard Mirman (1972) "Optimal Economic Growth under Uncertainty: Discounted Case." *Journal Economic Theory*, pp. 479-513.

3. Ljunqvist, Lars and Thomas J. Sargent (2005) *Recursive Macroeconomic Theory.* MIT Press, Cambridge, MA, Chapters 8 and 12.

4. Aiyagari, S. Rao (1994) "Uninsured Indiosyncratic Risk and Aggregate Saving." *Quarterly Journal of Economics*, 109, pp. 659-684.

5. Bewley, Truman F. (1977) "The Permanent Income Hypothesis: A Theoretical Formulation." *Journal of Economic Theory*, 16, pp. 252-292.

6. Bewley, Truman F. (1980) "The Optimum Quantity of Money." In J.H. Kareken and N. Wallace (eds.) *Models of Monetary Economies.* Federal Reserve Bank of Minneapolis, Minneapolis, MN, pp. 169-210.

7. Ljunqvist, Lars and Thomas J. Sargent (2005) *Recursive Macroeconomic Theory.* MIT Press, Cambridge, MA, Chapters 16 and 17.

8. Acemoglu, Daron and Fabrizio Zilibotti (1997) "Was Prometheus Unbound By Chance? Risk, Diversification and Growth." *Journal of Political Economy,* 105, pp. 709-751.