

# 14.461: Part I: Technological Change

Daron Acemoglu

September 13, 2011

This course will cover selected topics in theoretical and empirical analysis of technological change. The course will draw both on Acemoglu, *Introduction to Modern Economic Growth*, Princeton University Press, 2008, and research articles.

There will be three problem sets, which will count towards 30% of your final grade for this part of the course. The remaining 70% will be from a one half hour final examination at the end of the course (time to be determined).

## Topics

### Review of Basic Models of Endogenous Technological Progress (two lectures)

Main reading:

Acemoglu, Daron (2008) *Introduction to Modern Economic Growth*, Chapters 13 and 14.

Jones, Charles I (1995) "Timeseries Tests of Endogenous Growth Models" *Quarterly Journal of Economics*, 110.

Other references:

Aghion, Philippe and Peter Howitt (1992) "A Model of Growth Through Creative Destruction" *Econometrica*, 60, 323-351

Aghion, Philippe and Peter Howitt (2008) *The Economics of Growth*, MIT, Cambridge.

Backus, David, Patrick J. Kehoe and Timothy J. Kehoe (1992) "In Search of Scale Effects in Trade and Growth." *Journal of Economic Theory*, 58, pp. 377-409.

Grossman, Gene and Elhanan Helpman (1991) "Quality Ladders in the Theory of Growth" *Review of Economic Studies*, 58, 43-61.

Moser, Petra (2005) "How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World Fairs" *American Economic Review* 95, 1214-1236.

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

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

Williams, Heidi (2010) "Intellectual Property Rights and Innovation: Evidence from the Human Genome" NBER working paper 16213.

## **Knowledge Spillovers and Diffusion (one lecture)**

Main reading:

Bloom, Nicholas, Mark Schankerman and John Van Reenen, J. (2010) "Identifying Technology Spillovers and Product Market Rivalry" Stanford mimeo.

Jaffe, Adam, Manuel Trajtenberg and Rebecca Henderson (1993) "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations" *Quarterly Journal of Economics* 108, 577-598

Kerr, William (2008) "Ethnic Scientific Communities and International Technology Diffusion" *The Review of Economics and Statistics* 90, 518-537

Other references:

Adams, James D., and Adam Jaffe (1996) "Bounding the Effects of R&D: An Investigation Using Matched Establishment-Firm Data." *RAND Journal of Economics* 27, 700-721.

Griliches, Zvi (1957) "Hybrid Corn: an Exploration in the Economics of Technological Change" *Econometrica*, 25, 501-522.

Griliches, Zvi (1992) "The Search for R&D Spillovers" *Scandinavian Journal of Economics*, 94, 29-47.

Irwin, Douglas and Peter Klenow (1994) "Learning by Doing Spillovers in the Semiconductor Industry" *Journal of Political Economy*, 102, 1200-1227.

Jaffe, Adam. (1986) "Technological Opportunity and Spillovers of R&D: Evidence from Firms' Patents, Profits and Market Value" *American Economic Review* 76, 984-1001.

Pakes, Ariel (1987) "Patents as Options: Some Estimates of the Value of Holding European Patent Stocks" *Econometrica* 54, 755-784.

## **Competition and Technological Change (one lecture)**

Main reading:

Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith and Peter Howitt (2005) "Competition and Innovation: An Inverted-U Relationship." *Quarterly Journal of Economics*, 120, pp. 701-728.

Acemoglu, Daron (2008) *Introduction to Modern Economic Growth*, Chapter 14.

Acemoglu, Daron and Ufuk Akcigit (2006) "Intellectual Property Rights Policy, Competition and Innovation." NBER Working Paper, No. 12775.

Segal, Ilya, and Michael Whinston (2007) “Antitrust in Innovative Industries.” *American Economic Review* 97, 1703-1730.

Other references:

Aghion, Philippe, Christopher Harris, Peter Howitt and John Vickers (2001) “Competition, Imitation, and Growth with Step-by-Step Innovation.” *Review of Economic Studies*, 68, pp. 467-492.

Aghion, Philippe and Rachel Griffith (2007) *Competition and Growth: Reconciling Theory and Evidence*, MIT Press, Cambridge.

## **Directed Technological Change and Implications (two lectures)**

Main reading:

Acemoglu, Daron (2008) *Introduction to Modern Economic Growth*, Chapter 15.

Acemoglu, Daron, Philippe Aghion, Leonardo Bursztyn and David Hemous (2010) “The Environment and Directed Technical Change” forthcoming *American Economic Review*.

Acemoglu, Daron and Joshua Linn (2004) “Market Size in Innovation: Theory and Evidence from the Pharmaceutical Industry.” *Quarterly Journal of Economics*, 119, 1049-1090.

Finkelstein, Amy (2004) “Static and Dynamic Effects of Health Policy: Evidence from the Vaccine Industry.” *Quarterly Journal of Economics*, 119, 527-564.

Other references:

Acemoglu, Daron (1998) “Why Do New Technologies Complement Skills? Directed Technical Change and Wage Inequality.” *Quarterly Journal of Economics*, 113, pp. 1055-1090.

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

Acemoglu, Daron (2003) “Patterns of Skill Premia.” *Review of Economic Studies*, 70, pp. 199-230.

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

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

Acemoglu, Daron (2010) “When Does Labor Scarcity Encourage Innovation” forthcoming *Journal of Political Economy*.

Bloom, Nicholas, Mirko Draca and John Van Reenen (2011) “Trade Induced Technical Change: The Impact of Chinese Imports on Innovation, Diffusion and Productivity” Stanford mimeo.

Epifani, Paolo and Gino Gancia (2006) “The Skill Bias of World Trade.” *The Economic Journal*, 118, 927-960.

Jones, Charles I. (2005) “The Shape of Production Functions and the Direction of Technical Change.” *Quarterly Journal of Economics*, 2, pp. 517-549.

Newell, Richard, Adam Jaffe and Robert Stavins (1999) “The Induced Innovation Hypothesis and Energy-Saving Technological Change.” *Quarterly Journal of Economics*. 114, pp. 907-940.

Popp, David (2002) “Induced Innovation and Energy Prices.” *American Economic Review*, 92, pp. 160-180.

Thoenig, Matthias and Thierry Verdier (2003) “A Theory of Defensive Innovations and Globalization” *American Economic Review*, 93, pp. 709-728.

## **Technology and the Labor Market (one lecture)**

Main reading:

Acemoglu, Daron and David Autor (2010) “Skills, Tasks and Technologies: Implications for Employment and Earnings” in O. Ashenfelter and D. Card *Handbook of Labor Economics*, volume 4, North Holland.

Other references:

Acemoglu, Daron (2002) “Technical Change, Inequality and the Labor Market” *Journal of Economic Literature*, 40, 7-72.

Autor, David H. and David Dorn (2010) “Inequality and Specialization: The Growth of Low-Skilled Service Employment in the United States.” MIT Working Paper, April, 2010.

Autor, David, Lawrence Katz and Alan Krueger (1998) “Computing Inequality: Have Computers Changed the Labor Market?” *Quarterly Journal of Economics*, 113, pp. 1169-1214.

Autor, David H., Frank Levy and Richard J. Murnane (2003) “The Skill Content of Recent Technological Change: An Empirical Exploration.” *Quarterly Journal of Economics*, 116(4).

## **Productivity Differences Across Countries (one lecture)**

Main reading:

Acemoglu, Daron (2008) *Introduction to Modern Economic Growth*, Chapter 18.

Acemoglu, Daron and Fabrizio Zilibotti (2001) “Productivity Differences” *Quarterly Journal of Economics*, 116 (2), 563-606.

Other references:

Atkinson, Anthony B. and Joseph E. Stiglitz (1969) “A New View of Technological Change,” *Economic Journal* 79, 573-78.

Basu, Susanto and David N. Weil (1998) “Appropriate Technology and Growth,” *Quarterly Journal of Economics*, volume 113, 1025-1054.

Howitt, Peter (2000) “Endogenous growth and Cross-Country Income Differences.” *American Economic Review*, 90, 829-846.

Parente, Stephen L. and Edward C. Prescott (1994) “Barriers to Technology Adoption and Development.” *Journal of Political Economy* 102, 298-321.

Prescott, Edward C. (1998) “Needed: A Theory of Total Factor Productivity.” *International Economic Review*, 39, 525-553.

## **Misallocation, Productivity Differences and Growth (one lecture)**

Main reading:

Acemoglu, Daron (2008) *Introduction to Modern Economic Growth*, Chapter 21.

Hsieh, Chang-Tai and Peter Klenow (2009) “Misallocation and Manufacturing TFP in China and India” *Quarterly Journal of Economics*, 124, 1403-1447.

Lewis, William (2004) *The Power of Productivity: Wealth, Poverty and the Threat to Global Stability*, University of Chicago Press, Chicago.

Song, Michael, Storlesseten, Kjetil and Zilibotti, Fabrizio (2011) “Growing Like China,” *American Economic Review*, 101, 196-233.

Other references:

Foster, Lucia, John Haltiwanger and Chad Syverson (2008) “Reallocation, Firm Turnover, and Efficiency: Selection on Productivity or Profitability?” *American Economic Review*, 98, 394-425.

Hopenhayn, Hugo A. (1992), “Entry, Exit, and firm Dynamics in Long Run Equilibrium,” *Econometrica*, 60:5, pp. 1127-1150.

Melitz, Mark (2003) “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity.” *Econometrica*, 71(6), pp. 1695-1725.

## **Innovation and Reallocation (one lecture)**

Main reading:

Klette, Tor Jacob and Samuel Kortum (2004) “Innovating Firms and Aggregate Innovation” *Journal of Political Economy*, 112, 986-1018.

Lentz, Rasmus and Dale Mortensen (2008) “An Empirical Model of Growth through Product Innovation” *Econometrica*, 76, 1313-1373.

Acemoglu, Daron, Ufuk Akcigit, Nicholas Bloom and William Kerr (2010) “Innovation and Reallocation” in progress.

## **Innovation, Growth and Firm Size Dynamics (two lectures)**

Main reading:

Acemoglu, Daron and Dan Cao (2010) "Innovation by Entrants and Incumbents" mimeo.

Akicigit, Ufuk and William Kerr (2010) "Growth through Heterogeneous Innovation" mimeo.

Gabaix, Xavier (1999) "Zipf's Law for Cities: An Explanation." *Quarterly Journal of Economics*, 114, 739-767.

Luttmer, Erzo (2010) "Models of Growth and Firm Heterogeneity" *Annual Review of Economics*, 10, 547-576.

Other references:

Akicigit, Ufuk (2010) "Firm Size Innovation Dynamics and Growth" mimeo.

Atkeson, Andrew and Ariel Burstein (2009) "Innovation, Firm Dynamics and International Trade," *Journal of Political Economy*

Axtell, R.L. (2001) "Zipf Distribution of US Firm Sizes." *Science*, 293, 1818-1820.

Lucas, Robert. E. Jr. (1978) "On the Size Distribution of Business Firms." *Bell Journal of Economics*, 9(2), pp. 508-523.

Luttmer, Erzo (2007) "Selection, Growth and the Size Distribution of Firms," *Quarterly Journal of Economics*, 122, 1103-1144.

Luttmer, Erzo (2011) "Technology, Diffusion and Growth," forthcoming *Journal of Economic Theory*.

Rossi-Hansberg, Esteban and Mark L.J. Wright (2007) "Firm Dynamics in the Aggregate Economy." *American Economic Review*, 97, 1639-1666.

## **Sectoral Linkages: Implications for Growth and Volatility (two lectures)**

Main reading:

Jones, Charles I. (2011) "Misallocation, Economic Growth and Input-Output Economics" forthcoming in *Advances in Economic and Econometric Theory: Proceedings of the Ninth World Congress of the Econometric Society*, Daron Acemoglu, Manuel Arellano and Eddie Dekel (editors).

Acemoglu, Daron, Asuman Ozdaglar and Alireza Tahbaz-Salehi (2010) "Cascades in Networks and Aggregate Volatility." NBER Working Paper, 16516.

Foerster, Andrew, Pierre-Daniel Sarte and Mark Watson (2011) "Sectoral Vs. Aggregate Shocks: A Structural Factor Analysis of Industrial Production." *Journal of Political Economy*, 119, 1-38.

Other references:

Carvalho, Vasco (2010) "Aggregate Fluctuations and the Network Structure of Intersectoral Trade." UPF mimeo.

Carvalho, Vasco and Xavier Gabaix (2010) "The Great Diversification and Its Undoing." New York University and UPF mimeo.

Ciccone, Antonio (2002) "Input Chains and Industrialization." *Review of Economic Studies*, 69, 565-587.

Dupor, Bill (1999) "Aggregation and Irrelevance in Multi-Sector Models." *Journal of Monetary Economics*, 43, 391-409.

Gabaix, Xavier (2011) "Granular Origins of Aggregate Fluctuations." *Econometrica*

Horvath, Michael (1998) "Cyclicalities and Sectoral Linkages: Aggregate Fluctuations from Interdependent Sectoral Shocks." *Review of Economic Dynamics*, 1, 781-808.

Horvath, Michael (2000) "Sectoral Shocks and Aggregate Fluctuations." *Journal of Monetary Economics*, 45, 69-106.