







## Johannes Gutenberg University Mainz Graduate School of Economics, Finance, and Management

## Advanced Macroeconomic Theory 1 (Part 2)

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## References

- Aghion, P., and P. Howitt (1992): "A Model of Growth Through Creative Destruction," Econometrica, 60, 323–351.
- Aghion, P., and P. Howitt (1994): "Growth and Unemployment," Review of Economic Studies, 61(3), 477–494.
- Aghion, P., and P. Howitt (1998): Endogenous Growth Theory. MIT Press, Cambridge, Massachusetts.
- Barro, R. J., and X. S. i Martin (2004): Economic Growth, 2nd. ed. MIT Press.
- Benhabib, J., and A. Bisin (2017): "Skewed Wealth Distributions: Theory and Empirics," Journal of Economic Literature, forthcoming, 1–47.
- Benhabib, J., A. Bisin, and M. Luo (2017): "Earnings Inequality and Other Determinants of Wealth Inequality," American Economic Review: Papers & Proceedings, 107(5), 593–597.
- Benhabib, J., A. Bisin, and S. Zhu (2011): "The Distribution of Wealth and Fiscal Policy in Economies with Finitely Lived Agents," Econometrica, 79(1), 123–157.
- Cahuc, P., and A. Zylberberg (2004): Labor Economics. The MIT Press.

- Cass, D. (1965): "Optimum Growth in an Aggregative Model of Capital Accumulation," Review of Economic Studies, 32(2), 233–240.
- Castaneda, A., J. Diaz-Gimenez, and J.-V. Rios-Rull (2003): "Accounting for the U.S. Earnings and Wealth Inequality," Journal of Political Economy, 111, 818–857.
- Cyert, R., and M. DeGroot (1970): "Bayesian Analysis and Duopoly Theory," Journal of Political Economy, 78(5), 1168–1184.
- DeGroot, M. H. (1970): Optimal statistical decisions. McGraw-Hill.
- Dixit, A., and J. Stiglitz (1977): "Monopolistic competition and optimum product diversity," American Economic Review, 67, 297–308.
- Gabaix, X., J.-M. Lasry, P.-L. Lions, and B. Moll (2015): "The Dynamics of Inequality," Working Paper Princeton University.
- Galor, O. (2005): From Stagnation to Growth: Unified Growth Theorypp. 171–293. Handbook of Economic Growth, Volume 1A., Philippe Aghion and Steven N. Durlauf,eds. (Elsevier).

- Grossman, G. M., and E. Helpman (1991): Innovation and Growth in the Global Economy. The MIT Press, Cambridge, Massachusetts.
- Helpman, E., and O. Itskhoki (2010): "Labor Market Rigidities, Trade and Unemployment," Review of Economic Studies, 77(3), 1100–1137.
- Helpman, E., O. Itskhoki, and S. Redding (2010): "Inequality and unemployment in a global economy," Econometrica, 78(4), 1239–1283.
- Jones, C. I. (1995a): "R&D-Based Models of Economic Growth," Journal of Political Economy, 103(3), 759–784.
- ———— (1995b): "Time Series Tests of Endogenous Growth Models," Quarterly Journal of Economics, 110(2), 495–525.
- Kaymak, B., and M. Poschke (2016): "The evolution of wealth inequality over half a century: The role of taxes, transfers and technology," Journal of Monetary Economics, 77, 1–25.
- Keller, G., and S. Rady (2010): "Strategic experimentation with Poisson bandits," Theoretical Economics, 5(2), 275–311.
- Keller, G., S. Rady, and M. Cripps (2005): "Strategic Experimentation with Exponential Bandits," Econometrica, 73(1), 39–68.

- Khieu, H., and K. Wälde (2018): "Capital Income Risk and the Dynamics of the Wealth Distribution," mimeo Johannes Gutenberg University Mainz.
- Kihlstrom, R. E. (1974a): "A Bayesian Model of Demand for Information About Product Quality.," International Economic Review, 15(1), 99 118.
- ———— (1974b): "A General Theory of Demand for Information about Product Quality.," Journal of Economic Theory, 8(4), 413 439.
- Koopmans, T. (1965): On the Concept of Optimal Economic Growthpp. 225–287. The Economic Approach to Development Planning. Chicago: Rand McNally.
- Launov, A., and K. Wälde (2013): "Estimating Incentive and Welfare Effects of Non-Stationary Unemployment Benefits," International Economic Review, 54, 1159–1198.
- ——— (2015): "The Employment Effect of Reforming a Public Employment Agency," available at www.waelde.com/pub.
- ——— (2016): "The Employment Effect of Reforming a Public Employment Agency," European Economic Review, 84, 140–164.
- Mortensen, D. T. (1977): "Unemployment Insurance and Job Search Decisions," Industrial and Labor Relations Review, 30, 505–517.

- Pissarides, C. A. (1985): "Short-run Equilibrium Dynamics of Unemployment Vacancies, and Real Wages," American Economic Review, 75, 676–90.
- Pissarides, C. A. (2000): Equilibrium Unemployment Theory. MIT Press, Cambridge, Massachusetts.
- Rogerson, R., R. Shimer, and R. Wright (2005): "Search-Theoretic Models of the Labor Market: A Survey," Journal of Economic Literature, 43, 959–988.
- Romer, P. M. (1986): "Increasing Returns and Long-Run Growth," Journal of Political Economy, 94, 1002–1037.
- ——— (1990): "Endogenous Technological Change," Journal of Political Economy, 98, S71–S102.
- Ross, S. M. (1993): Introduction to Probability Models, 5th edition. Academic Press, San Diego.
- ——— (1996): Stochastic processes, 2nd edition. Academic Press, San Diego.
- Rothschild, M. (1974): "Searching for the Lowest Price When the Distribution of Prices Is Unknown," Journal of Political Economy, 82(4), 689–711.

- Segerstrom, P. S. (1998): "Endogenous Growth without Scale Effects," American Economic Review, 88, 1290–1310.
- Sennewald, K. (2007): "Controlled Stochastic Differential Equations under Poisson Uncertainty and with Unbounded Utility," Journal of Economic Dynamics and Control, 31, 1106–1131.
- Sennewald, K., and K. Wälde (2006): "It 's Lemma and the Bellman Equation for Poisson Processes: An Applied View," Journal of Economics, 89(1), 1–36.
- Shell, K. (1966): "Toward A Theory of Inventive Activity and Capital Accumulation," American Economic Review, 56(1/2), 62-68.
- Shimer, R. (2005): "The Cyclical Behavior of Equilibrium Unemployment and Vacancies," American Economic Review, 95, 25–49.
- Solow, R. M. (1956): "A Contribution to the Theory of Economic Growth," Quarterly Journal of Economics, 70, 65–94.
- Stigler, G. (1961): "The Economics of Information," Journal of Political Economy, 69(3), 213–225.
- Tonks, I. (1983): "Bayesian learning and the optimal investment decision of the firm," Economic Journal, 93, 87–98.

- van den Berg, G. (1990): "Nonstationarity in Job Search Theory," Review of Economic Studies, 57(2), 255–277.
- Wackerly, D., W. Mendenhall, and R. Scheaffer (2008): Mathematical Statistics with Applications, 7th ed. Thomson Brooks/Cole.
- Wälde, K. (1999a): "A Model of Creative Destruction with Undiversifiable Risk and Optimising Households," Economic Journal, 109, C156–C171.
- ——— (1999b): "Optimal Saving under Poisson Uncertainty," Journal of Economic Theory, 87, 194–217.
- ——— (2011): "Production technologies in stochastic continuous time models," Journal of Economic Dynamics and Control, 35, 616–622.
- ——— (2012): Applied Intertemporal Optimization. Know Thyself Academic Publishers, available at www.waelde.com/KTAP.
- ——— (2016): "Pareto-Improving Redistribution of Wealth The Case of the NLSY 1979 Cohort," mimeo Johannes Gutenberg University Mainz.
- Zwillinger, D., and S. Kokoska (2000): Standard probability and statistics tables and formulae. Chapman & Hall/CRC.