



GUTENBERG SCHOOL OF  
MANAGEMENT  
& ECONOMICS



Johannes-Gutenberg Universität Mainz

Master in International Economics and Public Policy 1st Semester

# Advanced Macroeconomics

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[www.macro.economics.uni-mainz.de](http://www.macro.economics.uni-mainz.de)

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## Part IV

# Conclusion

## 14 What did we learn from the individual fields?

### 14.1 Economic growth

- Central empirical questions
  - Why are some countries rich, why are some others poor?
  - Do countries converge to the same long-run level of income?
  - Is there a reduction of the poverty rate and of inequality as measured by the Gini coefficient?
- Current view of convergence debate
  - Poverty persists but the absolute number declines
  - Inequality as measured by Gini declines as well but very slowly

- Theory of economic growth
  - From exogenous factors of growth to endogenous, economically determined drivers of growth
  - Policy and politics play a crucial role in shaping the growth path of a society
- Contribution of psychological views
  - Impulse control and savings (Fudenberg and Levine, 2006)
  - Dual-self model provides new determinants (costs of self-control) of saving rate
  - Behavioural growth extends existing views on the growth process and allows for novel predictions
  - Empirical relevance to be investigated

## 14.2 Business cycles

- Central empirical questions
  - Why do growth rates of countries fluctuate over time?
  - How do we measure these fluctuations?
  - Can we date the beginning and end of a business cycle?
- The current approach to measurement
  - Various type of filters that produce trend vs cyclical component of a cycle
  - Dates of peak and trough of a cycle differ across methods but are sufficiently close
- Theories of business cycles
  - Real-business cycle vs natural volatility vs sunspot cycles
  - Exogenous shocks vs endogenous shocks vs mood
  - Efficient factor allocation vs potential inefficiency vs inefficiency

- Contribution of psychological views
  - Time-consistency and time-inconsistent behaviour is widely observed
  - This might play a role for theories of business-cycles as well
  - Aggregate events that trigger reoptimisation would lead to changes in consumption and saving behaviour
  - Could be used to understand how moods affect production and growth
  - Sunspot models can be carried one step further

## 14.3 Unemployment

- Central empirical questions
  - How can unemployment meaningfully be defined?
  - How high are unemployment rates in Germany and how do they change over time?
  - How do unemployment rates differ across countries?
  - Who is most affected by unemployment? Skill, age, region ...
  - How often do individuals become unemployed and how many of them (stocks vs flows)?
- The central theoretical questions
  - Why is there unemployment?
  - How can one reduce unemployment?
  - Can unemployment be reduced without creating poverty?



- Theories of unemployment
  - Traditional theories of labour supply (voluntary unemployment)
  - Traditional theories of real wage rigidities (involuntary unemployment)
  - Pure search views – stresses worker's behaviour
  - Matching models with vacancy creation – stresses the job creation by firms
- Contribution of psychological views
  - Unemployment creates stress
  - Additional channel through which unemployment reduces well-being
  - Economic policy should not orient itself only at material aspects like income and consumption but also at feelings
  - There is a trade-off for policy as well between material growth and well-being

## 15 Overall conclusion

- A lot can be learned from economic analysis about growth, business cycles, unemployment and other macroeconomic questions
- There are many macroeconomic questions that need further investigation
- Generalizing the “model of man” in economics to allow for more psychological thinking is useful per se
- More psychological thinking also promises to yield a better understanding of macroeconomic questions

# References

- Aghion, P., and P. Howitt (1992): “A Model of Growth Through Creative Destruction,” *Econometrica*, 60, 323–351.
- (1998): *Endogenous Growth Theory*. MIT Press, Cambridge, Massachusetts.
- Bakker, A., and E. Demerouti (2013): The Spillover-Crossover Model. In: *New Frontiers in Work and Family Research*, Joseph G. Grzywacz and Evangelia Demerouti (eds.), pp. 54–70. Routledge.
- Benhabib, J., and A. Bisin (2005): “Modeling internal commitment mechanisms and self-control: A neuroeconomics approach to consumption-saving decisions,” *Games and Economic Behavior*, 52(2), 460–492.
- Benhabib, J., and R. Farmer (1994): “Indeterminacy and Increasing Returns,” *Journal of Economic Theory*, 63(1), 19–41.
- Bental, B., and D. Peled (1996): “The Accumulation of Wealth and the Cyclical Generation of New Technologies: A Search Theoretic Approach,” *International Economic Review*, 37, 687–718.
- Brunnermeier, M. (2009): “Deciphering the Liquidity and Credit Crunch 2007 - 2008,” *Journal of Economic Perspectives*, 23(1), 77–100.

- Bryan, G., D. Karlan, and N. Scott (2010): “Commitment Devices,” *Annual Review of Economics*, 2(1), 671–698.
- Burns, A., and W. Mitchell (1946): *Measuring Business Cycles*. NBER.
- Caplin, A., and J. Leahy (2006): “The recursive approach to time inconsistency,” *Journal of Economic Theory*, 131(1), 134–156.
- Cass, D. (1965): “Optimum Growth in an Aggregative Model of Capital Accumulation,” *Review of Economic Studies*, 32(2), 233–240.
- CEPR (2014): “Eurocoin the real time indicator of the Euro Area economy,” <http://eurocoin.cepr.org/>.
- Clark, A., and A. J. Oswald (1994): “Unhappiness and unemployment,” *Economic Journal*, 104(424), 648–659.
- Dhami, S. (2016): *Foundations of Behavioral Economic Analysis*. Oxford University Press.
- DiTella, R., R. J. MacCulloch, and A. J. Oswald (2001): “Preferences over inflation and unemployment: Evidence from surveys of happiness,” *American Economic Review*, 91(1), 335–341.
- Dixit, A., and J. Stiglitz (1977): “Monopolistic competition and optimum product diversity,” *American Economic Review*, 67, 297–308.

- Dodd, R. (2007): “Subprime: Tentacles of a Crisis,” *Finance and Development*, 44(4), 1–10.
- Fan, J. (1995): “Endogenous Technical Progress, R&D Periods and Durations of Business Cycles,” *Journal of Evolutionary Economics*, 5, 341–368.
- Farmer, R., and J.-T. Guo (1994): “Real Business Cycles and the Animal Spirits Hypothesis,” *Journal of Economic Theory*, 63(1), 42–72.
- Francois, P., and H. Lloyd-Ellis (2003): “Animal Spirits Trough Creative Destruction,” *American Economic Review*, 93, 530–550.
- (2008): “Implementation Cycles, Investment, And Growth,” *International Economic Review*, 49(3), 901–942.
- Frederick, S., G. Loewenstein, and T. O’Donoghue (2002): “Time Discounting and Time Preference: A Critical Review,” *Journal of Economic Literature*, 40(2), 351–401.
- Freeman, S., D. P. Hong, and D. Peled (1999): “Endogenous Cycles and Growth with Indivisible Technological Developments,” *Review of Economic Dynamics*, 2, 403–432.
- Fudenberg, D., and D. K. Levine (2006): “A Dual-Self Model of Impulse Control,” *American Economic Review*, 96(5), 1449 – 1476.

- 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.
- Hellwig, M. (2009): “Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis.,” *De Economist*, 157(2), 129–207.
- Howitt, P., and R. McAfee (1992): “Animal Spirits,” *American Economic Review*, 82(3), 493–507.
- Jones, C. I. (1995): “Time Series Tests of Endogenous Growth Models,” *Quarterly Journal of Economics*, 110(2), 495–525.
- Koopmans, T. (1965): On the Concept of Optimal Economic Growthpp. 225–287. *The Economic Approach to Development Planning*. Chicago: Rand McNally.
- Krieger, D. (2011): “Zeitkonsistente Präferenzen und Emotionen,” Diplomarbeit, Johannes Gutenberg Universität Mainz.
- Krugman, P. R. (1979): “Increasing Returns, Monopolistic Competition and International Trade,” *Journal of International Economics*, 9(4), 469–479.

- Kydland, F. E., and E. C. Prescott (1980): A Competitive Theory of Fluctuations and the Feasibility and Desirability of Stabilization Policy. in S. Fischer, Ed., *Rational Expectations and Economic Policy*, University of Chicago Press, 169–198.
- (1982): “Time to Build and Aggregate Fluctuations,” *Econometrica*, 50(6), 1345–1370.
- Laibson, D. (1997): “Golden Eggs and Hyperbolic Discounting,” *Quarterly Journal of Economics*, 112(2), 443–477.
- Launov, A., and K. Wälde (2013): “Estimating Incentive and Welfare Effects of Non-Stationary Unemployment Benefits,” *International Economic Review*, 54, 1159–1198.
- Li, C.-W. (2001): “Science, Diminishing Returns, and Long Waves,” *The Manchester School*, 69, 553–573.
- Maliar, L., and S. Maliar (2004): “Endogenous Growth and Endogenous Business Cycles,” *Macroeconomic Dynamics*, 8, 559–581.
- Marczak, M., and T. Beissinger (2013): “Real wages and the business cycle in Germany,” *Empirical Economics*, 44(2), 469–490.
- Matsuyama, K. (1999): “Growing Through Cycles,” *Econometrica*, 67, 335–347.

- O'Donoghue, T., and M. Rabin (1999): "Doing It Now or Later," *American Economic Review*, 89(1), 103–124.
- OECD (2014): *Making Mental Health Count*. OECD, Paris.
- (2015): *In It Together - Why Less Inequality Benefits All*. OECD, Paris.
- of Economic Research, N. B. (2010): "US Business Cycle Expansions and Contractions," <http://www.nber.org/cycles/cyclesmain.html>.
- Ohtake, F. (2012): "Unemployment and Happiness," *Japan Labor Review*, 9(2), 59–74.
- Phillips, K. L., and J. Wrase (2006): "Is Schumpeterian 'creative destruction' a plausible source of endogenous real business cycle shocks?," *Journal of Economic Dynamics and Control*, 30(11), 1885–1913.
- 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.
- Posch, O., and K. Wälde (2011): "On the Link between Volatility and Growth," *Journal of Economic Growth*, 16, 285 – 308.



- Prelec, D. (2004): “Decreasing Impatience: A Criterion for Non-stationary Time Preference and Hyperbolic Discounting,” *Scandinavian Journal of Economics*, 106(3), 511–532.
- 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, D. (2011): *Advanced Macroeconomics*. McGraw-Hill Higher Education, 4th edition.
- 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.
- Schirwitz, B. (2009): “A comprehensive German business cycle chronology,” *Empirical Economics*, 37(2), 287–301.
- Segerstrom, P. S. (1998): “Endogenous Growth without Scale Effects,” *American Economic Review*, 88, 1290–1310.
- 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.
- Strotz, R. (1955/56): “Myopia and Inconsistency in Dynamic Utility Maximization,” *Review of Economic Studies*, 23(3), 165–180.
- Sullivan, D., and T. Von Wachter (2009): “Job Displacement and Mortality: An Analysis Using Administrative Data,” *The Quarterly Journal of Economics*, 124(3), 1265–1306.
- Tefft, N. (2011): “Insights on unemployment, unemployment insurance, and mental health,” *Journal of Health Economics*, 30(2), 258–264.
- World Bank (2014): “World Development Report 2014,” pp. 293–324.
- Wälde, K. (1999): “Optimal Saving under Poisson Uncertainty,” *Journal of Economic Theory*, 87, 194–217.
- (2002): “The economic determinants of technology shocks in a real business cycle model,” *Journal of Economic Dynamics and Control*, 27(1), 1–28.
- (2005): “Endogenous Growth Cycles,” *International Economic Review*, 46, 867–894.

- (2012): Applied Intertemporal Optimization. Know Thyself - Academic Publishers, available at [www.waelde.com/KTAP](http://www.waelde.com/KTAP).
- (2015): “Stress and Coping: An Economic Approach,” mimeo Gutenberg University Mainz, available at [www.waelde.com/pub](http://www.waelde.com/pub).