

Doctoral School in Economics and Finance 2022/23

THE MACROECONOMICS OF AUTOMATION, ARTIFICIAL INTELLIGENCE, AND DIGITIZATION - Part I

1. Course details

Semester:	1
Credit rating:	2 ECTS
Pre-requisite(s):	The prerequisite for this course is Advanced Macroeconomics I of the Master in Economics and Finance (Research Track).
Lecturers:	Andreas Irmen (University of Luxembourg)

Administrator:	Roswitha Glorieux
Seminar times and rooms:	Wednesdays from 9:30am until 11:45 am

Communications It is important that students regularly read their University e-mails, as important information will be communicated this way.

Reading week: -

Mode of assessment: oral exam and/or student presentations, and assignments

Additional work: TBA

Examination Periods: -

Course WebPage: [Moodle.uni.lu](https://moodle.uni.lu)

2. Aims and objectives

Aims

The course Advanced Macroeconomics II of the Doctoral School in Economics and Finance connects students to the research frontier of modern Macroeconomics. It builds on and complements the PhD-training in Macroeconomics that begins with the

course Advanced Macroeconomics I of the Master of Science in Quantitative Economics and Finance (MScQEF). The present syllabus presents **Block A** of Advanced Macroeconomics II. This block is concerned with recent advances in the theory of economic growth. Covered topics include theories of endogenous technical change with a particular emphasis on the recent literature on the role of automation, artificial intelligence, and digitization for economic growth and the distribution of incomes.

Learning Objectives

Upon successful completion of this course students will be able to analyze and assess scientific contributions in the areas of Economic Growth and Dynamic Macroeconomics. They will master modern methodological concepts such as techniques of dynamic optimization, the analysis of complex dynamical systems, and dynamic general equilibrium theory. Moreover, they will be in a position to apply these concepts in their own research. **Plan of semester**

Overall, this course comprises 30 hours, roughly 20 hours of regular lectures, 5 hours of exercise lectures, and 5 hours of presentations by participating students. The precise mix depends on the number of enrolled students. Exercise lectures are based on assignments that students have to prepare in advance.

The first regular lecture will be on:

Wednesday, September 21, 2022, 9:30-11:45, Room BLG001, no course 2 Nov

We will meet for regular or exercise lectures ten times, respectively, on Wednesdays at the indicated time and place. The last lecture will be on Wednesday, November 23, 2022.

The grading of this course reflects the student's presentation and an oral exam in January 2023. Details on this will be given later in class. Grading will be Pass or Fail. Passing the exam will earn you 2 ECTS.

3. Course details

1. Introduction: Exogenous Technical Change (Acemoglu (2009), Chapter 2)
2. Endogenous Growth through Expanding Product Varieties (Grossman and Helpman (1991), Chapter 3, Barro and Sala-i-Martin (2004), Chapter 6, Acemoglu (2009), Chapter 13)
3. Economic Growth and the Distribution of Income and Wealth (Bertola, Foellmi, and Zweimüller (2006), Chapter 10, Irmen and Tabakovic (2020))
4. Schumpeterian Growth (Grossman and Helpman (1991), Chapter 4, Barro and Sala-i-Martin (2004), Chapter 7, Acemoglu (2009), Chapter 14)
5. The Direction of Technological Change (Acemoglu (2003), Acemoglu (2009), Chapter 15, Irmen and Tabakovic (2017))

6. Automation and Economic Growth (Steigum (2011), Acemoglu and Restrepo (2018), Irmen (2020), Irmen (2020a))
7. Labor-Augmenting Automation and Human Capital (Irmen (2021))
8. Digitization, Artificial Intelligence, and Economic Growth (Goldfarb and Tucker (2017), Aghion, Jones, and Jones (2018))

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Acemoglu, D. (2009): *Introduction to Modern Economic Growth*. Princeton University Press, Princeton, New Jersey.

Acemoglu, D., and P. Restrepo (2018): "The Race between Man and Machine: Implications of Technology for Growth, Factor Shares, and Employment," *American Economic Review*, 108(6), 1488–1542.

Aghion, P., and P. Howitt (2009): *The Economics of Growth*. MIT Press, Cambridge, MA.

Aghion, P., B. F. Jones, and C. I. Jones (2018): "Artificial Intelligence and Economic Growth," in *The Economics of Artificial Intelligence: An Agenda*, NBER Chapters, pp. 237–282. National Bureau of Economic Research, Inc.

Barro, R. J., and X. Sala-i-Martin (2004): *Economic Growth*. MIT Press, Cambridge, MA, 2nd edn.

Bertola, G., R. Foellmi, and J. Zweimüller (2006): *Income Distribution in Macroeconomic Models*. Princeton University Press, Princeton.

Dixit, A. K. (1990): *Optimization in Economic Theory*. Oxford University Press, Oxford, 2nd edn.

Galor, O. (2007): *Discrete Dynamical Systems*. Springer Verlag, Berlin – Heidelberg.

Gandolfo, G. (2009): *Economic Dynamics – Study Edition*. Springer Verlag, Berlin – Heidelberg, 4th edn.

Goldfarb, A., and C. Tucker (2019): "Digital Economics," *Journal of Economic Literature*, vol. 57(1), pages 343, March.

Grossman, G. M., and E. Helpman (1991): *Innovation and Growth in the Global Economy*. MIT Press, Cambridge, MA.

Heer, B., and A. Maussner (2009): *Dynamic General Equilibrium Modeling*. Springer Verlag, Heidelberg, 2nd edn.

Irmen, A. (2020): "Automation, Factor Shares and Growth in the Era of Population Aging," DEM Discussion Paper 15-2020, University of Luxembourg.

Irmen, A. (2020a): "The Macroeconomics of Automation," draft, DEM, University of Luxembourg.

Irmen, A. (2021): "Labor-Augmenting Automation and Human Capital," draft, DEM, University of Luxembourg.

Irmen, A., and A. Tabakovic (2020): "Endogenous Economic Growth and the Factor Income Distribution - Piketty Meets Romer -," *Economic Inquiry*, vol. 58, 1342-1361

Irmen, A., and A. Tabakovic (2017): "Endogenous Capital- and Labor-Augmenting Technical Change in the Neoclassical Growth Model," *Journal of Economic Theory*, 170, 346–384.

Ljungqvist, L., and T. J. Sargent (2012): *Recursive Macroeconomic Theory*. The MIT Press, Cambridge, Massachusetts, 3rd edn.

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Steigum, E. (2011), *Robotics and Growth*, in: La Grandville, O., *Economic Growth and Development (Frontiers of Economics and Globalization, Volume 11)*, 543-555, Emerald Group Publishing Limited, Bingley, UK

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Sydsæter, K., A. Strøm, and P. Berck (2005): *Economists' Mathematical Manual*. Springer, Heidelberg, 4th edn.

Velleman, D. J. (2006): *How to Prove It – A Structured Approach*. Cambridge University Press, Cambridge, UK, 2nd edn.