

**ECO 529 Financial and Monetary Economics**  
Fall 2020  
TTh 4:15PM – 5:45PM  
Online

## **Macro, Money and (International) Finance: A Heterogeneous Agents Continuous Time Approach**

### **Course Description:**

This course will expose students to modern continuous time modeling technics at the intersection between macroeconomics, monetary economics and (international) finance. The aim of this course is to develop and teach advanced tools and includes a step-by-step solution procedure that students can apply to a variety of economic problems. (See last page of this syllabus.)

While prior to the Great Recession the key frictions were price stickiness and wage rigidities, the great recession highlighted the importance of financial frictions. Similarly, financial regulation shifted course. Whereas prior to the crisis the focus was on micro-prudential regulation, measuring the soundness and risks of individual banks in isolation, current thinking stresses the importance of macro-prudential regulation with its focus on spillover risks. Several new systemic risk measures were proposed. The course would also cover interaction between monetary policy and macro-prudential policy within a thorough welfare analysis. Another emphasis is a thorough study of the international financial architecture, also in the light of emergence of new digital forms of money. New concepts like Digital Currency Areas and digital dollarization will be discussed.

### **Lecture Notes:**

See link: [https://www.dropbox.com/s/z73ys7xpqaxwdua/ECO529\\_Notes.pdf?dl=0](https://www.dropbox.com/s/z73ys7xpqaxwdua/ECO529_Notes.pdf?dl=0)

(The lectures notes will be constantly updated.)

### **Online Format:**

The lecture will be online via ZOOM.us. It will be made available online and students can watch it live or at their convenient time. Students should form groups to watch the lectures simultaneously using interactive chat features. Ideally, we will have student groups from several universities participating.

Problem Sets can be solved in groups of 3 to 5 students, will be submitted to the university point person and passed on to head TA Sebastian Merkel at Princeton.

Review sessions (precepts) will be held on Saturdays.

## Structure of the Course:

[x] refers to the chapter in the lecture notes

1. Intro: Run-up, Amplifications, Externalities, Recovery *Sept 1, 2020*

### Part I: Real Macro-Finance Models with Heterogenous Agents

2. A Simple Heterogenous Agents Model [2] *Sept 3*

Princeton Initiative: <https://initiative.princeton.edu/programs/2020-program/> *Sept 4-6*

3. Endogenous Risk (and Price of Risk) Dynamics [3] *Sept 8, 10*

4. A Model with Endogenous Jumps due to Runs [4] *Sept 15*

### Part II: Monetary Models with Aggregate and Idiosyncratic Risk

5. A Simple One-Sector Money Model with Idiosyncratic Risk [5] *Sept 17, 22*

6. Cash vs. Cashless Economy and Inflation Risk as Hedge [6] *Sept 24, 29*

7. The I Theory of Money *Oct 1*

Safe Assets and Flight to Safety [6]

8. Welfare: Monetary Policy and Macro-Prudential Policy Interaction [7] *Oct 6*

9. International Monetary System: A Risk Perspective [9] *Oct 8*

10. Digital Money, Digital Currency Areas, Digital Dollarization

### Optional Topics:

Machine Learning and Macro-Models

Reversal Interest Rate – Effective Lower Bound of Monetary Policy

Opening the current account: Consumption-led growth

## Readings:

### 1. Run-up, Crisis-Amplification, Recovery

Brunnermeier, Markus K, and Lasse Heje Pedersen, 2009, "Market Liquidity and Funding Liquidity". Review of Financial Studies 22, 2201-2238.

Brunnermeier, Markus K., Thomas Eisenbach and Yuliy Sannikov, 2013, "Macroeconomics with Financial Frictions: A Survey", (please study it carefully before class)

Brunnermeier, Markus K, and Martin Oehmke, 2013, "The Maturity Rat Race", Journal of Finance 68(2), pp. 483-521.

Brunnermeier, Markus K, 2015, Baffi Lecture: "Financial Dominance".

Shleifer, Andrei and Robert W. Vishny, "The Limits of Arbitrage", Journal of Finance, 52(1), 35-55.

### 2. A Simple Heterogenous Agents Model

See also website: <http://scholar.princeton.edu/markus/MacroMoneyFinance>

\*\*Brunnermeier, Markus K. and Yuliy Sannikov, 2017, "Macro, Money and Finance: A Continuous Time Approach," Handbook of Macroeconomics, pp. 1497-1546.  
[https://scholar.princeton.edu/sites/default/files/markus/files/\\_macrohandbook\\_brusan.pdf](https://scholar.princeton.edu/sites/default/files/markus/files/_macrohandbook_brusan.pdf)

Caballero, Ricardo J. and Alp Simsek, 2018, "A Risk-centric View of Demand Recessions and Macro-prudential Regulation"  
[https://www.dropbox.com/s/ud0jejruxsc852/DRSR\\_37\\_public.pdf?dl=0](https://www.dropbox.com/s/ud0jejruxsc852/DRSR_37_public.pdf?dl=0)

### 3. Endogenous Risk (and Price of Risk) Dynamics

\*Brunnermeier, Markus K. and Yuliy Sannikov, 2014, "A Macroeconomic Model with a Financial Sector", American Economic Review 104(2), pp. 379-421.

Di Tella, Sebastian, 2017, "Uncertainty Shocks and Balance Sheet Recessions", Journal of Political Economy 125 No. 6, 2038-2081

He, Zhiguo, and Arvind Krishnamurthy, 2013, "Intermediary Asset Pricing", American Economic Review 103(2): pp. 732-70.

He, Zhiguo, and Arvind Krishnamurthy, 2012, "A Model of Capital and Crises", Review of Economic Studies 79(2): pp. 735-777.

Kaplan, Greg, Ben Moll, and Gianluca Violante, 2018, "Monetary Policy According to HANK", American Economic Review 108 No. 3, 697-743

Moreira, Alan, and Alexi Savov. "The macroeconomics of shadow banking." *The Journal of Finance* 72.6 (2017): 2381-2432.

#### 4. A Model with Endogenous Jumps due to Runs

Fernando Mendo, 2020, "Risky low-volatility environments and the stability paradox",  
<https://drive.google.com/file/d/1Nluz0cJKzVssFgazRKsxo9m-W6SNRUi/view>

#### 5. A Simple One Sector Money Model

\*Brunnermeier, Markus K. and Yuliy Sannikov, 2016, "On the Optimal Rate of Inflation",  
*American Economic Review* 106(5), pp. 484-489.

#### 6. Cash versus Cashless Economy

Lecture Notes: [https://www.dropbox.com/s/r7ek4cy59nda2fp/EC0529\\_Notes.pdf?dl=0](https://www.dropbox.com/s/r7ek4cy59nda2fp/EC0529_Notes.pdf?dl=0)

#### 7. The I Theory of Money

\*Brunnermeier, Markus K. and Yuliy Sannikov, 2015, "The I Theory of Money".(see website)

Drechsler, Itamar, Alexi Savov and Philipp Schnabl, 2015, "A Model of Monetary Policy and Risk Premia", *Journal of Finance*.

#### 8. Welfare

Lecture Notes: [https://www.dropbox.com/s/r7ek4cy59nda2fp/EC0529\\_Notes.pdf?dl=0](https://www.dropbox.com/s/r7ek4cy59nda2fp/EC0529_Notes.pdf?dl=0)

#### 9. Real International Models with Pecuniary Externalities and Sudden Stops

\*Brunnermeier, Markus K. and Yuliy Sannikov, 2015, "International Credit Flows and Pecuniary Externalities", *American Economic Journal: Macro*. 7(1): pp. 297-338.

Dávila, Eduardo, and Anton Korinek, 2017, "Pecuniary Externalities in Economies with Financial Frictions.", *The Review of Economic Studies*, 85 (1): pp. 352-395.

Lorenzoni, Guido, 2008, "Inefficient Credit Booms", *The Review of Economic Studies*, 75 (3): pp. 809-833.

Bianchi, Javier, 2011, "Overborrowing and systemic externalities in the business cycle." *American Economic Review*, 101 (7): pp. 3400-3426.

Bianchi, Javier, and Enrique G. Mendoza, 2018, "Optimal time-consistent macroprudential policy", *Journal of Political Economy*, 26(2): pp. 588-634.

## 10. International Monetary System and Safe Assets

\*\*Brunnermeier, Markus K. and Yuliy Sannikov, 2019, "International Monetary Theory: A Risk Perspective". (see website).

Brunnermeier, Markus K. et al., 2018, "The Sovereign-Banking Diabolic Loop and ESBies", *American Economic Review Papers and Proceedings* 106.5, 106, 5, pp. 508-512

Brunnermeier, Markus K. and Linyang Huang, 2018, "A Global Safe Asset for and from Emerging Market Economies", working paper, see my website.

Acharya, Viral, Itamar Drechsler, and Philipp Schnabl, 2014, "A pyrrhic victory? Bank bailouts and sovereign credit risk." *The Journal of Finance* 69(6), pp. 2689-2739.

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas, 2017, "The Safe Asset Shortage Conundrum", *Journal of Economic Perspectives* 31(3), pp. 29-46.

Caballero, Ricardo J., and Arvind Krishnamurthy, 2008, "Collective risk management in a flight to quality episode." *The Journal of Finance* 63(5), pp. 2195-2230.

Farhi, Emmanuel, and Matteo Maggiori, 2017, "A Model of the International Monetary System", *The Quarterly Journal of Economics* 133(1), pp. 295-355.

Farhi, Emmanuel, and Jean Tirole, 2017, "Deadly embrace: Sovereign and financial balance sheets doom loops." *The Review of Economic Studies* 85 (3), pp. 1781-1823.

Gennaioli, Nicola, Alberto Martin, and Stefano Rossi, 2014, "Sovereign default, domestic banks, and financial institutions." *The Journal of Finance* 69(2), pp. 819-866.

Dang, Trivi, Gary Gorton, and Bengt Holmström, 2015, "The Information Sensitivity of a Security". Working Paper.

Maggiori, Matteo, 2017, Financial Intermediation, International Risk Sharing, and Reserve Currencies, *American Economic Review* 107(1), pp. 3038-3071.

Brunnermeier, Markus K., Pierre-Olivier Gourinchas, and Oleg Itskoki, "Consumption-Led Growth", working paper.

## 10. Digital Money

Brunnermeier, Markus K., Harold James and Jean-Pierre Landau, 2019, "The Digitalization of Money", (see also "Digital Currency Areas" <https://voxeu.org/article/digital-currency-areas>).

Brunnermeier, Markus K. and Jonathan Payne, 2020, “Money, Credit, and Platforms”.

11. Machine Learning and Macromodels (optional guest lecture)

Fernandez-Villaverde, Jesus, Samuel Hurtado and Galo Nuno, 2019, “Financial Frictions and the Wealth Distribution”, working paper.

Duarte, Victor, 2018, “Machine Learning for Continuous Time Economics”, working paper

**Additional Course Material:**

Additional course material (if necessary) and lecture slides will be made available on jointly shared Google Drive.

**Teaching Assistant:**

Main TA:

Contact person at participating university

Princeton’s TA’s Name:

Sebastian Merkel

Office:

online

E-mail:

[smerkel@princeton.edu](mailto:smerkel@princeton.edu)

- The preceptors’ job is to act as a catalytic in that process. Please **ask** him when something is not clear – if you did not understand something, the odds are that somebody else did not either.

# Solving MacroModels Step-by-Step

0. Postulate aggregates, price processes & obtain return processes
1. For given SDF processes *static*
  - a. Real investment  $\iota$ , (portfolio  $\theta$ , & consumption choice of *each agent*)
    - *Toolbox 1*: Martingale Approach
  - b. Asset/Risk Allocation *across types/sectors* & asset market clearing
    - *Toolbox 2*: “price-taking social planner approach” – Fisher separation theorem
2. Value functions *backward equation*
  - a. Value fcn. as fcn. of individual investment opportunities  $\omega$ 
    - *Special cases*
  - b. De-scaled value fcn. as function of state variables  $\eta$ 
    - *Digression*: HJB-approach (instead of martingale approach & envelop condition)
  - c. Derive  $\zeta$  price of risk,  $C/N$ -ratio from value fcn. envelop condition
3. Evolution of state variable  $\eta$  *forward equation*
  - *Toolbox 3*: Change in numeraire to total wealth (including SDF)
  - (“Money evaluation equation”  $\mu^\theta$ )
4. Value function iteration & goods market clearing
  - a. PDE of de-scaled value fcn.
  - b. Value function iteration by solving PDE