ECON 605 - Macroeconomic Theory II

Instructor: Vincenzo Quadrini (quadrini@usc.edu)

TA: Diego Vilan (diegovilan@gmail.com)

Class meetings: Tuesday and Thursday, 12:00-1:30, KAP 134

Objective: The main objective of the course is to learn some of the most common tools used in the analysis of general equilibrium models applied to study the macro-economy. Special emphasis will be placed on tools used to bring the models to the data. Although the main focus is macroeconomics, some of the tools are also used in finance to study asset price issues.

Requirement: There will be a number of problem sets, approximately one for each topic. Some of the problem sets require the use of a mathematical software like `Matlab` or `Gauss`. There will be also a final exam.

I. Preliminary review

We start reviewing dynamic programming and some of the key general equilibrium notions. Since these topics have been covered in ECON 505, the review will be brief. Yet, having a review will be helpful since the main concepts of dynamic programming and general equilibrium will be used repeatedly throughout the course. However, if there are students who have not taken ECON 505, I will try to arrange a way for them to catch up.

References

- Ljungqvist, L and Sargent, T. J. (2004). *Recursive Macroeconomic Theory*, MIT Press, Chapters 3, 4, 8, 12.

II. Two workhorse models: Lucas' tree and RBC

We study the two workhorse models used in finance and macroeconomics: The Lucas' tree model and the Real Business cycle model. The key difference between these two models is the endogeneity of production. While in the Lucas' tree model production is purely exogenous, that is, it does not depend

on the agents' decisions, in the RBC model production is endogenous and it depends on the accumulation of capital and on the labor decision of individual agents. The Lucas' tree model is the basic framework used to study asset prices. A large body of asset price theory builds upon and extends the basic structure of this model. The RBC model is the basic framework for studying the business cycle. Most of the models used to study the business cycle can be seen as extensions of the RBC framework. Once we understand the key elements of these two models, it will be easier to understand a large set of models used in asset price and business cycle studies. We will see some of these extensions later in the course. Students who are taking or plan to take finance courses in asset prices will find the analysis of the Lucas' tree model repetitive. However, we will not spend to much time on it.

References

- Ljungqvist, L. and Sargent, T. J. (2004). *Recursive Macroeconomic Theory*, MIT Press, Chapters 12, 13.

- Cooley, T. F. (1995). *Frontiers of Business Cycle Research*, Princeton University press, Chapter 1.

III. Numerical approximation

This part of the course deals with numerical methods to solve macroeconomic models. A large set of models used in macroeconomics are quite complex and do not have a closed form solution. Therefore, in order to bring them to the data and studying their quantitative properties, we need to find approximate solutions. We first study the linear approximation technique. Because of its simplicity, this technique is widely used in macroeconomic studies. Unfortunately, the linear approximation ignores the impact of 'risk' on agents' decision. Because risk is central for portfolio choices, we cannot use this technique to study asset prices. Therefore, we will briefly review some more complex (non-linear) approximation techniques that can account also for risk. Of course, a complete coverage of numerical techniques would require a full course. Therefore, the coverage is limited to the most common techniques.

References

- Heer, B. and Maussner, A. (2005). *Dynamic General Equilibrium Modelling*, Springer, First Edition, Chapters 2, 4.

- Heer, B. and Maussner, A. (2009). *Dynamic General Equilibrium Modeling*, Springer, Second Edition, Chapters 2, 6.

- Handout distributed in class.

IV. Calibration and structural estimation

In this part of the course we learn how to bring a model to the data. There are many approaches we can use but we will focus on two: 'calibration' and 'structural estimation'. As far as macroeconomic models are concerned, calibration has been the most common approach used in the literature. Most recently, however, structural estimation has become more popular. We will consider the structural estimation based on maximum likelihood. We will also deal with Bayesian structural estimation. This is probably the most involved part of the course since it combines the tools we have developed so far with tools that are usually covered in econometrics (construction of the likelihood function, Kalmar filter, variance decomposition, etc.).

References

- Canova, F. (2007). *Methods for Applied Macroeconomic Research*, Chapters 7, 9, 11.

- Cooley, T. F. (1995). *Frontiers of Business Cycle Research*, Princeton University press, Chapter 1.

- Hamilton, J. D. (1994). *Time Series Analysis*, Princeton University Press, Chapter 5 (Sections 5.1-5.6, 5.8), Chapter 11 (Section 11.5), Chapter 13 (Sections 13.1-13.4).

- An, S. and Schorfheide, F. (2007), Bayesian Analysis of DSGE Models, *Econometric Reviews*, 26(2-4), 113-72.

- Handout distributed in class.

V. The New-Keynesian framework

Now that we know the tools with which we can solve a model numerically and bring it to the data, we start looking at models that deviate from the neoclassical apparatus. We start with the New-Keynesian model. This is the

most popular model used to study issues related to monetary policy. The NK model shares the key ingredients of the RBC model but it contains important new ingredients. In addition to having nominal variables, it assumes that prices are sticky. Some versions of the NK models are quite complex. In addition to nominal price rigidities, they consider competitive monopolistic producers, wage stickiness, costly adjustment costs in investment, endogenous capacity utilization. Especially interesting is the adjustment cost in investment. Because of the adjustment cost, the model can generate fluctuations in the market price of existing capital. This price is often interpreted as capturing the value of the stock market. Therefore, the model has some interesting implications for asset prices. The model is also related to the Q-theory of investment, another popular topic in finance.

References

- Gali, J. (2008). *Monetary Policy, Inflation, and the Business Cycle*, MIT Press, Chapter 1-4, 6.

VI. Adding financial frictions

All the models considered so far assume complete markets and the financial sector does not play a crucial role. In this part of the course we will consider some of the most common approaches that can be used to introduce financial frictions in macroeconomic models. We will look at two approaches: information asymmetries and collateral or enforcement constrains.

References

- Bernanke, B. and Gertler, M. (1989). Agency Costs, Net Worth, and Business Fluctuations, *American Economic Review*, 79 (1), pp. 14-31.

- Bernanke, B., Gertler, M., Gilchrist, S. (1999). The Financial Accelerator in a Quantitative Business Cycle Framework, *Handbook of Macroenomics*, North Holland, Volume 1C, Chapter 21, pp. 1341-96.

- Kiyotaki, N. and Moore, J. H. (1997). Credit Cycles, *Journal of Political Economy*, 105(2), pp. 211-48.

- Jerman, U. and Quadrini, V. (2009). Macroeconomic Effects of Financial Shocks, NBER Working Paper # 15338.

VII.   Introduction to heterogeneity in macroeconomics

Conditional on time availability, the last part of the course provides an introduction to models with heterogeneous agents. We will consider two types of heterogeneity: overlapping generations and heterogeneity is asset holdings when agents face uninsurable idiosyncratic risks.

References

- Ljungqvist, L and Sargent, T. J. (2004). *Recursive Macroeconomic Theory*, MIT Press, Chapters 9, 16, 17.

- Aiyagari, S. R. (1994). Uninsured Idiosyncratic Risk and Aggregate Saving, *Quarterly Journal of Economics*, CIX(3), pp. 659-84.

- Huggett, M. (1993). The Risk Free Rate in Heterogeneous-Agents, Incomplete Markets Economies, *Journal of Economic, Dynamics and Control*, 17(5/6), pp. 953-70.

- İmrohoroğlu, A. (1989), Cost of Business Cycles With Indivisibilities and Liquidity Constraints, *Journal of Political Economy*, 97(6), pp. 1364-83.

- Krusell, P. and Smith, A. A. (1998). Income and Wealth Heterogeneity in the Macroeconomy, *Journal of Political Economy*, 106(5), pp. 867-896.