Macroeconomics 4

Module 4, 2017-2018

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Course description

This is the forth part of the sequence of macroeconomics courses at NES. The goal of this module is to introduce the students to the microeconomic foundations of aggregate demand. The course will cover the basic theories of consumption, investment and capital markets. We will start with a baseline model (life cycle/permanent income hypothesis for consumption, Tobin's q-theory for investment and CAPM/CCAPM theory for asset pricing) and study when and why these basic theories fail empirical tests. After that we will consider extensions and modifications of the baseline model which are more successful in replicating the data.

Course requirements, grading, and attendance policies

There will be a midterm quiz (30% of the final grade, 1.5 hours, closed book, exits are not allowed, questions are allowed) and a final exam (70% of the final grade, 3 hours, A4, exits are not allowed, questions are allowed). Passing the course requires all students to take two exams (at their regularly scheduled times), unless an exam is missed for a documented reason approved by NES administration. There will be also several homework assignments during the course, which will not be graded.

Course contents

1. **Consumption**

    (a) The Life Cycle/Permanent Income Hypothesis

    (b) Consumption under uncertainty: Random Walk Hypothesis

    (c) Empirical applications: excess smoothness and excess sensitivity of consumption

    (d) Extensions: precautionary saving, liquidity constraints, time inconsistent preferences, habit formation, durable goods

2. **Asset pricing**

    (a) CAPM and Consumption CAPM

    (b) Lucas model of asset pricing

    (c) Stock prices and equity premium puzzle

    (d) Term structure of interest rates

3. **Investment**

    (a) A model of investment with adjustment costs, Tobin's q, its empirical testing, Hayashi conditions

    (b) Extensions: non-convex adjustment costs, fixed costs

    (c) Investment under uncertainty, irreversible investments and real options

    (d) The Modigliani-Miller theorem

    (e) Financial market imperfections and investment, the role of asymmetric information

Sample tasks for course evaluation

Problem 1. Durable goods PIH

(problem from Ivan Werning)

    Suppose that consumers have the following preferences over durable goods (there are no non-durables in this exercise):

$$E_0 \sum_{t=0}^{\infty} \beta^t u(S_t) \tag{1}$$

where $S_t = (1 - \delta)S_{t-1} + c_t$ and S_t is the stock of durables and c_t is the purchase of new durables. Consumers have access to a financial market with no borrowing constraints. Labor income y_t is the only source of uncertainty, the interest rate is constant and equal to r, so $A_{t+1} = (1 + r)(A_t + y_t - c_t)$.

1. Show that the budget constraint and the accumulation equation imply that:

$$\tilde{A}_{t+1} = (1 + r)\left(\tilde{A}_t + y_t - S_t\left[1 - \frac{1 - \delta}{1 + r}\right]\right) \tag{2}$$

where $\tilde{A}_t = A_t + S_{t-1}(1 - \delta)$. You can interpret $1 - \frac{1 - \delta}{1 + r}$ as the shadow cost of renting a unit of a durable good and $\tilde{A}_t$ as a total net wealth.

Write out the maximization problem the agent faces in terms of $\tilde{A}_t$. Show that the first order condition for optimality is:

$$u'(S_t) = \beta R E_t u'(S_{t+1}) \tag{3}$$

2. Show that if u is quadratic and $\beta(1 + r) = 1$ then (3) implies that, $\Delta c_t = u_t - (1 - \delta)u_{t-1}$, i.e. the innovations in consumption have a MA(1). Compare with the Random Walk hypothesis for the model with non-durable goods. Interpret.

Problem 2. Lucas tree model.

Consider an economy with a representative agent, in which a random amount of perishable output y_t falls from a fruit tree each period t. Output follows the stochastic process: $\log y_t = \log y_{t-1} + \epsilon_t$, where the i.i.d. shock ϵ_t is drawn from a normal distribution $N(0, \sigma^2)$. The agent maximizes her expected lifetime utility function: $E_t\left\{\sum_{s=t}^{\infty} e^{-\theta(s-t)} u(c_s)\right\}$, where $\theta > 0$ is the rate of time preference. Assume that there is a competitive stock market in which people can trade shares in the fruit tree, whose price on date t is p_t. This is the ex-dividend price: if you buy a share on date t, you get your first dividend on date $t + 1$.

1. Show that the agent will choose optimal contingent consumption plans such that on each date: $p_t u'(c_t) = e^{-\theta} E_t\left\{(y_{t+1} + p_{t+1})u'(c_{t+1})\right\}$. Interpret this equation.

2. Show that in equilibrium, the fundamental price of the tree is:
   $p_t = E_t\left\{\sum_{s=t+1}^{\infty} e^{-\theta(s-t)} \frac{u'(y_s)}{u'(y_t)} y_s\right\}$. Interpret this equation.

3. Let $u(c) = c^{1-\gamma}/(1-\gamma)$ for $\gamma > 0$. Show that the normality and i.i.d. assumptions for shocks ϵ_t imply for all $s > t$: $E_t\{y_s^{1-\gamma}\} = y_t^{1-\gamma} e^{\frac{\sigma^2(1-\gamma)^2}{2}(s-t)}$. (Hint: use the properties of log-normal distribution; if $\epsilon \sim N(\mu, \sigma^2)$, then e^{ϵ} has a log-normal distribution with $E(e^{\epsilon}) = e^{\mu + \frac{1}{2}\sigma^2}$.)

4. Deduce from part (3) that if $\theta > \sigma^2(1-\gamma)^2/2$, then $p_t = \kappa y_t$. Compute κ and interpret this equation.

Course materials

Required textbooks and materials

1. Romer, David, *Advanced Macroeconomics*, McGraw-Hill/Irwin, 4th ed., 2011

2. Blanchard, Oliver J. & Fischer, Stanley, *Lectures on Macroeconomics*, The MIT Press, 1989

Additional materials

1. Ljungqvist, Lars & Sargent, Thomas J., *Recursive Macroeconomic Theory*, The MIT Press, 2nd ed., 2004

2. Attanasio, Orazio P., *Consumption*, in J.B. Taylor & M. Woodford (eds.), *Handbook of Macroeconomics*, Elsevier Science, 1999

3. Caballero, Ricardo J., *Aggregate Investment*, in J.B. Taylor & M. Woodford (eds.), *Handbook of Macroeconomics*, Elsevier Science, 1999

4. Campbell, John Y., *Asset Prices, Consumption and the Business Cycle*, in J.B. Taylor & M. Woodford (eds.), *Handbook of Macroeconomics*, Elsevier Science, 1999

Academic integrity policy

Cheating, plagiarism, and any other violations of academic ethics at NES are not tolerated.