

Written Exam for the B.Sc. in Economics winter 2015

Macro B

Final Exam

February 17 2015
(3 hours closed-book exam)

Please note that the language used in your exam paper must correspond to the language of the title for which you registered during exam registration. *I.e.* if you registered for the English title of the course, you must write your exam paper in English. Likewise, if you registered for the Danish title of the course or if you registered for the English title which was followed by “eksamen på dansk” in brackets, you must write your exam paper in Danish.

This exam question consists of 6 pages in total

All questions of both problems should be answered

Problem A

In this exercise you are invited to analyze aspects of the interaction between mandatory pensions savings and consumption in the context of the standard two-period model for private consumption known from the text book.

Consider a representative household that lives for two time periods; period 1 (working life) which is the current period and period 2 which is the future retirement period. Utility is obtained from consumption in the two periods, *i.e.* C_1 and C_2 and the household's preferences may be written as

$$U = u(C_1) + \frac{1}{1+\phi}u(C_2), \quad \text{where } \phi > 0, u' > 0, u'' < 0 \quad (\text{A.1})$$

The household receives a lump sum income Y_t and pay net taxes T_t which are also lump sum in the two periods, $t = 1, 2$. Furthermore, initial household wealth is V_1 . The market for capital is assumed to be perfect so that the household is able to transfer income between the two periods at the going (real) interest rate, r .

The household's budget constraint for period 1 is

$$V_2 = (1+r)(Y_1 - T_1 + V_1 - C_1) \quad (\text{A.2})$$

and the budget constraint for period 2 is

$$C_2 = V_2 + Y_2 - T_2. \quad (\text{A.3})$$

1. Describe the households preferences given by equation (A.1). Why do these preferences foster consumption smoothing? How does ϕ affect the allocation of consumption over time?
2. Interpret equation (A.2) and equation (A.3). Show that (A.2) and (A.3) can be combined into the household's intertemporal budget constraint

$$\begin{aligned} C_1 + \frac{C_2}{1+r} &= Y_1 - T_1 + \frac{Y_2 - T_2}{1+r} + V_1 = H_1 + V_1, \\ \text{where } H_1 &= Y_1 - T_1 + \frac{Y_2 - T_2}{1+r}. \end{aligned} \quad (\text{A.4})$$

Interpret the resulting equation (A.4). Describe H_1 . Finally, explain that an optimizing household solves the problem:

$$\begin{aligned} \max_{C_1, C_2} U &= u(C_1) + \frac{u(C_2)}{1 + \phi} \\ \text{st.} & \\ C_1 + \frac{C_2}{1 + r} &= Y_1 - T_1 + \frac{Y_2 - T_2}{1 + r} + V_1 \end{aligned} \tag{M.1}$$

Throughout the remaining questions we assume $T_1 = T_2 = V_1 = 0$. Also, you may assume Y_2 is "small" compared to Y_1 and that the optimal total savings in period 1 are positive.

3. Show that the first-order condition for solving the households' maximization problem is

$$\frac{u'(C_1)}{u'(C_2)} = \frac{1 + r}{1 + \phi}. \tag{A.5}$$

Interpret (A.5). How is the ratio C_2/C_1 affected by a) an increase in ϕ and b) an increase in r . Explain. Illustrate the solution of the consumers problem (M.1) in a diagram where you have C_1 at the first axis and C_2 at the second axis. In the chart also illustrate total savings in period 1. Explain that $0 < \partial C_1 / \partial Y_1 < 1$. Explain in a few words that it is reasonable to expect that total savings are positive if Y_2 is "small" compared to Y_1 . In your answer you may assume that $r = \phi$. Finally, explain and illustrate why the existence of capital markets is welfare improving.

Now assume households differ only with respect to the income flow. To be specific, households may be divided into two segments. One group currently earns a relatively high income Y_1^H whereas the other group has an income that is relatively low in the current period, $0 < Y_1^L < Y_1^H$. Otherwise consumers are identical. In particular, both groups have the same amount of human capital so that $H_1^H = H_1^L$.

4. Explain the implicit assumption on Y_2 for the two groups and explain why both groups face the same intertemporal budget constraint. Which income group has the largest average propensity to consume in period 1? Is this in accordance with the empirical observations cited in the textbook?

We now introduce a mandatory pension scheme. Assume that a fraction $0 \leq a < 1$ of period 1 income Y_1 is transferred to a mandatory pension scheme. Accordingly, mandatory pension savings in period 1 is

$$PS_1 = aY_1. \quad (\text{A.6})$$

Households may choose to make additional savings during period 1 so that total household savings is given as the sum of mandatory pension savings and voluntary (so-called "free" savings). To simplify the analysis both "free" savings and pension savings are assumed to earn an interest rate of r during period 1 (so that the accumulated household pension savings stemming from the mandatory pension scheme when entering period 2 is $(1 + r)PS_1$).

Furthermore, households are assumed to be identical in all but one aspects; the ability to borrow against mandatory pension savings. Households may be segmented into two groups called A and B . To be specific:

- Household A : May borrow against savings stemming from the mandatory pension scheme (*i.e.* for these households capital markets are perfect)
- Household B : Pension savings cannot be borrowed against (*i.e.* for these households capital markets are imperfect. Hence, potential period 1-consumption is reduced with the payments made into the pension scheme).

Notice; in the following you are *not* asked to modify the budget constraints for the households in order to encompass this. Instead you are supposed to use the framework already established in questions 1-4 and to illustrate in a diagram with C_1 on the first axis and C_2 on the second axis.

5. Illustrate the solution to household A 's maximization problem. In particular, the illustrate and comment on the interaction between voluntary (or "free") savings and mandatory pension savings. Does an increase in the pension contribution rate affect the household's optimal consumption. Explain.
6. Illustrate the solution to household B 's maximization problem. In particular, illustrate and comment on the interaction between voluntary (or "free") savings and mandatory pension savings. Does a change in the mandatory pension scheme affect consumption? Is it possible that the households are

forced into "oversaving" in period 1 due to the mandatory pension scheme? Illustrate and explain. Compare your answer to this question to your answer to question 5.

7. Assume that the pension system given by equation (A.6) is introduced and that pension savings cannot be borrowed against for all households (*i.e.* household B in the above is the general case). How does this affect the intertemporal budget constraint for the two groups? Illustrate how this affects the intertemporal budget constraint for the two groups of consumers. Based on this, how do you think the consumption of low and high income groups is affected by an increase in a ? Illustrate. When answering, comment on the effect on free savings.

Problem B

1. In three sentences or less, what is the Taylor principle?
2. Define the real exchange rate and explain the meaning of a real appreciation.
If a country experiences an appreciation of the real exchange rate, do you get more or less foreign goods in exchange for a domestic good?
3. Under perfect capital mobility, the domestic nominal interest rate must equal the foreign nominal interest rate. True or false? Why?