

Suggested answers for written Exam for the B.Sc. in Economics winter 2013

Macro B

Final Exam

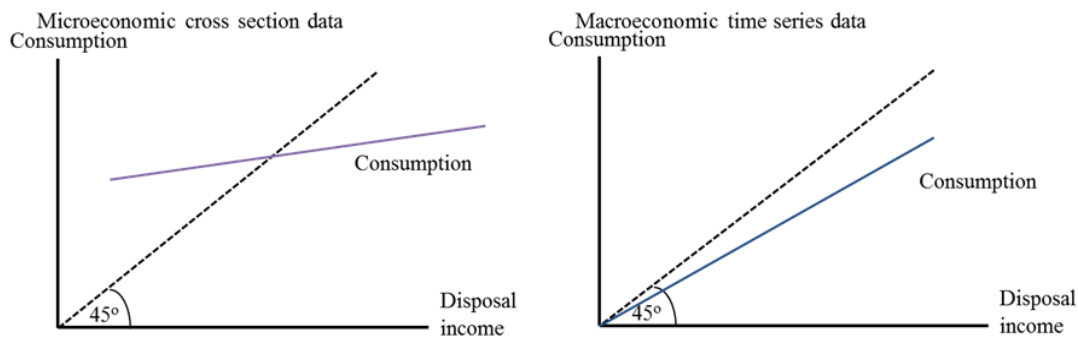
February 18 2013
(3 hours closed-book exam)

Academic Aim: The aim of the course is to describe and explain the macroeconomic fluctuations in the short run, i.e. the business cycles around the long run growth trend, as well as various issues related to this, and to teach the methodology used in formulating and solving formal models explaining these phenomena. Students are to learn the most important stylized facts about business cycles and to acquire knowledge about theoretical dynamic models aimed at explaining these facts. In connection with this, the aim is to make students familiar with the distinction between deterministic and stochastic models. Furthermore, students are to gain an understanding of the distinction between the impulses initiating a business cycle and the propagation mechanisms that give business cycles a systematic character. Finally students are to learn how to use the models for analyzing the effects of macroeconomic stabilization policy under various assumptions regarding the exchange rate regime. To obtain a top mark in the course students should at the end of the course be able to demonstrate full capability of using the techniques of analysis taught in the course as well as a thorough understanding of the mechanisms in the business cycle models for open and closed economies, including the ability to use relevant variants and extensions of the models in order to explain the effects of various shocks and the effects of macroeconomic stabilization policies under alternative monetary and exchange rate regimes.

Problem A

1. Theoretically there is no reason to believe that consumption should depend only on current income. On the contrary, there is reason to believe that for example expectations regarding future (disposal) income also plays a role for current consumption.

When it comes to empirical evidence, microeconomic cross section data suggest that the average propensity to consume falls as current disposal income goes up. This is in accordance with Keynesian theory. But macroeconomic time series data show that the average propensity to consume does not systematically fall as income rises over time. Instead the average propensity to consume seems roughly constant. This could be illustrated in the following way



A satisfactory theory should be consistent with the microeconomic cross section data as well as with the macroeconomic time series data.

2. By assumption, lifetime utility is a weighted sum of utility in the two periods. For both periods the utility function u is identical so preferences are assumed to remain unchanged over the entire lifespan. According to the assumptions the marginal utility of consumption in each period is positive, but diminishing. This provides an incentive for consumption smoothing. ϕ is the rate of time preference which measures the consumer's impatience as utility stemming from consumption in period 2 is discounted using ϕ as a discount factor. If $\phi > 0$ current consumption is valued higher than future consumption. The positive rate of time preference means that if $C_1 = C_2$

then $u(C_1) > u(C_2)/(1 + \phi)$. Hence, an additional unit of consumption in the current period is valued more highly than an additional unit of consumption in the future.

The consumer's intertemporal budget constraint (IBC) states that the present value of total consumption equals the present value of disposable lifetime income plus the initial stock of wealth. The numerical value of slope of the consumer's IBC is $(1 + r)$ which is the market rate for shifting consumption across periods. By assumption, capital markets are perfect. Consumers can borrow and lend as they like to the going (real) interest rate r which is identical for borrowers and lenders. Consumers earn an income in both periods. The theory does not describe how this income come about, instead it is taken as given. Net-taxes are lump-sum and are taken as given. The same goes for initial wealth V_1 .

3. Technically, the consumer's maximization problem (M.1) may be solved by using either the Lagrange or the substitution method. By substitution the consumer's problem may be reformulated as

$$\max_{C_1} U = u(C_1) + \frac{u\left([1 + r] \left[Y_1 - T_1 + \frac{Y_2 - T_2}{1 + r} + V_1 - C_1\right]\right)}{1 + \phi}$$

When solving this problem the following first-order condition is found

$$\frac{dU}{dC_1} = 0 \implies u'(C_1) = \frac{1 + r}{1 + \phi} \overbrace{u'\left([1 + r] \left[Y_1 - T_1 + \frac{Y_2 - T_2}{1 + r} + V_1 - C_1\right]\right)}^{C_2}$$

from which we have

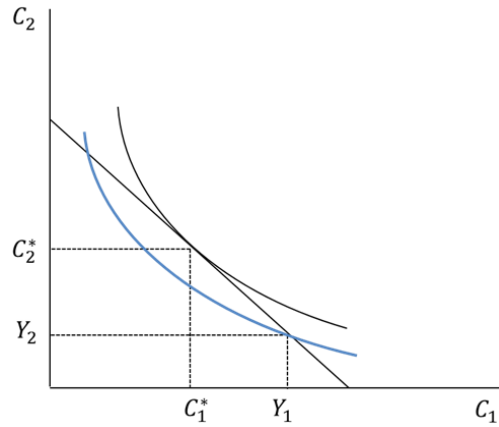
$$-\frac{dC_2}{dC_1} = \frac{u'(C_1)}{u'(C_2)/(1 + \phi)} = 1 + r. \quad (\text{A.1})$$

(A.1) states that in optimum the consumer is indifferent between consuming an extra unit today and saving an extra unit today. The left-hand side is the marginal rate of substitution, MRS, which expresses how much utility decreases today relative to the increase in future utility if an infinite small part of today's consumption is postponed to the future. The marginal rate of substitution between present and future consumption (the left-hand side)

must equal the relative price of present consumption (the right-hand side). Also, it follows directly from the characteristics of the utility function u that C_2 is increasing in r and declining in ϕ .

For $r = \phi$ optimization implies $C_1 = C_2$. In this situation the consumer will smooth consumption completely.

Capital markets makes it possible for the consumer to shift consumption between different phases in life. Consumption in a given period is not restricted completely by income in this period. Instead the consumer may trade consumption between the periods at a given market rate. This makes it possible for the consumer to obtain higher utility (illustrated in the figure below where the optimal consumption stream is at a higher indifference curve than the indifference curve going through the income stream (Y_1, Y_2)). An illustration may be the following.



4. A decrease in initial wealth shifts the budget constraint inwards in the diagram as total wealth is reduced. This lowers consumption in both periods as the consumer smooth consumption. Thus the decrease in current consumption will be smaller than the decrease in initial wealth. This is also the case if Y_1 is reduced. Due to the consumption smoothing only the lowering of current income current is only partially reflected in current consumption. Hence, the reduction in C_1 is smaller than the reduction in Y_1 .

In case c, incomes in both periods is reduced by the same amount as income is reduced in period 1 in case b. Hence, life income is lower in scenario c than

in scenario b. Accordingly the effect on current consumption is stronger in scenario c.

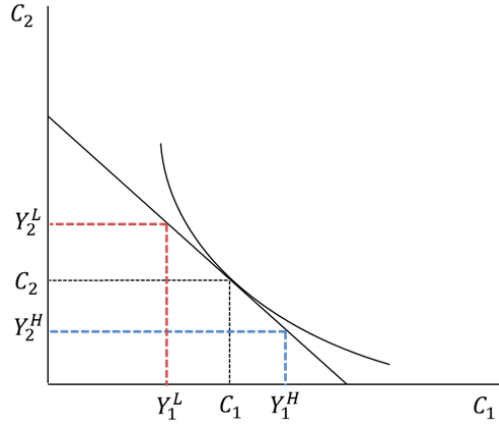
5. Consumers of both groups face the same intertemporal budget constraint (IBC) as they have the same total wealth. Consumers who currently have a relative high income will have a relatively low income in the next period and vice versa. And by assumption total wealth (i.e. the present value of income streams) is identical. So the only difference between the two income groups is related to the timing of high vs. low incomes. Formally we may back out the precise relationship between incomes by assuming that $Y_1^H = Y_1^L + \Delta$ so that the high income group currently earn an income which is Δ higher than the low income group. From the assumptions that both groups have the same human capital ($H^H = H^L$), and initial wealth, V_1 , it follows that

$$\begin{aligned}
H^H &= Y_1^H + \frac{Y_2^H}{1+r} = Y_1^L + \frac{Y_2^L}{1+r} = H^L \\
\Downarrow \\
Y_1^L + \Delta + \frac{Y_2^H}{1+r} &= Y_1^L + \frac{Y_2^L}{1+r} \\
\Downarrow \\
\Delta &= Y_1^H - Y_1^L = \frac{1}{1+r} (Y_2^L - Y_2^H)
\end{aligned}$$

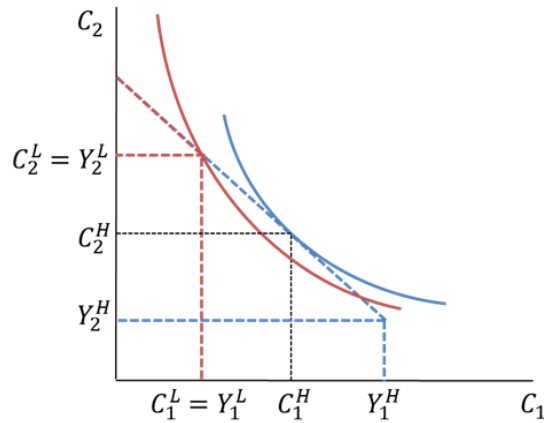
As both income groups have identical preferences they have identical indifference curves. Accordingly, the optimal consumption path is the same for both income groups assuming capital markets are perfect. It follows that the high-income group has the lowest average propensity to consume. Also both income groups choose to smooth consumption between the two periods that an increase in current income is only in part gives rise to higher consumption in the current period. Hence the marginal propensity is below 1 for both groups.

The optimal consumption path (C_1, C_2) is identical across income groups. This follows from the fact that both preferences and the IBC is identical across income groups and the assumption that capital markets are perfect so that consumers may borrow or lend as much as they like at a given real interest rate no matter the current income. Hence the low income group

has the highest average propensity to consume in the current period. (Same consumption but lower income). This is in line with empirical observations from microeconomic cross section data. An illustration could look like.



6. With a binding liquidity constraint, the solution to the consumer's problem is a corner solution. Current consumption is restricted by current (disposal) income C_1^L falls when Y_1^L falls and the marginal propensity to consume is equal to 1. This is illustrated in the figure below where the budget constraint and the indifference curve defining the optimal consumption for the credit constrained consumer is shown by the red lines/curves whereas the budget constraint and optimal indifference curve for the unconstrained high income consumer is drawn in blue.



In this situation, the correlation between C and Y looks like a Keynesian

consumption function. Thus, when capital markets are imperfect the model may lead to a consumption function that looks Keynesian. Again, the low-income group has the highest average propensity to consume. Although both income groups face the same lifetime real income (human and initial wealth) the low-income group will have a lower lifetime utility due to capital market imperfections which hinders them from smoothing consumption across periods.

7. This question asks the student to draw conclusions from the analysis above.

First of all the analysis in question 4 showed that changes in initial wealth affects current consumption. The effect on current consumption is muted thanks to the consumption smoothing effects. Though not shown in the analysis asked for this effect is also present in case credit constraints exists in the form used in this exercise.

Second, if banks etc. become increasingly reluctant to give loans the effect on consumption will be amplified further. The analysis in question 6 showed that the aggregate consumption may increasingly look like a Keynesian consumption function if credit constraints are in effect.

The student may notice that in case housing wealth is part of collateralizable wealth then a downturn in the housing market may restrict consumers even more from borrowing. Hence the possibilities for consumption smoothing are narrowed. In connection to this it could be noted that housing prices depends on general incomes (a decline in incomes will also lead to lower house prices). This kind of reasoning is in line with the model for the housing market presented in the textbook.

The reasoning presented here may also be used in connection with a boom in the economy leading to a loosening of loan standards. Hence if loan standards are procyclical, so that standards are tightened when the economy is in a slump and loosened when the economy is booming, this may amplify the business cycle.

Problem B

1. In the union model labor, market imperfections results from the wage setting structure in the economy. Wages are set by a monopoly union striving to maximize utility given that firms then determine labor demand taking the wage level as given. This is called a Right to Manage model. When setting the wage level the union cares about the total rent accruing to the workers/members, *i.e.* through total employment and the gain from having a member employed earning a wage w which is higher than the alternative unemployment benefit, b . The real wage is set as a mark-up over the real rate of unemployment benefit. The size of the mark-up depends on how much the union cares about employment (lower wages if the union cares much about employment). Also, the size of the mark-up depends on how much employment reacts to changes in wages. This in turn depends on the price setting in the economy. If product markets are highly competitive a higher wage claim will have a large negative impact on employment/labor demand (as higher marginal costs in production and hence higher selling prices leads to a large decline in the amount sold). These labor and product market imperfections imply a structural unemployment which also depends positively on the generosity of the unemployment benefits.

In the efficient wage model imperfections arise as firms are not able to monitor perfectly and without costs the effort put into work by the employees. As a result, workers may shirk without being caught. In order to obtain the effort needed firms pay higher wages. Thereby it becomes more costly to get sacked in case you are caught shirking. Hence, the incentive to shirk is reduced which increase efficiency. Again the outside option plays a crucial role for the wage setting and ultimately employment. If the outside option which includes the possibility of having unemployment benefits instead of a wage income is attractive firms have to pay higher wage rate to make people work instead of shirk. This in turn affects labor demand. Hence again structural unemployment results.

It could be noted that both models results in AS curves witch have the same functional form.

2. It is sufficient to explain that fluctuations in employment leads to welfare

losses when the marginal product of labor (MPL) is declining and/or the marginal rate of substitution (MRS) which measures the additional income necessary to compensate the worker for the loss of leisure is increasing. Distortions means that $MPL > MRS$ so that the the amount necessary to compensate the worker for supplying the additional labor is exceeded by the additional amount of output produced by this additional labor. If in this situation an economic boom leading to an increase in employment is followed by a recession leading to an equally sized decline in employment (relative to structural employment), then the welfare gain during the boom is lower than the welfare loss during the recession. Accordingly fluctuations in employment leads to welfare losses.

It could be added that policy makers are concerned about fluctuations in output because for the following reason. Assuming consumers have declining marginal utility in consumption, the marginal utility gain from a given increase in consumption is lower than the marginal utility loss from an equally sized drop in consumption. As a consequence, consumers prefer to experience constant levels of consumption over time. That income is volatile over time does not exclude the possibility of consumers smoothing consumption by using private capital markets. However, if these are not perfect some consumers might find themselves unable to smooth consumption. In addition, problems of moral hazard and adverse selection may limit the scope for consumption smoothing through insurance markets.

It is socially desirable to stabilize inflation around a constant target value because it makes it easier for wage setters, consumers and firms to forecast inflation. A fluctuating inflation rate typically leads to unanticipated inflation, causing the ex post real interest rate and the ex post real wage to deviate from their ex ante expected levels. Because of these expectational errors, economic agents will make suboptimal decisions and hence experience lower welfare relative to a situation where actual inflation equals anticipations. Unanticipated inflation leads to an arbitrary redistribution of real income between lenders and borrowers and real wages deviate from target.

3. The uncovered interest parity (UIP) is essential when explaining the "impossible trinity". UIP which is a financial arbitrage condition (or rather

absence of arbitrage) whereby the return on domestically denominated financial assets is tied to the return on foreign denominated assets may be stated as

$$i = i^f + e_{+1}^e - e,$$

where i is the domestic interest, i^f is the interest rate abroad and $e_{+1}^e - e$ is the expected reduction in the value of the domestic currency. If investors are risk averse a risk premium is added. If the value of the domestic currency is expected to be reduced (and increase in e) the domestic interest rate has to be larger than the foreign interest rate so that the expected investment return is the same when measured in the same currency.

The "impossible trinity" may be shown by assuming that two of the three policy goals are upheld. Then the third can not be obtained.

If cross-border capital flows are free and the exchange rate is fixed then from the UIP it follows directly that $i = i^f$. Hence, monetary policy can not be independent. If $i < i^f$ capital will flow out of the domestic economy. Investors sell domestic denominated assets (and thereby domestic currency) and buy foreign denominated assets (and thereby foreign currency). The central bank has to sell foreign currency and buy domestic currency to maintain a fixed exchange rate. However eventually the foreign exchange reserves are exhausted and the central bank can not defend the exchange rate any more. If $i > i^f$ capital will flow into of the domestic economy. This creates a pressure for an appreciation of the domestic currency as the foreign reserve keep growing.

If cross-border capital flows are free and monetary policy is independent, $i \neq i^f$, then $e_{+1}^e \neq e$ which is at odds with a fixed exchange rate.

If monetary policy is independent, *i.e.* $i \neq i^f$ and the exchange rate is fixed $e_{+1}^e = e$ then UIP stresses that capital can not move freely across borders as it would take an infinite foreign exchange reserve to uphold a fixed exchange rate.