UNIVERSITY OF OSLO
DEPARTMENT OF ECONOMICS

Postponed exam: **ECON4330 – International Macroeconomics**

Date of exam: Monday, 13 June, 2016

Time for exam: 09:00 a.m. – 12:00 noon

The problem set covers 5 pages (incl. cover sheet)

Resources allowed:
- No written or printed resources – or calculator - is allowed (except if you have been granted use of a dictionary from the Faculty of Social Sciences)

The grades given: A-F, with A as the best and E as the weakest passing grade. F is fail.

EXAM
ECON 4330

A: Real Exchange Rates (50%)

Consider the model with tradable and non-tradable goods as in class but with two modifications. There is no capital and the production function in the non-tradable sector does decreasing returns to scale. To remind you: The country produces Y_T tradables and Y_N nontradables. Tradables can be imported and exported without any costs, while nontradables are impossible to export/import. Labor is mobile across sectors, but not across countries The tradable good is the numeraire. p is the relative price of nontradables. w is the wage rate. Output is assumed to be given by two production functions:

$$Y_T = A_T L_T \tag{1}$$

$$Y_N = A_N L_N^{\alpha}, \tag{2}$$

where L_T and L_N are labor inputs into the tradable sector and non-tradable sector respectively and $0 < \alpha < 1$. We assume a representative agent who chooses consumption C_T and C_N to maximize utility, for $0 < \gamma < 1$,

$$(\kappa C_T^{\gamma} + (1-\kappa) C_N^{\gamma})^{1/\gamma}$$

subject to the budget constraint $C_T + pC_N = wL + \Pi$, where L is inelastically supplied labor and Π are profits. In equilibrium $L = L_T + L_N$. Do not forget to explain results and provide the economic intuition.

1. Write down the household's optimization problem, derive the first order condition and derive the demand for tradable and nontradable goods.

2. Write down the firm optimization both for the traded and non-traded sector. Compute the equilibrium wage. What are profits in the tradable and non-tradable sector?

3. Use the result that the wage has to be the same in both sectors to derive the price p (as a function of L_N).

4. Derive domestic demand for the home good.

5. All non-tradable goods have to be produced at home, $C_N = Y_N = A_N L_N^\alpha$. Consider now the long run equilibrium where imports and exports of tradable good are zero as well so that $C_T = Y_T = A_T L_T$. Derive L_N first as a function of L_T and then use $L_T = L - L_N$ to derive L_N. Does L_N depend on demand or parameters of the utility function such as γ or κ? Is this different from the model in class? Explain why.

6. Now assume that the country discovers oil and sells it to the rest of the world for tradable goods so that $C_T = A_T L_T \lambda$ with $\lambda > 1$, that is the country can consume more tradable goods than it produces.

   (a) Derive the price p. Does the price depend on demand or parameters of the utility function such as γ or κ? Is this different from the model we used in class to study the real exchange rate? Explain why. Does the price depend on λ? Explain.

   (b) Derive L_N.

   (c) How does the oil discovery change L_N and the price of non-tradable. Provide also some intuition for your result.

B: Nominal exchange rates (50%)

An investor with financial wealth W_p is considering how to divide her investments between assets denominated in Norwegian(B_p) and in foreign currency(F_p). Her preferences between risk and return are described by:

$$\mathcal{E}(\pi) - \frac{1}{2} R var(\pi) \tag{3}$$

where π is the real rate of return and R is the degree of relative risk aversion and $\mathcal{E}$ is for expectation. Let

$$\pi = (1 - f)i + f(i_* + e) - p \tag{4}$$

$f = \frac{EF_p}{PW_p}$ = share of foreign currency in portfolio

i, i_* = Norwegian and foreign interests rate

e = rate of depreciation of the Norwegian krone (E is exchange rate)

$p =$ inflation rate in Norway (P is the price level)

The Variables e and p are stochastic with

Expectations μ_e and μ_p

Variances σ_{ee}, σ_{pp}

Covariance $\sigma_{ep} > 0$

1. Set up the investors maximization problem and find the optimal share held in foreign currency f.
   Hint: If X and Y are two stochastic variables, then

$$Var(aX + bY) = a^2Var(X) + b^2Var(Y) + 2abCov(X, Y)$$

2. Discuss how exchange rate risk, measured by σ_{ee}, and the covariance between the exchange rate and inflation, σ_{ep} affects the investors optimal share, f.

Lets look at the market for foreign currency assets. There is also a foreign investor who choose to invest in Norwegian(B_*) and in foreign currency(F_*) in the same way. He holds an optimal share of his wealth, W_*, in Norwegian bonds(b) such that

$(1 - b) = \frac{F_*}{P_*W_*}$

is the share held in foreign(non-Norwegian) assets. You can view b as constant for now. Norwegian and foreign investor initially hold wealth(denominated in their own currency) given by:

$W_p = B_{p0} + EF_{p0}$

$W_* = \frac{B_{*0}}{E} + F_{*0}$

All private initial holdings are positive, $B_{p0}, F_{p0}, B_{*0}, F_{*0} > 0$. The final actor in the foreign currency market is a government that supply a fixed amount of the foreign assets(F_g). The exchange rate, E, is determined in the market. Market clearing requires:

$$F_p + F_* + F_g = 0 \tag{5}$$

3. You can assume that $0 < f < 1$ and $0 < b < 1$. What does this imply for F_g?

4. Find an expression for the exchange rate E at initial wealth levels.

5. Assume that b is still constant and $r = i - i_* - e < 0$. Volatility in the foreign exchange market increase (σ_{ee} increase). How does this affect the exchange rate? Provide intuition for your answer.

6. Discuss how the effect on the exchange rate would be different if b was not constant, but the result of optimization in the same way as the Norwegian investor ($b = -\frac{\sigma_{ep*}}{\sigma_{ee}} + \frac{r}{R\sigma_{ee}}$). No math required in your answer.