Final Exam, May 3 — 4 questions. All sub-questions carry equal weight unless otherwise indicated.

1. (15%) Assume that Joe’s wage income follows the AR(2) process

\[ y_t = 3 + 0.9y_{t-1} + 0.1y_{t-2} + e_t \]  

where \( e_t \) is white noise with variance 3.

Assume Joe’s boss gave Joe a wage of 100$ period 0 and a salary of 50$ in period 1.

i) (5%) What is Joe’s expected wages in periods 2 and 3?

ii) (10%) If Joe’s boss give Joe a raise of 50$ in period 2, what would be Joe’s change in consumption if the rate of interest is 10%. (Assume the PIH holds.)

2. i) (5%) i) Explain what is meant by excess sensitivity of consumption. (Be precise about all assumptions.)

ii) (10%) Explain what is meant by excess smoothness of consumption.

3. (10%) Consider the CAPM-model. Assume the safe rate of interest is 3%, the mean return to the market portfolio is 5% and the variance of the return to the market portfolio is 0.02. Now consider assets D and E. For these we know the distribution of the pay-outs. For D the payout is normally distributed with mean 100 and variance 10, while for E the payout is normally distributed with mean 1000 and variance 5. Assume the covariance of the payout to asset D with the market return is 1 while the covariance of payout to asset E with the market return is 2. What would be the prices of assets D and E?

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4. (60%) Consider the case of a 3 agents (“Home,” “Foreign,” and “Really Foreign”), 2 periods, 2 states-of-the-world model where agents can trade using a full set of Arrow securities. Assume that all agents have quadratic utility functions $U(C_0) + \beta E_0 U(C_1)$, where $U(C_t) = C_t - \frac{1}{200} C_t^2$ and $\beta = \frac{1}{11}$. Assume that the endowment of the first agent is $y_0 = 3$, that of the second agent in period 0 is $y^*_0 = 3$, and that of the third agent $y^{**} = 6$.

The following table gives the possible endowments and the probabilities for Home, Foreign and Really Foreign:

<table>
<thead>
<tr>
<th>State of the world:</th>
<th>Home</th>
<th>Foreign</th>
<th>Really Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>period 1 endowment</td>
<td>2</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>probability:</td>
<td>.5</td>
<td>.5</td>
<td>.5</td>
</tr>
</tbody>
</table>

a) Find the prices of the Arrow-Debreu assets for each of the 2 states of the world.
b) Find the rate of interest.
c) Argue in economic terms why the interest rate is larger or smaller than 0 and larger or smaller than the discount rate.
d) Assume that now only bonds can be traded. Find the rate of interest?
e) Find the consumption in period 1 and period 2 of the Home agent. (If you write down one equation in one unknown, that is considered a full answer, don’t spend time on solving.)
f) Assume that now there again are Arrow-Debreu securities but $U(C) = \log(C)$. Find the prices of the Arrow-Debreu securities.
g) Find the rate of interest.
h) Find the consumption of all agents in all periods and all states of the world.
i) Assume that the agents only have access to a bond. State 3 equations in 3 unknowns that would determine the consumption of the agents and the interest rate. (The equations are messy to solve, so do not solve them.)
j) Assume now that agents have access to an Arrow-Debreu security that pays out one unit in state A and the agents also have access to a bond. Find the consumption of all agents in all states of the world. (Hint: If you think carefully about this, you may not have to do a lot of calculations.)