PROBLEM SET #2
Econ 308, Money and Banking

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Exercise 1 (40 pts)

Assume that the annual interest rate is 7.5%. Your assets are as follows:

- A balance of $6,000 in your checking account.
- A coupon bond that matures in three months. It has a face value of 10,000 and a coupon bond of 500.
- T-bills maturing at the end of this month with face value of 1000.
- Assume that you own a small business. The net profits for the firm are as follows: 1,000 for the next three months; 2,000 for the subsequent five months and 1,500 for the last four months of the year. At the end of the year the value of this business is 10,000.

You also have debts:

- You borrowed money from a commercial bank. For the next 14 months you have to make a fixed payment of 750.
- You also just obtained a simple loan. In a year (twelve months from now) you are supposed to repay the principal of 5,000 and interests of 385.

1. With this information:

   (a) What is the present value of your assets?
   (b) What is the present value of your liabilities?
   (c) What is your net worth?
   (d) Compute the duration of your assets and the duration of your liabilities. Would you be better off if interest rates go down? Explain.

2. Now, assume that the interest rate decline to 5%.

   (a) Compute the present value of assets, liabilities and net worth with this interest rate.
   (b) How good are the approximation formula using the approximation formula using the duration of assets, duration of liabilities and the duration gap.
Exercise 2: Real Interest Rates (25 pts)

1. Imagine that you are in an inflationary economy. The annual nominal interest rate is \( i_n = 18\% \) and the inflation rate is \( \pi = 10.5\% \). What is the real interest rate? How good is the approximation \( i_r = i_n - \pi \). How good is the approximation if instead the nominal interest and inflation rates are, respectively, 68\% and 60, 5\%.

2. You are given the quarterly data for the inflation and interest rates for the quarters of a year. Complete the table: (Hint: Use the formula for the real interest rate as seen in class. You may also need to compound quarterly rates to obtain yearly rates.)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>I Quarter</th>
<th>II Quarter</th>
<th>III Quarter</th>
<th>IV Quarter</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Interest Rate (%)</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Inflation Rate (%)</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>11.5</td>
</tr>
<tr>
<td>Real Interest Rate (%)</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exercise 4: Expected Rate of Return (35 pts)

Assume that you just acquired a house for US\$500,000. You didn’t buy to leave in it. It was a pure investment. Assume you were lucky enough to immediately find a tenant for the current year. You and the tenant signed a lease contract that specifies that he will pay 1,600 at the beginning of the month for the next 12 months. Indeed, he just paid you for the current month. Moreover, he also gave you a deposit of one month of rent (i.e. 1,600), which you can put right now to earn interest. At the end of the year, in case of damages, you cannot ask for more money than that. But if repairing the house costs less that the (future value of) the deposit you have to return the difference to the tenant.

While you are certain that the tenant will pay the rent (no default risk), you do not know how careful he is. Assume there are only three possibilities: the tenant is a neat person, a regular chap or a sloppy dude. You just don’t know how he is, but the probabilities are 25\%, 50\% and 25\%, respectively.

At the end of the year the house will be worth 515,000. Also, at the end of the year the cost of repairing the house is as follows: 6,000 if he turns out to be sloppy, 700 if regular and 0 if neat.

If the monthly interest rate is \( i = 0.5\% \): What is the expected rate of return of your investment in the house?

Exercise 4 (10 pts extra credit)

What is the formula for the duration of a perpetuity? Show your derivation.