1 Homework 8

1.1 Exercise 1

For the inflation rates use the formula:

$\frac{P_{t+1}-P_t}{P_t} = \pi_{t+1}$

For the nominal interest rates, first obtain the nominal interest rate for 1991 using the one period bond price "p_t^1":

$\frac{100}{P_t^1} = (1 + i_{t+1})$

Once you have the '91 nominal interest rate you can go on to '92 by using the two period bond price together with the '91 nominal interest rate:

$\frac{100}{P_t^2} = (1 + i_{t+1})(1 + i_{t+2})$ (Here "$t = 1990$")

Repeat this formula for $t = 1991...1997$ to obtain the other nominal interest rates.

For the real interest rate, just use the following:

$(1 + \pi_t)(1 + r_t) = (1 + i_t)$

For the prices of the one period bonds use the nominal interest rates you found above (along with the bond price formula). These are the results you should obtain:

(Here: Table 2; see a separate EXCEL document on the web page.)

1.2 Exercise 2

To compute the price indexes just use the formula:

$CPI_t^s = 100\frac{\sum p_t q_t}{\sum p_s q_s}$, where "$s$" represents the base year and "t" the current year.

As for the relevance of these indexes, we should ask ourselves what it is that we are trying to measure (is it the price of a computer or the price of certain amount of computing power?). For more on this you should check out page 128 of the book (about New Goods and Quality Change).

A new price index could be constructed using computing power as a reference. To do this we would need data on quantities of RAM memory, Hard disk memory and units of clock speed sold.

1.3 Exercise 3

To measure real GDP at date "t" with base year "s" use the following:

$GDP_t^s = \sum p_s q_t$

For the chain weighted GDP define your base year's GDP as the value of nominal GDP and for the others use the chain weighting formula:

$\frac{GDP_{t+1}}{GDP_t} = \sqrt{\frac{\sum p_t q_{t+1}}{\sum p_t q_t} \frac{\sum p_{t+1} q_{t+1}}{\sum p_{t+1} q_t}}$

Finally, obtain the deflators by using:

$GDP_{nom} = GDP_{\text{real}} DEF$

These are the results you should obtain:

(Here: Table 3; see a separate EXCEL document on the web page.)

1.4 Exercise 4

Specify the real budget constraints for an individual born in period "t" (when young and when old) .

Specify the nominal budget constraints by multiplying quantities by their current price levels.

Replace "$p_{t+1} a_{t+1}(1 + r_{t+1})$" with "$p_t a_{t+1}(1 + i_{t+1})$".

To obtain the present value budget constraint in real terms combine the young and old real budget constraints by replacing for "a_{t+1}". You should get:

$w_t^y + \frac{w_{t+1}^o}{(1+r_{t+1})} - c_t^y - \frac{c_{t+1}^o}{(1+r_{t+1})} = 0$

To obtain the present value budget constraint in nominal terms combine the young and old nominal budget constraints by replacing for "$p_t a_{t+1}$". You should get:

$p_t w_t^y + \frac{p_{t+1} w_{t+1}^o}{(1+i_{t+1})} - p_t c_t^y - \frac{p_{t+1} c_{t+1}^o}{(1+i_{t+1})} = 0$

You can obtain the real and nominal interest rates relation by combining the nominal and real budget constraints of the old:

Divide the nominal budget constraint by "p_{t+1}" and replace "$\frac{p_{t+1}}{pt}$" with "$(1+\pi)$".

Combine the two by canceling out wages and consumption. You should get:

$$\left[\frac{(1+i_{t+1})}{(1+\pi_{t+1})} - (1+r_{t+1})\right] a_{t+1} = 0$$

The only way this equation will equal zero is if the term in brackets is zero (or if every single individual in the economy does not purchase assets) . Use this to prove that:

$\mathrm{i}_{t+1} = \pi_{t+1} + r_{t+1} + \pi_{t+1} r_{t+1}$.