3 INTEREST RATES AND INVESTMENT

1.

a) If Karl abstains from 52 hamburgers this year he can eat 53 hamburgers next year:

$$52 \cdot 4 \cdot (1+0.045) \cdot \frac{1}{4.1} \approx 53.$$

b) One plus the real interest rate is how many hamburgers you get next year if you give up one hamburger today:

$$1+r \approx \frac{53}{52} \approx 1.02; \quad r \approx 0.02.$$

The real interest rate is approximately two percent.

c) $1+\pi = \frac{4.10}{4}$; $\pi = 0.025$. The inflation rate in terms of hamburgers is 2.5 percent.

d) $r = i - \pi = 0.045 - 0.025 = 0.02$. You get approximately the same answer.

2. The long run demand for capital is:

$$K = \left[\frac{\alpha}{(r+\delta)(1+\mu)}\right]^{\frac{1}{1-\alpha}} EN^n.$$

A higher α means that capital is a more important production factor so firms want more capital for a given level of employment.

A higher real interest rate, r, means a higher required return on capital so firms invest less.

A higher depreciation rate δ reduces the return on investment so firms invest less.

A higher mark-up μ means that firms set higher prices and produce less, so they also need less capital.

A more efficient technology (higher E) means that investments are more profitable so firms invest more.

With a higher long run (natural) level of employment, N^n, the marginal product of capital is higher for a given capital stock, so firms want a higher capital stock.

3. For a given real interest rate, the desired capital stock is proportional to the level of production and about twice as large as GDP in one year. When production increases one percent, the desired capital stock also increases one percent, which corresponds to two percent of GDP and about 10 percent of investment since investment is 20-30 percent of GDP. Therefore, changes in the level of economic activity have large effects on investment. In relative terms (in percent) investment is about three times as volatile as GDP. (As we will discuss in Chapter 16, fluctuations in activity may be caused by changes in technology but also other factors.)

4.

a) If the central bank leaves the nominal interest rate unchanged when inflation increases, the real interest rate will fall and investment will increase. The borrowing cost is unchanged but firms expect that they can sell the goods at a higher price in the future, so they invest more.

b) If the central bank raises the interest rate more than inflation has increased, the real interest rate increases and this has a negative effect on investment. This reduces aggregate demand.

c) If more workers enter the labour market, employment will increase, at least in the long run. With more workers employed the marginal product of capital increases for a given capital stock, so firms will increase the capital stock.

d) If computers become cheaper and more powerful this is an improvement in technology, so E increases. This makes investment more profitable so investment increases.

e) In a closed economy, increased savings will increase the supply of lending so the real interest rate is reduced and investment increases. We will analyse this in Chapter 4. (In a completely open economy, the real interest rate is determined in the world market so there is no effect on investment in the long run; see Chapter 13.)

5. Consider an economy where firms lease capital (machines) from leasing firms. The rental price per unit of capital is R. Capital can be bought at the price P, the nominal interest rate is i and there is no inflation. Capital depreciates at the rate δ.

a) The production function is $Y = \sqrt{KN}$. The product market is competitive and profit is $PK^{1/2}N^{1/2} - WN - RK$. Taking the derivative with respect to K we get $P\frac{1}{2}K^{-1/2}N^{1/2} - R = 0$.

Solving for K we get the desired capital stock $K^d = \left(\frac{1/2}{R/P}\right)^2 N$

b) If a rental firm lets out the machine for one year and it gets the rent and the value of the machinge increases with inflation but it also has to pay interest to finance the machine and the machine depreciates. The rental firms break even when $R + \pi P - (i + \delta) P = 0$.

Thus, in a competitive market with $\pi = 0$ we will have $R = (i + \delta) P = (r + \delta) P$.

c) $K^d = \left(\frac{1/2}{r + \delta} \right)^2 N$.

This is the same formula as in the text for the case when $\mu = 0, \alpha = 1/2$ and E=1. Thus the condition determining investment is the same as when the producing firms make the investments instead of renting the capital stock.