

Some Simulations of the Infinite Horizon Neoclassical Model with government

The model is parameterised as follows:

Date period = annual

Production function: $y=0.5 k^{0.5}+oil$ (Cobb Douglas)

Oil = 0

Rate of time preference = 0.075

Population growth rate = 0.05

Government spending = 0.2

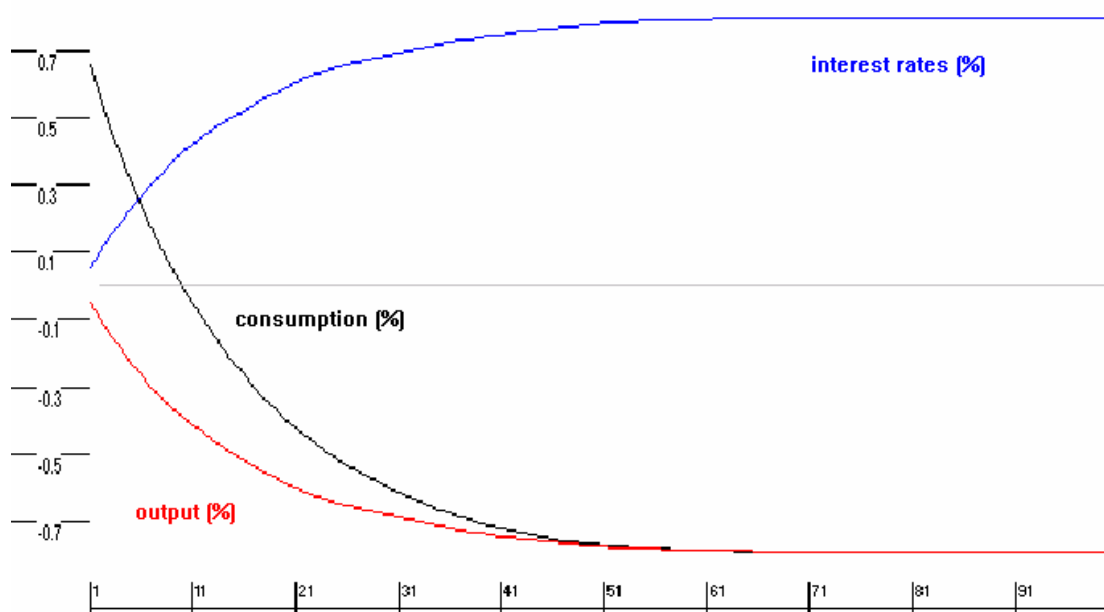
Log utility

If we normalise steady state output = 1, then this implies steady state capital=4.

1. An increase in impatience

This model replaces the fixed savings rate from the Solow model with the rate of time preference, which measures impatience to consume. Suppose this increases from 0.075 to 0.076 – an increase of 1.33%.

Figure 1 Increase in impatience



Initially consumption increases. However higher consumption means that investment is crowded out, and capital falls as interest rates increase. Lower capital means lower output throughout. From the Keynes Ramsey rule we know that interest rates will rise by 0.001 in the long run, which reduces long run output and consumption by about 0.7%. Note that consumption is above its initial level for about ten years.

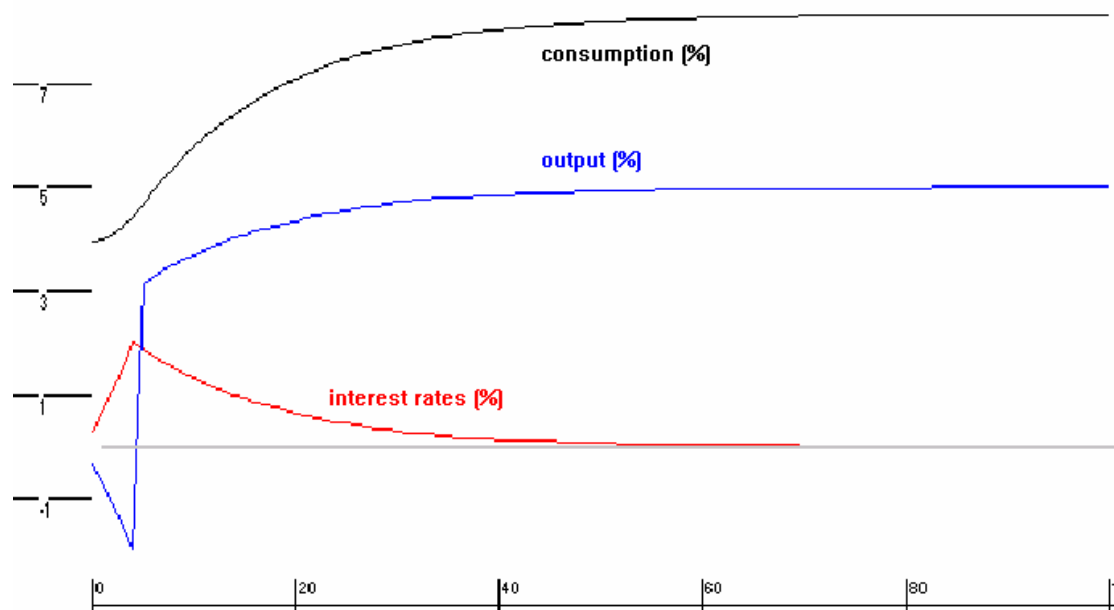
2. An anticipated future improvement in technology

a) Discovering oil

This can be described as an additive shock to output. It is worth 5% of output, and occurs from period 5 onwards. We assume that oil needs no capital to be extracted. The key point is that there is no change in the marginal productivity condition – the productivity of capital has not been increased, $f'(k)$ is unchanged. Interest rates are given by the Keynes Ramsey rule, so will not change in the long run. With no shift in the marginal productivity of capital, the long run capital stock is also unchanged. In the long run, therefore, output is higher by 5%, and all the extra output goes to consumption.

The interest is in the short run. Consumers will want to smooth consumption, so they will start spending more immediately. This crowds out the capital stock. Output falls, and real interest rates rise. Higher real interest rates dampen the initial increase in consumption: recall under the Keynes Ramsey rule with log utility an increase in interest rates will lead to an equivalent increase in the growth of consumption (for given population growth and impatience).

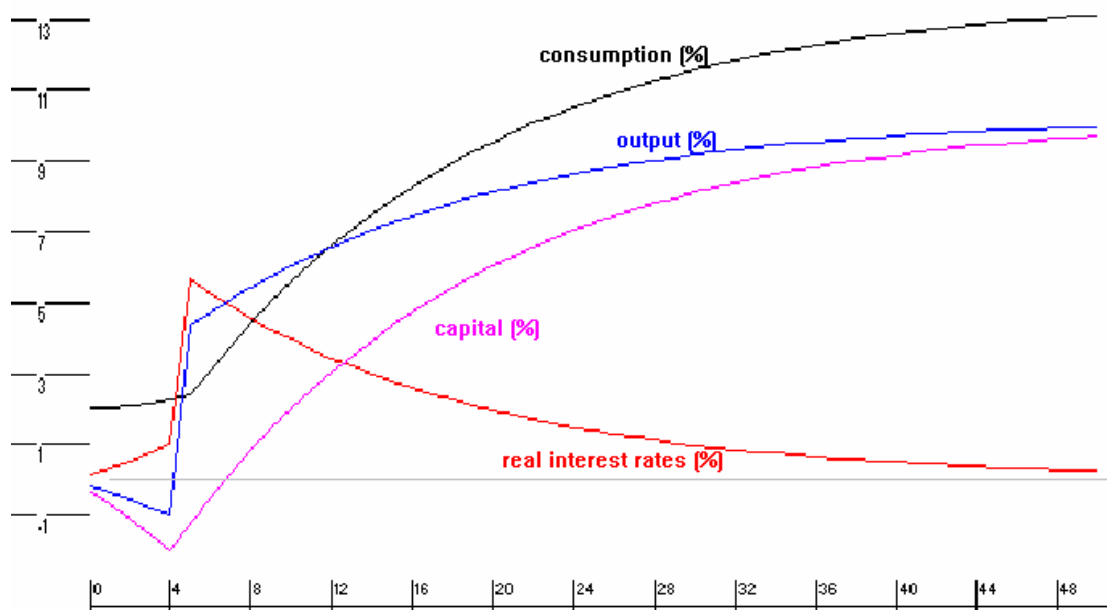
Figure 2 Oil discovery, anticipated by 5 years



b) A multiplicative output shock

In this case capital gets more productive – the coefficient multiplying capital in the production rises by 5% in year 5. Now the marginal productivity relationship shifts – a given real interest rate will be associated with more capital.

Figure 3 An anticipated multiplicative technology improvement



The capital stock and output rise by about 10% in the long run. Profit maximising firms want to increase production and capital at the steady state interest rate, because the slope of the production function has changed.

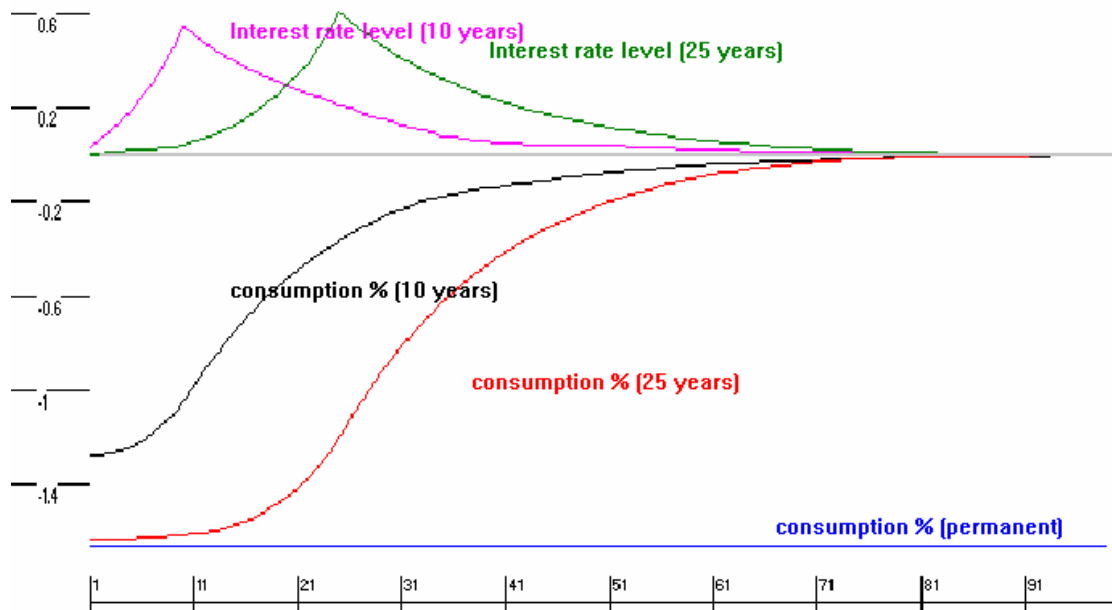
Consumers still anticipate the higher output, but by rather less than in the previous case. The reason is that when the new technology arrives, interest rates also shift up, because the marginal productivity condition has changed. This dampens initial consumption by more than with the oil discovery, where no shift in interest rates occurs.

3. A temporary increase in government spending

A permanent, unexpected increase in government spending leads to an immediate and equal reduction in consumption, with no change in other variables. Given Ricardian Equivalence, it makes no difference how and when this government spending is financed.

A temporary increase in government spending is more complex. Suppose government spending increases by 5% for either 10 or 25 years. The total increase in taxes required to finance this temporary increase in spending is less per year than the value of the higher spending, so there is a squeeze on resources while government spending is higher. Investment falls, raising real interest rates. The figure below shows the results.

Figure 1 Temporary increase in government spending.

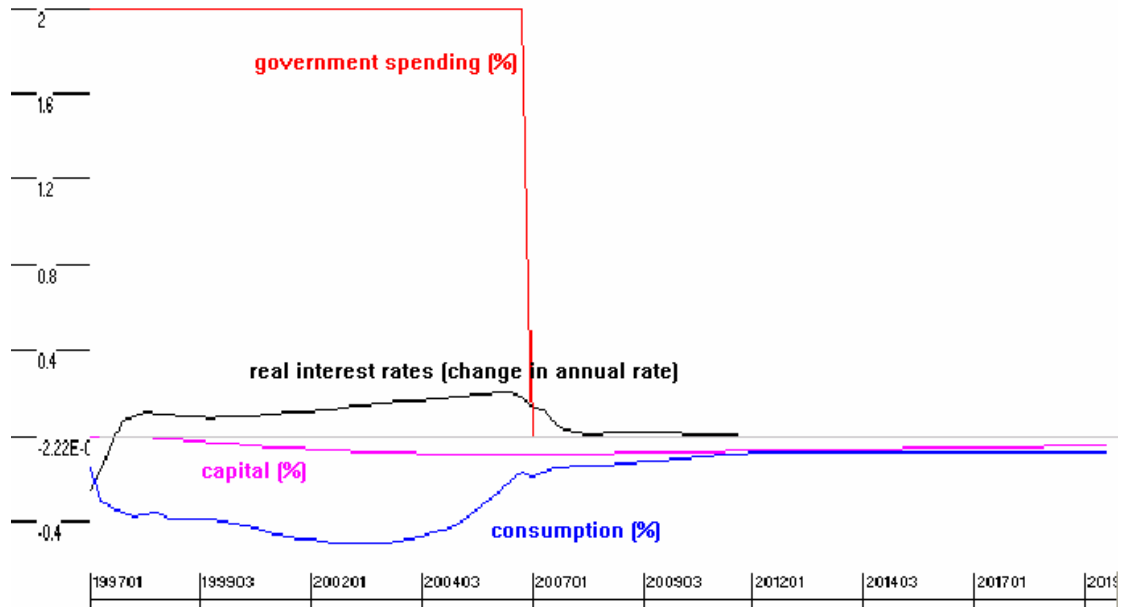


Interest rates peak in the final year of the government spending increase. Rising rates also raises the growth of consumption, following the Keynes Ramsey rule. Once government spending returns to its steady state level, consumption is on the stable saddlepath. As it is below steady state consumption, capital can rebuild, and interest rates move back down.

With this particular parameterisation, a 25 year increase in government spending produces an initial cut in consumption very similar to what would occur if the spending increase was permanent.

Figure 2 shows a 10 year increase in government spending in a much more complex model: the COMPACT model of the UK economy.

Figure 2 10 year increase in government spending in COMPACT



COMPACT is an estimated model. It elaborates on the basic neoclassical model in many ways: consumers do not act as if they live forever, some are credit constrained, production has a vintage structure, the monetary authorities can temporarily change real interest rates because of Keynesian nominal rigidities etc etc. However, despite all this, the basic character of the simulation is similar. Real interest rates reach a peak about the time the government spending increase ends, the capital stock falls until this point, consumption falls substantially. The main difference is in the detail of the consumption profile, which is stronger in the short term in COMPACT.