A diagramatic solution of the NK model at the ELB (loosely based on Williamson's book)

Juan Paez-Farrell

March 2022

1 Introduction

We consider the consequences of the effective lower bound (ELB) on the economy using a very simple set-up, as shown in Figure **??**. For the analysis we want to carry out we do not need to model the flexible-price side of the model (but you could easily just append it if you want to). The economy begins at point a with a zero output gap and inflation equal to target. As a result, the natural and actual rates of interest are the same. The first plot shows the IS so that output (relative to potential) depends on the real interest rate (relative to the natural rate). The Phillips curve (PC) is also standard and was considered before The only novelty lies in the inclusion of the Fisher equation into the diagram. Assuming $\pi' = 0$ it is just a 45-degree line (the starting value of π' as well as the steady state value of π won't affect our results).

It is always good to note the equations underlying the figure:

$$Y - Y_m = -\alpha\left(r - r^*\right)$$

$$R = r + \pi'$$

$$\pi = \beta\pi' + \delta\left(Y - Y_m\right)$$

π represents deviations of inflation from target so in steady state it is equal to zero (so $\pi_1 = 0$).

Next, consider the consequences of a shock that lowers r^* and increases Y_m so that the IS does not shift.[1] If the central ensures that the real interest tracks the natural rate, the former fall so that the economy is at point b. As a result, the ouptut gap is still zero, the real interest rate falls and therefore so does the nominal interest rate. However, assume that R cannot go lower than $\underline{R}$. Then, if the central bank lowered interest rates down to this value, the economy would be at point c: $r > r^*$ with the result that output is below its flexible-price level and inflation is below target. From the point of view of setting interest rates, there is nothing else a central bank can do and it is one of the reasons that the ELB is viewed as problematic.

1.1 Solutions to the ELB

From the point of view of our model, anything that increases r^* (up to point c, say) will do the trick (think of fiscal policy). However, analysing this properly would require including the flexible-price version of the model. Another potential solution involves promising inflation above target in the next period; if believed, this would raise π'. This can easily be done with our three subplots below as it does not require any further figures. However, it is always best to use the equations in order to avoid mistakes.

1. The increase in π' shifts the PC upwards and the Fisher equation downwards.

2. The latter implies that the kink occurs at a lower value of r^* so increase π' by a sufficient amount and c will be below b, in which case the ELB no longer binds.
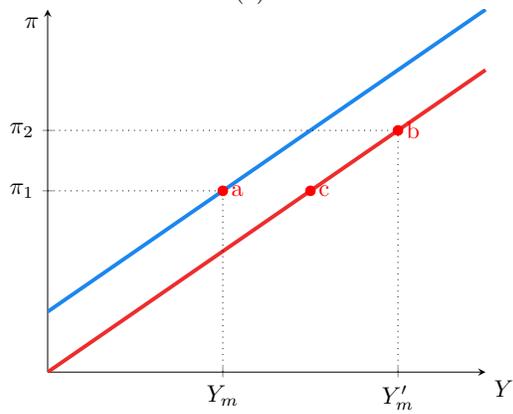
---

[1] The increase in Y_m does shift the Phillips curve though.
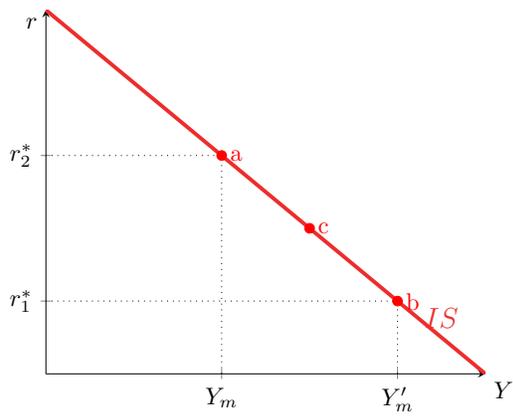
(a) IS
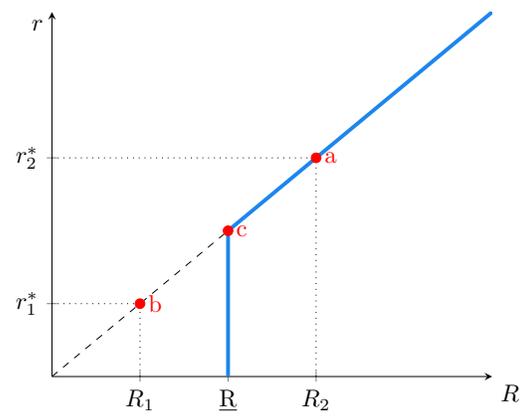
(b) Fisher equation

(c) Phillips curve

3