Problem 2: Fisher equation

1. **Fisher equation: assume that the economy is at full employment, with an anticipated inflation rate of 7% and a nominal interest rate of 11%.**

   (a) **State the Fisher equation.**

   In its final form, the Fisher equation relates the nominal interest rate denoted i, the real interest rate denoted r and the expected inflation rate denoted π^e.

   Fisher's equation is explained in class so you don't have to explain it again. It is written:

$$i = r + \pi^e$$

   Here is one way to interpret this equation: agents think in terms of real interest rate r because it is the only one that takes inflation into account. But when, for example, they are going to sign a mortgage contract, only the nominal interest rate i is written on the contract. So to evaluate the rate real interest, agents will form inflation expectations π^e for correct the nominal interest rate and obtain a view of the real interest rate, this is what Fisher's equation does. However, it should not be forgotten that the nominal interest rate i is linked to the activity of the Central Bank, it will therefore be likely to change as a result of monetary policy. This will not be the case in the classical model of the real interest rate which is a real variable.

   (b) **What is the real interest rate in this economy?**

   We apply Fisher's equation with the data from the statement:

$$\begin{aligned} r &= i - \pi^e \\ &= 11\% - 7\% = 4\% \end{aligned}$$

   The real interest rate is 4%.

   (c) **Suppose that the anticipated inflation rate rises to $\pi^e =$ 9%. What is the real interest rate? The nominal interest rate?**

   If $\pi^e = 9\%$ then the real interest rate will not change it remains at 4%. It is fixed by the real variables of the economy and not by the nominal variables this is the dichotomy of the classical model. When expected inflation moves due to changes in the money supply, for example, the real interest rate is not modified. But inflation affects the nominal interest rate

$$\begin{aligned} i &= r + \pi^e \\ &= 0.04 + 0.09 \\ &= 0.13 = 13\% \end{aligned}$$

2. **Fisher equation and the quantity equation: suppose now that the money supply increases at a rate of 7%, the real interest rate is 3% and the real growth rate of GDP is 2%.**

   (a) **Write the inflation rate as a function of the growth rate of the stock of money, the velocity of money and the growth rate of real GDP. Solve for the inflation rate in this economy.**

   To answer this question, we will use the quantitative equation of money in its percentage version:

$$\begin{aligned} MV &= PY \\ \%\Delta M + \%\Delta V &= \%\Delta P + \%\Delta Y \end{aligned}$$

   According to the statement, $\%\Delta M = 7\%$ and $\%\Delta Y = 2\%$. We also know that V is constant when no hypothesis says otherwise, so $\%\Delta V$. We conclude that:

$$\begin{aligned} \pi = \%\Delta P &= \%\Delta M + \%\Delta V - \%\Delta Y \\ &= 7\% + 0\% - 2\% = 5\% \end{aligned}$$

   (b) **According to the quantity theory of money, what should the nominal interest rate be?**

   Assuming that inflation is very stable in this economy, we can approximate that:

$$\pi^e = \pi$$

   Applying Fisher's equation now, we have:

$$i = r + \pi^e = 3\% + 5\% = 8\%$$

   The nominal interest rate is 8%.