Consider three discount bonds sold in 2016 by the US Treasury. Each has a face value F=$100.

The 1-year bond (maturing in 2017) sells for \( P_{1,2016} = 99 \)

The 2-year bond (maturing in 2018) sells for \( P_{2,2016} = 97 \)

The 3-year bond (maturing in 2019) sells for \( P_{3,2016} = 94 \)

If you buy an N-year bond for \( P \) in 2016, it is like you lend \( P \) to the government for \( N \) years. You can then compute your average interest rate or return - also known as the yield on the bond – by using that if initial wealth of \( P \) grows to \( 100 \) in \( N \) years, then the growth rate per year solves \( P (1 + i_{N,2016})^N = 100 \leftrightarrow i_{N,2016} = \frac{\sqrt[N]{(100/P)} - 1}{N} \). For example, if a 4-year bond cost \( P_{4,2016} = 90 \), the 4-year bond yield in 2016 would be \( i_{4,2016} = \frac{\sqrt[4]{(100/90)} - 1}{4} = 0.027 = 2.7\% \).

a. Compute the yields on the 2017, 2018 and 2019 bonds \( (i_{1,2016}, i_{2,2016} \text{ and } i_{3,2016}) \).

b. Draw the yield curve for the 2017-2019 period (see Chapter 15).

Instead of buying, say, a two year bond maturing in 2018, an investor is free to buy a 1-year bond maturing in 2017 and reinvest her 2017 income in another 1-year bond maturing in 2018. The one-year bond she buys in 2016 will pay the current one-year bond interest rate or one-year yield, \( i_{2016} = i_{1,2016} \). The bond she buys in 2017 is expected to pay next year’s expected one-year interest rate or one-year yield, \( i'_{2017} \). The average annual interest rate is then \( \frac{1}{2} (i_{2016} + i'_{2017}) \). Since in practice investors are willing to buy both one and two year bonds, economic theory suggests they must be indifferent between them. Therefore the two-year bond yield must roughly equal the average of the one-year yields during the same period:

\[
i_{2,2016} \approx \frac{1}{2} \left( i_{2016} + i'_{2017} \right).
\]

By the same logic the three-year bond yield \( i_{3,2016} \approx \frac{1}{3} \left( i_{2016} + i'_{2017} + i'_{2018} \right) \).

c. Using the yields from part a. and the formulas with the expected future one-year interest rates just above, compute the expected future one-year interest rates \( i'_{2017} \) and \( i'_{2017} \). Do markets expect short-term rates to rise or fall compared to the \( i_{2016} \) rate?

d. Which scenario would better explain the pattern of yields and expected short-term interest rates: (a) people expect the Federal Reserve to increase the money supply. (b) People expect the Feds to decrease the money supply. (Remember that changing the money supply will move interest rates in the opposite direction).