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DEPARTMENT OF ECONOMICS
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EC 247 Financial Instruments and Capital Markets

Class Exercise 2

Questions 1, 2 and 3 correspond to chapter 4 of the Frederic S. Mishkin and Stanley G. Eakins, *Financial Markets and Institutions,* 7th Edition, Pearson Prentice Hall, 2012.

Chapter 4 introduces the determinants of asset demand. It indicates that there are four primary factors that influence an investor's decision to hold assets: wealth, expected returns, risk, and liquidity. In addition, the chapter lays out a partial equilibrium approach to the determination of interest rates using the supply and demand in the bond market.

Question 1 provides an example on the response of the quantity demanded of an asset to changes in wealth, expected return, liquidity and risk. This analysis provides a framework for deciding which factors cause the demand curve for bonds to shift. The relevant effects are summarized in Table 4.1 in the textbook.

Question 2
The first part asks for the price of the bond in order for investors to expect a yield to maturity of 10%. In order to find this price we have to discount the expected cash flows at the expected yield. However, in order to find the expected cash flows for each year we have to consider the assigned probabilities of default. The probability that the bond will default the first year is 20% in which case will pay nothing ($0). As a consequence, there is 80% probability that the bond will not default and pay the first coupon payment of $120. The same reasoning is applied for the second period with the relevant probabilities of default. In this case, there is 25% probability that the bond will default in the second year, and consequently, a 75% probability that the bond will not default, in which case will provide a payment of ($1000 principal+ $120 final coupon payment). Discounting the expected cash flows at 10% will provide the price that the investor is willing to pay for this bond. This price is calculated as follows:

Expected cash Flows:

The expected cash flow at $t_1 = 0.20\,(0) + 0.80\,(120) = 96$
The expected cash flow at $t_2 = 0.25\,(0) + 0.75\,(1{,}120) = 840$

Price that the investor is willing to pay:

$$P_0 = \frac{\$96}{1.10} + \frac{\$840}{1.10^2} = \$781.49$$

In the second part of the question we will use the price that was calculated in part (a) so as to find the expected holding period return (the holding period is 2 years). In this case, we have:

- 20% probability of having $0 final cash flow in 2 years, in which case we have (-100%) holding period return.
- 20% probability of having $132 final cash flow in 2 years, in which case we have $\frac{\$132 - \$781,49}{\$781,49} = -83.11\%$ holding period return.

There is 80% probability of receiving the first coupon payment of $120 in one year. We then reinvest this amount at 10%, so at the end of the two-year period we will have an amount of $132. Given the fact that the probability that the company will default after paying the first coupon payment is 25%, the probability of reaching the end of the second period with an amount of $132 is 20% (80%X25%)

- 60% probability of having ($132+$120+$1000=$1252) final cash flow in 2 years, in which case we have $\frac{\$1.252 - \$781,49}{\$781,49} = 60.21\%$ holding period return.

There is 80% probability of receiving the first coupon payment of $120 in one year. We then reinvest this amount at 10%, so at the end of the two-year period we will have an amount of $132. Given the fact that the probability that the company will not default after paying the first coupon payment is 75%, we have a probability of 60% (80%X75%) of reaching the second period with $1.252 i.e. $132 from reinvesting the first coupon payment last period, $120 from the final coupon payment and $1000 our principal).

Given that we have calculated the probabilities of the holding period returns, we can apply the following formula in order to find the expected holding period return:

$$R^e = p_1 R_1 + p_2 R_2 + ...p_n R_n$$

Where

R^e = expected return

n = number of possible outcomes

R_i = return in the i th state of nature

p_i = probability of occurrence.

As a result:

$$R^e = 0.20(-100\%) + 0.20(-83.11\%) + 0.60(60.21\%) = -0.5\%$$

This formula can be found on page 105 in the textbook.

Question 3

This question is an application on how the demand for bonds can shift to the right. We set initially demand to be equal to supply, so as to find the initial equilibrium price and quantity i.e. $-\frac{2}{5}Q+940=Q+500$. This implies that $Q=314.28$ and $P=\$814.28$

Given that the demand for bonds shifts to the right, we set the new demand curve i.e. $-\frac{2}{5}Q+990$ to be equal to supply. As a result:

$$-\frac{2}{5}Q+990=Q+500$$

This will give us a value of $Q=350$ and $P=\$850$.

Questions 4 and 5 correspond to chapter 5 of the Frederic S. Mishkin and Stanley G. Eakins, *Financial Markets and Institutions*, 7th Edition, Pearson Prentice Hall, 2012.

Question 5 has to do with the liquidity premium theory of the term structure of interest rates which is addressed on pages 143-147 in the textbook. We are given the one-year T-bill rates for the following 5-years and the corresponding liquidity premiums. We directly apply the formula on page 144 in order to find the interest rate i_{4t} on the four-year bond:

$$i_{nt}=\frac{i_t+i^e_{t+1}+i^e_{t+2}+i^e_{t+3}+............+i^e_{t+(n-1)}}{n}+l_{nt}$$

As a result,

$$i_{4t}=\frac{i_t+i^e_{t+1}+i^e_{t+2}+i^e_{t+3}}{4}+\ell_{4t}\Rightarrow$$

$$i_{4t}=\frac{4.25\%+5.15\%+5.50\%+6.25\%}{4}+0.50\%\Rightarrow$$

$$i_{4t}=5.29\%+0.50\%\Rightarrow$$

$$i_{4t}=5.78\%$$

SOLUTIONS

Question 1

Explain why you would be more or less willing to buy a share of Polaroid stock in the following situations:

(a) Your wealth falls.
(b) You expect it to appreciate in value.
(c) The bond market becomes more liquid.
(d) You expect gold to appreciate in value.
(e) Prices in the bond market become more volatile.

Answer:

(a) Less, because your wealth has declined.
(b) More, because its relative expected return has risen.
(c) Less, because it has become less liquid relative to bonds.
(d) Less, because its expected return has fallen relative to gold.
(e) More, because it has become less risky relative to bonds.

Question 2

Consider a $1,000-par junk bond paying a 12% annual coupon with two years of maturity. The issuing company has 20% chance of defaulting this year; in which case, the bond would not pay anything. If the company survives the first year, paying the annual coupon payment, it then has a 25% chance of defaulting in the second year. If the company defaults in the second year, neither the final coupon payment nor par value of the bond will be paid.

a) What price must investors pay for this bond to expect a 10% yield to maturity?

b) At that price, what is the expected holding period return? Assume that periodic cash flows are reinvested at 10%.

Answer:

The expected cash flow at t_1 = 0.20 (0) + 0.80 (120) = 96
The expected cash flow at t_2 = 0.25 (0) + 0.75 (1,120) = 840
The price today should be: $P_0 = \frac{\$96}{1.10} + \frac{\$840}{1.10^2} = \$781.49$

At the end of two years, the following cash flows and probabilities exist:

Event	Probability	Final Cash Flow	Holding Period Return
1	0.2	$ 0.00	−100.00%
2	0.2	$ 132.00	−83.11%
3	0.6	$ 1,252.00	60.21%

The expected holding period return will be:

$R^e = 0.20(-100\%) + 0.20(-83.11\%) + 0.60(60.21\%) = -0.5\%$

Question 3

The demand curve and supply curve for one year 1000$ discount bonds are estimated using the following equations:

$$B^d\text{: Price} = \frac{-2}{5}\text{ Quantity} + 940$$

$$B^s\text{: Price} = \text{Quantity} + 500$$

Following a dramatic increase in the value of the stock market, many retirees started moving money out of the stock market and into bonds. This resulted in a parallel shift in the demand for bonds, such that the price of bonds at all quantities increased $50. Assuming no change in the supply equation for bonds, what is the new equilibrium price and quantity? What is the new market interest rate?

Answer:

a) Before the increase in the value of the stock:

We set the supply curve to be equal to the demand curve i.e. $B^d = B^s$.

$$-\frac{2}{5}Q + 940 = Q + 500$$

This implies that $Q = 314.28$ and that $P = \$814.28$

After the increase in the value of the stock:

$$-\frac{2}{5}Q + 990 = Q + 500$$

This implies that $Q = 350$ and that $P = \$850$

b) The initial interest rate was given by: $i = \frac{\$1000 - \$814.28}{\$814.28} = 22.80\%$

The new market interest rate will be: $i = \frac{\$1000 - \$850.00}{\$850.00} = 17.65\%$

Question 4

Predict what will happen to interest rates on a corporation's bond if the federal government guarantees today that it will pay creditors if the corporation goes bankrupt. What will happen to the interest rates on Treasury securities?

Answer:

The government guarantee will reduce the default risk on corporate bonds, making them more desirable relative to Treasury securities. The increased demand for corporate bonds and decreased demand for Treasury securities will lower interest rates on corporate bonds and raise them on Treasury bonds.

Question 5

Government economists have forecasted one-year T-bill rates for the following five years, as follows:

Year	1-year rate
1	4.25%
2	5.15%
3	5.50%
4	6.25%
5	7.10%

You have liquidity premium 0.25% for the next two years and 0.50% thereafter. Would you be willing to purchase a four-year T-bond at a 5.75% interest rate?

Answer:

Your required interest rate on a 4-year T-bond (i_{4t}) = Average short-term rates (4-one-year rates) expected to occur over the life of the long-term bond + Liquidity Premium

This is reflected in the following equation:

$$i_{4t} = \frac{i_t + i^e_{t+1} + i^e_{t+2} + i^e_{t+3}}{4} + \ell_{4t} \Rightarrow$$

$$i_{4t} = \frac{4.25\% + 5.15\% + 5.50\% + 6.25\%}{4} + 0.50\% \Rightarrow$$

$$i_{4t} = 5.29\% + 0.50\% \Rightarrow$$

$$i_{4t} = 5.78\%$$

At a rate of 5.75%, the four-year T-bond is just below the required rate.

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