Econ 156
Gary Smith
Fall 2019

Midterm Answers

1. They still should compare alternative investments—for example, bonds versus machines—and therefore should take interest rates into account, plus risk premiums.

2. She could spend $4,155 a year in real terms and run out of money in 25 years:

$$100{,}000 = \frac{X(1.02)^1}{(1.023)^1} + \frac{X(1.02)^2}{(1.023)^2} + \ldots + \frac{X(1.02)^{25}}{(1.023)^{25}}$$

$$= \frac{X}{\left(\frac{1.023}{1.02}\right)^1} + \frac{X}{\left(\frac{1.023}{1.02}\right)^2} + \ldots + \frac{X}{\left(\frac{1.023}{1.02}\right)^{25}}$$

$$= \frac{X}{(1.002941)^1} + \frac{X}{(1.002941)^2} + \ldots + \frac{X}{(1.002941)^{25}}$$

$$X = \$4{,}155$$

3. Here is how I responded:

I don't think so!

If corporate profits quadruple in 30 years, corporate stock values will be much higher than they are today. Not necessarily quadrupled, but much higher. Even if the average P/E falls 50%, prices will still be double what they are today. Plus, there is a 2% dividend yield from stocks.

Bitcoin pays no dividends and has no logical relationship to the economy since it generates no free cash flow.

4.

$$(1.0189)^{20} = (1.0154)^{10}(1 + R_{10}^{+10})^{10}$$

$$R_{10}^{+10} = \left(\frac{(1.0189)^{20}}{(1.0154)^{10}}\right)^{1/10} - 1$$

$$= 0.0224 \ (2.24\%)$$

5. Since the shareholders' required return is equal to the firm's profit rate, the market value is equal to its assets, and the current market price is $100 million/one million shares = $100. To give shareholders their required return, the price will grow by 20% a year the first two years to $120 at the end of the first year and $144 at the end of the second year. After that, the earnings, dividends, and price will all grow by 10% a year since g = (1 – d)ROE = 0.5(0.20) = 0.10, and the stock price will give a 10% dividend, so that shareholders get their 20% return.

Checking,

Year	Profits	Dividends	Retained Earnings	Assets
1	20	0	20	120
2	24	0	24	144
3	28.8	14.4	14.4	158.4

The initial market value is

$$
\begin{aligned}
P &= \frac{14.4}{(1+R)^3} + \frac{14.4(1+g)}{(1+R)^4} + \frac{14.4(1+g)^2}{(1+R)^5} + \ldots \\
&= \frac{1}{(1+R)^2}\left(\frac{14.4}{(1+R)^1} + \frac{14.4(1+g)}{(1+R)^2} + \frac{14.4(1+g)^2}{(1+R)^3} + \ldots \right) \\
&= \frac{1}{(1+R)^2}\left(\frac{14.4}{R-g} \right) \\
&= \frac{1}{(1+0.20)^2}\left(\frac{14.4}{0.20-0.10} \right) \\
&= \frac{144}{(1+0.20)^2} \\
&= \$100
\end{aligned}
$$

6. It depends on her effective tax rate *t* (which takes into account both federal and state taxes and is now complicated by the fact that the total amount of state and local taxes that can be deducted is now limited to $10,000.) The break-even tax rate is given by

$$
\begin{aligned}
(1-t)3.8\% &= 3.1\% \\
1-t &= \frac{3.1\%}{3.8\%} \\
t &= 1-\frac{3.1\%}{3.8\%} = 0.184
\end{aligned}
$$

   She should buy municipals if her effective tax rate is greater than 18.4%, and buy corporates otherwise.

7. The appropriate present-value equation is

$$\$100{,}000 - \$14{,}350 = \sum_{t=1}^{10} \frac{\$9{,}000}{(1+R)^t}$$

   The implicit rate of return is less than 1%: R = 0.0091 (0.91%)

8. The main difference is whether she expects her tax rate when she withdraws the money from her traditional IRA to be higher or lower than the tax rate she pays now on income invested in the Roth IRA. A Roth IRA is better if she expects a higher rate in the future, and worse if she expects a lower rate in the future. (A Roth IRA also does not have required minimum distributions.)

9. a. Prices are historically high relative to earnings.
   b. We should also consider interest rates, which are historically low.

10. a. 10-year zero with a 5% yield to maturity.
    b. same
    c. 30-year $400,000 zero with an 8% yield to maturity.
    d. 10-year 2%-coupon bond with a 2% yield to maturity
    e. a stock with an annual dividend that is currently $1 and will grow by 10% annually.