Econ 156
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Final Examination Answers

1. Investors may have anticipated an even larger increase in the unemployment rate, or there may have been offsetting good news. As Ian Shepherdson, an economist at Pantheon Macroeconomics, said, "Terrible, but not really news."

2. a. Ten years, since thirty-years zeros have a duration of thirty years. (However, some long-term coupon bonds have durations well above 10 years)
   b. An increase in the coupon rate reduces the duration.
   [Barbara Donnelly, "Zero-Coupon Bonds: Simple Appeal but Not Zero Risk," The Wall Street Journal, June 26, 1989.]

3. a. Using the perpetuity formula: P = D/R, shareholders' required return is R = D/P = \$12/\$150 = 0.08 (8%)
   b. With no debt there is no leverage: 1/1
   c. Tobin's q = market price/replacement cost = \$150/\$100 = 1.5

4. Retain some earnings to expand since ρ > R and borrow some money to create a tax shield.

5. If you sell, you receive cash of C = \$1,800,000 – c_0(\$300,000) where c_0 is the current capital gains tax rate. If you rent for *n* years with net after-tax rental income growing by g_R per year, the sale price net of expenses growing by g_P per year, and a capital gains tax of c_n when you sell, the present value of your cash flow (assuming annual values beginning immediately) is

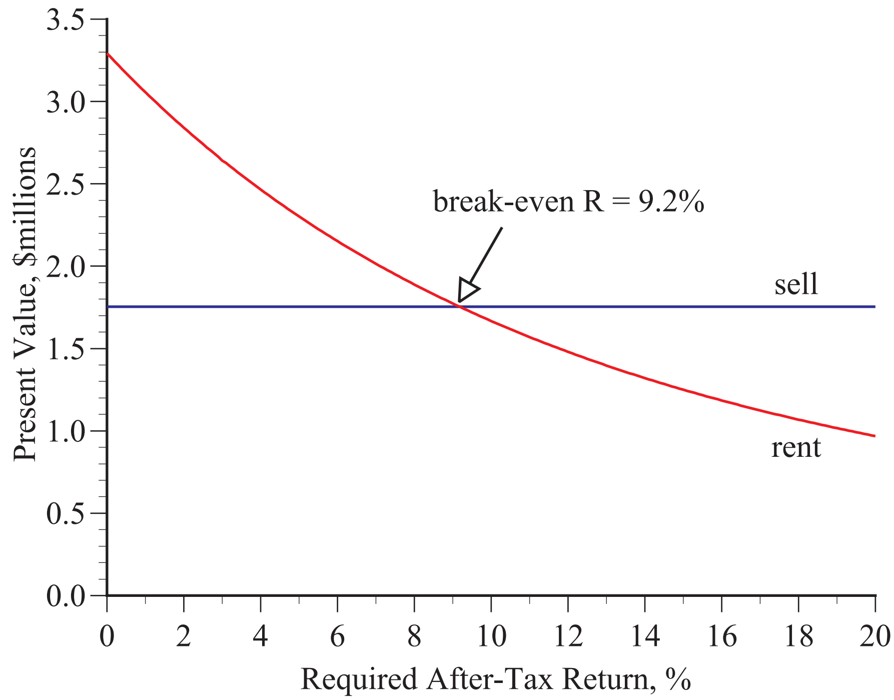
$$V = \$100{,}000 + \frac{\$100{,}000(1+g_R)^1}{(1+R)^1} + \frac{\$100{,}000(1+g_R)^2}{(1+R)^2} + \ldots$$
$$+ \frac{\$100{,}000(1+g_R)^{n-1} + \$1{,}800{,}000(1+g_P)^{n-1} - c_n(\$1{,}800{,}000(1+g_P)^{n-1} - \$1{,}000{,}000)}{(1+R)^{n-1}}$$

where R is your required after-tax return. The break-even R is determined by equating C and V.

For example, with a 10-year rental period, 3% growth rates of net rent and price, and a 15% capital gains tax rate currently and 10 years from now, the break-even R is determined by

$$\$1{,}800{,}000 - 0.15(\$300{,}000) = \$50{,}000 + \frac{\$50{,}000(1.03)^1}{(1+R)^1} + \frac{\$50{,}000(1.03)^2}{(1+R)^2} + \ldots$$
$$+ \frac{\$50{,}000(1.03)^9 + \$1{,}800{,}000(1.03)^9 - 0.15(\$1{,}800{,}000(1.03)^9 - \$1{,}000{,}000)}{(1+R)^9}$$

The break-even R is 9.2%:



6. a. The monthly payments X for a loan lasting n months are determined by

$$P = \sum_{t=1}^{n} \frac{X}{\left(1+0.0499/12\right)^{t}}$$

The effective annual interest rate s is then determinedly this equation:

$$P\left(1-0.0499\right) = \sum_{t=1}^{n} \frac{X}{\left(1+s/12\right)^{t}}$$

For a 5-year $150,000 loan, the monthly payments are $2,830.00 and the effective interest rate is 7.12%. For a 10-year $150,000 loan, the payments are $1,590.25 and the effective interest rate is 6.11%.

b. The effective annual interest rate is larger than 4.99% because of the processing fee.

c. The 5% processing fee is paid up front so it is more expensive than paying an extra 1-percentage point loan rate

d. The effective interest rate is lower if the loan is for 10 years because the processing fee is spread out over a longer horizon.

7. Dividends are involuntary, generally taxable events, while buybacks are voluntary and lightly taxed. Bary, Andrew, Apple Should Stop Buying Back Its Stock. Here's What It Should Do Instead, Barron's January 7, 2020.

8. A covered-call strategy makes money on the price of the call and any appreciation in the price of the stock up to the strike price. However, it loses money if the stock price drops by more than the option price and it misses out on any price increase above the strike price. (The figure is in the textbook.)

9.

$$P=\frac{\$1(1+.10)}{(1+.10)}+\frac{\$1(1+.10)^2}{(1+.10)^2}+\frac{\$1(1+.10)^3}{(1+.10)^3}+\frac{\$1(1+.10)^4}{(1+.10)^4}+\frac{\$1(1+.10)^5}{(1+.10)^5}+\frac{\$1(1+.10)^5(1.05)^1}{(1+.10)^6}+\frac{\$1(1+.10)^5(1.05)^2}{(1+.10)^7}+\ldots$$

$$=\frac{\$1(1+.10)}{(1+.10)}+\frac{\$1(1+.10)^2}{(1+.10)^2}+\frac{\$1(1+.10)^3}{(1+.10)^3}+\frac{\$1(1+.10)^4}{(1+.10)^4}+\frac{\$1(1+.10)^5}{(1+.10)^5}+\frac{\$1(1.05)}{1.10}\left(1+\left(\frac{1.05}{1.10}\right)^1+\left(\frac{1.05}{1.10}\right)^2+\ldots\right)$$

$$=\frac{\$1(1+.10)}{(1+.10)}+\frac{\$1(1+.10)^2}{(1+.10)^2}+\frac{\$1(1+.10)^3}{(1+.10)^3}+\frac{\$1(1+.10)^4}{(1+.10)^4}+\frac{\$1(1+.10)^5}{(1+.10)^5}+\frac{\$1(1.05)}{1.10}\left(\frac{1}{1-\left(\frac{1.05}{1.10}\right)}\right)$$

$$=\$1+\$1+\$1+\$1+\$1+\frac{1+.05}{0.10-0.05}$$

$$=\$5+\$21$$

$$=\$26$$

10. (b) 10 years

The present value is $P=\frac{\$1}{R}$. The effect of a change in the required return on the price is

$$\frac{\partial P}{\partial R}=-\frac{\$1}{R^2}=-\frac{\$1/R}{R}=-\frac{P}{R}$$

There are two duration measures, modified duration and Macaulay duration:

$$\text{modified duration} = -\frac{\partial P/P}{\partial R}=\frac{1}{R}$$

$$\text{Macaulay duration} = (1+R)\big(\text{modified duration}\big)=\frac{1+R}{R}$$

For R = 0.10, the modified duration is 10 years and the Macaulay duration is 11 years

11. The algorithm may spot useful patterns, but it is more likely to find useless coincidences.

12. Such predictions ignored the possibility of arbitrage between the index futures and the stocks in the index, which imply that the price of the futures contract F should be related to the current value of the index, not the anticipated future value of the index, by an amount that depends on the Treasury-bill rate R and the dividend yield d on these stocks: $F = P_0(1+R-d)$. [William F. Sharpe, Investments, 3rd edition, p. 556.]

13. a. We should consider the rent savings, too.
    b. Housing prices also depend on land values.
    c. We also have record-low interest rates.

14. By reducing the number of shares without altering current earnings, the firm does increase current earnings per share. But the cost of the stock repurchase reduces the firm's assets and, therefore, reduces its future earnings. If shares, assets and earnings decline proportionately, there is no effect on future earnings per share. More generally, the conservation-of-value principle says that firms cannot make shareholders better off by buying stock for what it is worth. [James McNeill Stancill, "Does the market know your company's real worth?," Harvard Business Review, September-October 1982, p. 48.]

15. The increased debt that creates leverage provides a tax shield for the firm's earnings. The risk of bankruptcy that accompanies breathtaking leverage also gives the firm a compelling incentive to reduce costs and

operate more efficiently. [John Paul Newport, Jr., "LBOs: Greed, Good Business—or Both?," Fortune, January 2, 1989, pp. 66-68.]

16. If L and M have the same profit rates ROE and are priced using the same required return R, then their different price-earnings ratios may be attributed to their different payout/retention policies. If ROE > R, as seems likely here with ROE = 20%, a firm that retains more of its earnings makes shareholders better off. Therefore, M, with the higher price-earnings ratio, probably has a lower payout ratio d.

17. Treating dividends and interest equally would remove the tax-shield advantage of corporate debt. Less debt means less leverage.

18. This sure sounds like data mining, which is good at identifying past patterns that are unreliable guides to the future. Why these words? Why 2-year and 5-year Treasury rates? Because they happened to be coincidentally correlated.

19. Regression to the mean. The top-quintile companies most likely had more good luck than bad, while the opposite was true of the bottom-quintile companies.

20. a. $\$1,000(1+R)^{10} = \$17,000$ implies $1+R = (17,000/1,000)^{(1/30)} = 1.10$, implies an assumed 10% return.
    b. I disagree. In current dollars, the cost is $1,000. Why not invest for 100 years and call the true cost $14 million?

    [Philip Elmer-DeWitt, The True Cost of Upgrading Your Phone, New York Times, October 21, 2021]