

1.

You work for an investment banking firm which "warehouses" (i.e., buys or funds) commercial mortgage loans and holds them until a sufficiently large pool (typically $\sim \$1$ billion) of diversified mortgages can be assembled and sold off as a commercial mortgage-backed security (CMBS). Your firm is about to warehouse a \$50 million individual mortgage loan that carries a (fixed) 6.0% interest rate, with a 20-year term when securitized. This loan is representative of other loans in the pool.

For purposes of this problem, make two simplifying assumptions: ignore monthly compounding (i.e., assume the annual compounding of interest) and treat the mortgage loans as if they are interest-only instruments (i.e., assume there is no principal amortization).

- A. Your firm wants to earn, upon the sale of the CMBS offering, a placement fee which has a present value equal to 2.0% of the placement (or loan) amount. For purposes of this computation, assume that the investment bank's cost of capital is 7.5%. As a representative loan, compute the annual fee (in dollars) that must be paid on the \$50 million loan such that the desired fee is earned. How large is this annual fee as a percentage of the (\$50 million) loan?

(9 minutes)

- B. When securitized, the (\$50 million) loan will be separated into A and B pieces (with the A piece being senior to the (subordinated) B piece). The firm's trading desk estimates that the A piece will be \$40 million and carry a rate of 5.0% (interest-only). Therefore, compute the maximum interest payable on the B piece.^t

(10 minutes)

- C. Name/describe four risks to which the firm is exposed while warehousing this (and other) loan(s).^f

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(9 minutes)

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(10 minutes)

C. Name/describe four risks to which the firm is exposed while warehousing this (and other) loan(s).^t

(12 minutes)

DO NOT WRITE ANSWERS IN THE EXAMINATION

^t Compute the interest rate on the B piece such that a) the A-piece buyers receive their 5.0% rate and b) your firm receives its investment banking fee. In so doing, ignore any implications of the Dodd-Frank regulations with regard to the risk-retention rules.

2.

You have been asked by your firm's chief investment officer (CIO) to estimate the risk/return profile of two competing real estate investments. In order to do so, you discuss the prospects for the general economy with your firm's in-house economist. From which, you produce a forecast of expected returns to each of the investments over the firm's anticipated holding period, given the economic landscape outlined by your colleague.

Economic Scenarios	Likelihood	Project #1	Project #2
"Double-Dip"	20%	-1.0%	1.0%
"Slow-and-Steady"	30%	5.5%	4.5%
"Rebounding"	30%	12.5%	14.5%
"Stagflation"	20%	9.0%	10.0%

You feel confident that all other significant investment variables have a reasonably small range of potential outcomes and that the normal distribution is a fair approximation of the true underlying distribution.

A. Compute the mean and standard deviation of the expected return for Project #1 (only).
(11 minutes)

B. You anticipate a portion of these investments will be financed with fixed-rate mortgage debt, where the effective interest rate ($k_d = \epsilon$) is expected to be 5.5% per annum. Assume that the mean and standard deviation of Project #2 are 8.0% and 6.0%, respectively (these are only approximations of the specific statistics). You are interested in the probability that each project will generate positive leverage (i.e., $E[k_j] > k_d$).

- i. What is the probability that Project #1 will generate positive leverage?
- ii. What is the probability for Project #2?
- iii. Based solely on this criterion, which project would you select?

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Page 3 of 6
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B. You anticipate a portion of these investments will be financed with fixed-rate mortgage debt, where the effective interest rate ($k_d = e$) is expected to be 5.5% per annum. Assume that the mean and standard deviation of Project #2 are 8.0% and 6.0%, respectively (these are only approximations of the specific statistics). You are interested in the probability that each project will generate positive leverage (i.e., $E[k] > k_d$).

- i. What is the probability that Project #1 will generate positive leverage?
- ii. What is the probability for Project #2?
- iii. Based solely on this criterion, which project would you select?

(9 minutes)

C. Assuming these two property investments are of equal size, a loan-to-value ratio of 50% would enable the investor to acquire both properties. Your CIO argues that this approach provides valuable diversification benefits. Identify three potential criticisms of this approach.

(9 minutes)

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D.

As you complete your analysis, the firm's CIO has one more investment idea. Project #2 is a "trophy" property and, accordingly, a lender has agreed to make a mortgage loan with an effective (fixed) interest rate ($k_d = \varepsilon$) of 7.5% per annum at a 95% loan-to-value ratio. As before, assume that the mean and standard deviation of Project #2 are 8.0% and 6.0%, respectively. You are interested in the probability of the project's bankruptcy (i.e., $E(k_e) < -1$). Notwithstanding all of the oversimplifications, you assume that the expected returns are normally distributed and that the one-period leverage model is sufficiently accurate for your purposes.

- i) What is the likely expected return on levered equity (k_e)?
- ii) What is the volatility of these levered returns (σ_e)?
- iii) What is the probability of bankruptcy ($\text{Prob}[E(k_e) < -1.0]$)?
} (9 minutes)

DO NOT WRITE ANSWERS IN THE EXAMINATION

Shortly after the latest financial meltdown (e.g., the global financial crisis (GFC), COVID pandemic, etc.), the share price of the common stock (10 million shares outstanding, no par value) of XYZ real estate investment trust (REIT) fell from \$40 to \$20. As a result, the firm's leverage ratio increased to 75%. Given the associated disruptions in the credit markets, the firm is concerned about the costliness of refinancing its mortgage indebtedness, as the entire amount of these loans are currently due. And, as a result, the firm has retained the investment banking services of ABC Company to explore a follow-on offering (i.e., a secondary offering of the company's common equity following the firm's initial public offering several years ago) and the pricing (i.e., the interest rate) of XYZ's indebtedness under various leverage ratios.

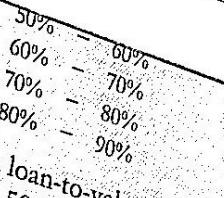
ABC reports to XYZ's senior management the following:

- Because of the turmoil in the capital markets, a follow-on (or secondary) offering of XYZ's stock would have to be priced at a 10% discount to the current share price.
- Given the quality of the assets in XYZ's portfolio and assuming fixed-rate financing, the pricing of the new debt is as follows:

<u>Debt Pricing</u>	
Risk-free Rate (r_f)	3.50%
<u>Spread over Risk-Free Rate</u>	
LTV Ranges	
0% – 50%	0.50%
50% – 60%	0.75%
60% – 70%	1.25%
70% – 80%	2.25%
80% – 90%	4.25%

[For example, a loan with a loan-to-value ratio of less than 50% would carry an all-in interest rate of 4.00% (i.e., 3.50% + 0.50).]

○ Based on the foregoing, ABC recommends that XYZ raise an additional \$150 million of



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- Based on the foregoing, ABC recommends that XYZ raise an additional \$150 million of equity capital through a follow-on stock offering. The proceeds (assume, for convenience, that fees and costs are zero) would be used entirely to pay down a portion of XYZ's outstanding debt.

In reflecting upon ABC's report, the senior management of XYZ forecasts an expected unlevered return from the assets in its portfolio (ϵ_u) of 10% (assuming a bit of a recovery in asset prices – from the market's current panic); however, senior management also recognizes that there is a good deal of variability in such returns. Accordingly, management also forecasts the standard deviation of asset-level returns (σ_e) to be 10%.

- A. What was XYZ's leverage ratio before the fall in its share price (from \$40 to \$20)?
(8 minutes)

B.

Because XYZ is concerned with risk-adjusted return to its shareholders, senior management asks you to prepare various analyses. In this regard, the Sharpe ratio (which is a measure of risk-adjusted returns) is an important metric to the senior management of XYZ. As a first step, assuming that XYZ ignores ABC's advice to issue additional equity and using a simple one-period model, forecast the following measures to the existing shareholders of XYZ (given the fall in its share price, from \$40 to \$20):

Before the Proposed Recapitalization:

- i) the cost of indebtedness (k_d),
- ii) the return on levered equity (k_e),
- iii) the volatility of levered equity (σ_e), and

iv) the Sharpe ratio of levered equity $\left(\frac{k_e - r_f}{\sigma_e} \right)$

(12 minutes)

C.

As a second step, now assume that XYZ's senior management accepts and implements the recommendations of ABC.

- i) What is the share price for the common stock issued in the follow-on offering and how many shares are to be issued?
- ii) Identify the balance sheet components of XYZ before and after the proposed recapitalization is completed. Your answer should take the following form:

XYZ Market Value: Before & After Recapitalization in thousands of \$ - except share price & percentages	
Before Recapitalization	After Recapitalization

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D.

As part of this second step, compute the same measures above now assuming that XYZ's senior management accepts and implements the recommendations of ABC:

After the Proposed Recapitalization:

- i) the cost of indebtedness (k_d),
- ii) the return on levered equity (k_e),
- iii) the volatility of levered equity (σ_e), and

iv) the Sharpe ratio of levered equity $\left(\frac{k_e - r_f}{\sigma_e} \right)$

(12 minutes)

E.

Notwithstanding your answers above, assume that your analysis concludes that Sharpe ratio to the initial shareholders under the Proposed Recapitalization (i.e., with the follow-on offering – as in D above) is lower than their Sharpe ratio if there were no Proposed Recapitalization (i.e., without the follow-on offering – as in B above). Despite the lower Sharpe ratio (i.e., lower risk-adjusted return), senior management decides to move forward with the follow-on offering. Give three strategic reasons why they may have decided to do so.

(9 minutes)

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Page < 6 > PDF

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As a second step, now assume that XYZ's senior management accepts and implements the recommendations of ABC.

i) What is the share price for the common stock issued in the follow-on offering and how many shares are to be issued?

ii) Identify the balance sheet components of XYZ before and after the proposed recapitalization is completed. Your answer should take the following form:

Total Market Value of the Firm
Mortgage Indebtedness
Current Equity Capitalization

XYZ Market Value: Before & After Recapitalization
in thousands of \$ - except share price & percentages

Before Recapitalization Amounts	Percent 100%	After Recapitalization	
		Amounts	Percent 100%

(10 minutes)