The University of North Carolina at Chapel Hill

Kenan-Flagler Business School

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KENAN-FLAGLER
BUSINESS SCHOOL

Investments – Sample Midterm Exam

Spring 2021

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Instructions:

Write your name and student ID in the space provided below. By writing your name, you pledge your honor that you will not violate the Honor Code during this examination. There are eighteen questions in this exam. Please answer all questions. The questions are multiple-choice: choose the correct answer, and guess if you do not know the answer.

Good luck!

Name:____

Student ID:____

Question 1 (5 points)

Which of the following is typically not part of the money market?

A. US T-bills
B. Eurodollar accounts
C. Municipal bonds
D. Commercial paper
E. Certificate of Deposits

Topic 1, slides 24, 26

Question 2 (6 points)

You short sell X shares of stock A. The initial price of stock X is P_0. The initial margin is 50%. Let P_1 the price of the stock when you get a margin call. The price when you receive a margin call is 35% higher (that is, $\frac{P_1}{P_0} - 1 = 35\%$). What is the maintenance margin?

Topic 1 slide 52, 55:

Assets $= P_0 \cdot X \cdot (1+50\%)$, Liabilities $= P_1 X = 1.35 P_0 \cdot X$

maintenance margin $= \frac{P_0 X \cdot 1.5 - 1.35 \cdot P_0 X}{1.35 P_0 X} = \frac{1.5-1.35}{1.35} = 11.11\%$

A. 10%
B. 11.11%
C. 12%
D. 15%
E. 15.38%

Question 3 (5 points)

Given the following information:

Stock	Initial Price	Final Price	Shares (million)
A	10	16	30
B	20	16	100

What is the percentage change in an index of the two stocks, assuming the index is computed like the S&P 500 Index?

Topic 1 slides 32, 33

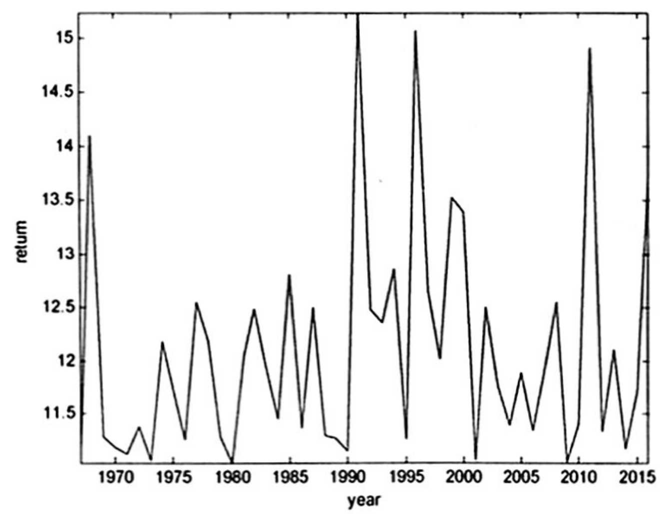
S&P500 ⇒ value weighted index

$\frac{16 \cdot 30 + 16 \cdot 100}{10 \cdot 30 + 20 \cdot 100} - 1 = -9.57\%$

A. -20.00%
B. -9.57%
C. 6.67%
D. 20.00%
E. 30.00%

Question 4 (5 points)

Consider an asset whose return over time are plotted below:



Topic 2 slide 21
(note: this is not a plot of the distribution!)
The time-series plot shows occasional positive jumps =>
⊕ skew (⊕ jumps)
⊕ ex kurt (non-negligible outliers)

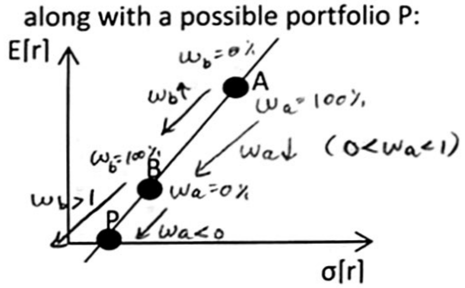
Which statement is correct?

A. The skewness of the asset is positive, and the excess kurtosis is positive
B. The skewness of the asset is negative, and the excess kurtosis is positive
C. The skewness of the asset is positive, and the excess kurtosis is negative
D. The skewness of the asset is negative, and the excess kurtosis is negative
E. The skewness and the excess kurtosis are both zero

Question 5 (6 points)

There are two stocks: A and B. The investment opportunity set from these two stocks is depicted below, along with a possible portfolio P:

Topic 3 slide 48



Complete the sentence:

"The correlation between the return on A and B must be ____, and to achieve portfolio P you need to ___ stock A, and ___ stock B."

A. 1, buy, buy
B. 1, buy, short-sell
C. 1, short-sell, buy because $w_a<0$, $w_b>1$
D. -1, buy, buy
E. -1, buy, short-sell

Question 9 (6 points)

You can only invest in the S&P500, whose expected return for the next year is 9%. Your goal is to obtain an expected return of 30% over the next year. You have 800 dollars that you intend to invest. Your broker is willing to lend you money at an interest rate of 2% (without a limit, no margin requirement). How much do you need to borrow from the broker? Topic 3 slide 9, 16

A. 240 dollars
B. 400 dollars
C. 1600 dollars
D. 2400 dollars
E. 4000 dollars

Let w_f be the weight on r_f, $1-w_f$ on S&P500. Then

$0.02 w_f + 0.09\cdot(1-w_f) = 0.3 \Rightarrow -0.07 w_f = 0.21 \Rightarrow w_f = -300\%$

$\Rightarrow$ Borrow 300% of equity $\Rightarrow 3\cdot 800 = \underline{2400}$

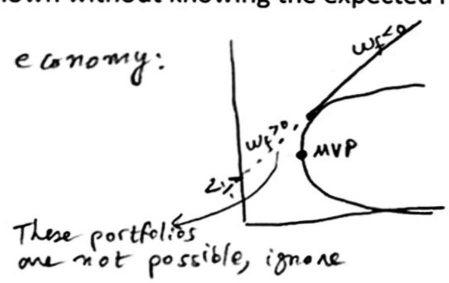
Not needed to show: $\frac{(800+2400)\cdot 1.09 - 2400\cdot 1.02}{800} - 1 = 30\%$

Question 6 (6 points)

There are two risky stocks whose standard deviations are 4% and 8%, respectively. The returns on the two assets are uncorrelated (correlation = 0). The risk free rate is 2%. Short selling of stocks is allowed. You can only borrow at the risk free rate, and you can't lend (at all). The minimum ~~variance~~ standard deviation of any portfolio in this economy must be:

A. 0%
B. 3.57% Topic 3 slides 47, problem set 2 part c (similar)
C. 4%
D. 6.45%
E. The answer is unknown without knowing the expected return of the two risky assets

First, plot the economy:



$\Rightarrow$ Because you cannot lend the lowest standard deviation is of MVP of 2 risky assets

$\Rightarrow w_1 = \frac{8^2}{4^2+8^2} = 0.8$, $w_2 = 0.2$

$\Rightarrow \sigma = \sqrt{0.8^2\cdot 4^2 + 0.2^2\cdot 8^2} = 3.57\%$

Question 7 (6 points) [A bit more challenging] Topic 3 slide 58

There are only two risky assets in the economy with the following properties:

Asset	Expected Return	Standard Deviation
A	6%	5%
B	10%	10%

The correlation between the assets is zero. The risk-free rate is 2% for both borrowing and lending. Which statement is correct?

A. The portfolio $w_f = 0.5, w_A = 0.428, w_B = 0.071$, is efficient.
B. The portfolio $w_f = 0.4, w_A = 0.500, w_B = 0.100$, is efficient.
C. The portfolio $w_f = 0.3, w_A = 0.560, w_B = 0.140$, is efficient.
D. The portfolio $w_f = 0.2, w_A = 0.533, w_B = 0.267$, is efficient.
E. The portfolio $w_f = 0.1, w_A = 0.675, w_B = 0.225$, is efficient.

Any efficient portfolio is on the optimal cal:

$\Rightarrow$ all efficient portfolios are a combination of r_f and M.

Find M:

$w_A = \frac{(6-2)\cdot 10^2}{(6-2)\cdot 10^2 + (10-2)5^2} = \frac{2}{3}$, $w_b = \frac{1}{3}$

$\Rightarrow$ If an efficient portfolio has weight w_f in r_f then it has a weight of $(1-w_f)$ in M, suggesting $w_a = (1-w_f)\cdot\frac{2}{3}$, $w_b = (1-w_f)\cdot\frac{1}{3}$. Plug $w_f = 0.2$, get D.

Question 8 (6 points) [A bit more challenging]

Assume the single-factor CAPM model holds. Asset A is has no idiosyncratic variance, $var(e_A) = 0$. The asset's total risk is four times as large as the market's ($\sigma_A^2 = 4\sigma_M^2$). What is the beta of asset A?

Topic 4, slide 22, 14

A. 0.25
B. 0.5
C. 2
D. 4
E. The answer is unknown without knowing ρ_{AM}.

$\sigma_A^2 = \beta_A^2 \cdot \sigma_M^2 + 0$

$\Rightarrow \beta_A^2 = \frac{\sigma_A^2}{\sigma_M^2} = 4 \Rightarrow \beta_A = 2$

Not needed for the question (but useful):

$\beta_A = \frac{\rho_{AM}\cdot\sigma_A\sigma_M}{\sigma_M^2} = \rho_{AM}\cdot\frac{\sigma_A}{\sigma_M} \Rightarrow 2 = \rho_{AM}\cdot 2$

$\Rightarrow \rho_{AM} = 1$

$\Rightarrow$ in general, if an asset has no idio var, its corr with the market is 1.

Question 10 (6 points)

Assume the CAPM model holds. The risk free rate is 3%. The market *risk premium* is 6%. The betas of stocks A and B are 0.2 and 0.8, respectively. What is the expected rate of return of a portfolio whose weights are 50% in A and 50% in B? Topic 4 slide 39, 26

A. 1.5%
B. 3%
C. 4.5%
D. 6%
E. 7.8%

$\beta_P = \frac{1}{2}\cdot 0.2 + \frac{1}{2}\cdot 0.8 = 0.5$

$E[R_p] - 3 = 0.5\cdot \underset{E[R_M^e]}{\underset{\parallel}{6}} \Rightarrow E[R_p] = 6\%$

Question 11 (5 points) [Articles > market predictors]

Which of the following predicts a significantly higher excess return on the market over the next 5 years?

I.	Increase in the Gold-to-platinum ratio	|t-stat| = 4,77 > 1,96 ✓
II.	Increase in the variance risk premium	|t-stat| = 0,79 < 1,96 ✗
III.	Increase in the Term Spread (10y-3m yield)	|t-stat| = 2,15 > 1,96 ✓
IV.	Increase in the Price-to-earnings ratio	|t-stat| = 1,99 but negative coef. ✗

⇒ only I + III

A. I, II, III, IV
B. I, II, III only
C. I, II only
D. I only
E. None of the above

Question 12 (6 points) Topic 5 slide 36

Assume the three-factor model of Fama-French (1993) holds. The risk premium of the market factor is 0.43%. The risk premium of the SMB factor is 0.27%. The risk premium of the HML factor is 0.40%.

Stock A has an exposure of 1.6 to the market factor, an exposure of 0 to SMB, and an exposure of 1.1 to HML. The actual expected excess rate of return on stock A is 1%.

Stock B has an exposure of 1.6 to the market factor, an exposure of 1.1 to SMB, and an exposure of 0 to HML. The actual expected excess rate of return on stock B is also 1%.

Therefore:

$\alpha_A = 1 - [1.6 \cdot 0.43 + 0 \cdot 0.27 + 1.1 \cdot 0.4] = -0.12 \Rightarrow$ short

$\alpha_B = 1 - [1.6 \cdot 0.43 + 1.1 \cdot 0.27 + 0 \cdot 0.4] = 0.015 \Rightarrow$ buy

A. Both assets are fairly-priced
B. You should buy both assets
C. You should short-sell both assets
D. You should buy A and short-sell B
E. You should buy B and short-sell A

Question 13 (5 points) Topic 5 slide 38,39

According to the findings of Fama-French (1992), which of the following is true?

A. Fixing a size decile, portfolios' returns increase with their beta decile.
B. Fixing a beta decile, portfolios' returns increase with their size decile.
C. Higher Book to Market ratios imply higher expected returns.
D. Controlling for book to market ratios, size does not explain expected returns.
E. Past winners have lower expected returns 3 months ahead.

Question 14 (5 points) Topic 5 slide 45, 46

In their multifactor model Chen, Roll, and Ross (1986) found that:

A. Changes in the returns on long-term government bonds and short-term T-bills is a priced factor.
B. Unexpected inflation seems to be associated with good states of the world.
C. Unexpected changes in default risk premium seems to be associated with bad states of the world.
D. Industrial production growth does not have a significant risk premium.
E. Value weighted NYSE index had the incorrect sign, implying a negative market risk premium.

Question 15 (6 points) Topic 5 slide 33

Consider the multifactor model with two factors. The risk premiums on the factor 1 and factor 2 portfolios are 5% and 6%, respectively. Stock A has a beta of 1.2 on factor 1, and a beta of 0.7 on factor 2. The expected return on stock A is 17%. If no arbitrage opportunities exists, the risk-free rate is:

A. 6.0%
B. 6.5%
C. 6.8%
D. 7.4%
E. 7.8%

$E[R_A] = R_f + \beta_1 E[F_1] + \beta_2 E[F_2]$

$17 = R_f + 1{,}2 \cdot 5 + 0{,}7 \cdot 6$

$R_f = 6{,}8\%$

Question 16 (5 points) Topic 5 slide 17, 18, 33

Consider the multifactor model with two factors. The risk premiums on the factor 1 and factor 2 portfolios are both 6%. The risk free rate is also 6%. You want to test if the model is correct. You collect data on several portfolios, and compute their exposures to factors 1 and 2. You run the following regression (similar to a second-stage Fama-Macbeth (1973) regression). Specifically, you regress portfolios' average <u>excess returns</u> on a constant, their exposure to the first factor, their exposure to the second factor, and ME_i, the average size of firms belonging to portfolio i.

$$\overline{R_i^e} = \gamma_0 + \gamma_1\beta_{1,i} + \gamma_2\beta_{2,i} + \gamma_3 ME_i + e_i$$

If the model is true, and there are no abnormal returns, then your null-hypotheses should be:

H_0: $\gamma_0 = $ _0_ $\gamma_1 = $ _6%_ $\gamma_2 = $ _6%_ $\gamma_3 = $ _0_

A. 6%, 6%, 6%, 6%
B. 6%, 6%, 6%, 0
C. 0, 0, 6%, 0
D. 0, 6%, 0, 0
E. 0, 6%, 6%, 0

$E[R_i^e] = 0 + \overset{6\%}{E[F_1]}\beta_1 + \overset{6\%}{E[F_2]}\beta_2 + 0 \cdot ME_i$

$\updownarrow$

$R_i^e = \gamma_0 + \gamma_1 \beta_1 + \gamma_2 \beta_2 + \gamma_3 \cdot ME$

Question 17 (6 points) Topic 5 slide 17, 18

Consider the multifactor model with two factors. The risk premiums on factor 1 and factor 2 portfolios are 5% and 6%, respectively. The risk free rate is 1%. You want to test if the model is correct. You collect data on several portfolios, and compute their exposures to factors 1 and 2. You run the following regression (similar to a second-stage Fama-Macbeth (1973) regression). Specifically, you regress portfolios' average returns on a constant, their exposure to the first factor, their exposure to the second factor, and ME_i, the average size of firms belonging to portfolio i.

$$\overline{R_i} = \gamma_0 + \gamma_1\beta_{1,i} + \gamma_2\beta_{2,i} + \gamma_3 ME_i + e_i$$

If the model is true, and there are no abnormal returns, then your null-hypotheses should be:

H_0: $\gamma_0 =$ 1% $\gamma_1 =$ 5% $\gamma_2 =$ 6% $\gamma_3 =$ 0

$E[R_i^e] = 0 + E[F_1]\beta_1 + E[F_2]\beta_2 + 0 \cdot ME$

$\Leftrightarrow E[R_i] = \overset{1\%}{r_f} + \overset{5\%}{E[F_1]}\beta_1 + \overset{6\%}{E[F_2]}\beta_2 + 0 \cdot ME$

$R_i = \gamma_0 + \gamma_1 \beta_1 + \gamma_2 \beta_2 + \gamma_3 \cdot ME$

A. 0, 5%, 6%, 0
B. 0, 6%, 5%, 0
C. 0, 6%, 0, 1%
D. 1%, 5%, 6%, 0
E. 0%, 1%, 5%, 6%

Question 18 (5 points) [Articles > AQR FF5F]

The following table is taken from Fama-French Five Factor Model paper:

	Intercept	RM-RF	SMB	HML	RMW	CMA	R²
RM-RF	9.8% (4.94)		0.25 (4.45)	0.03 (0.37)	-0.40 (-4.84)	-0.91 (-7.82)	24%
SMB	4.6% (3.22)	0.13 (4.45)		0.05 (0.81)	-0.48 (-8.42)	-0.17 (-1.92)	18%
HML	-0.5% (-0.46)	0.01 (0.37)	0.02 (0.81)		0.23 (5.39)	1.04 (23.04)	52%
RMW	5.2% (5.44)	-0.09 (-4.84)	-0.22 (-8.42)	0.20 (5.39)		-0.44 (-7.85)	22%
CMA	3.3% (5.03)	-0.10 (-7.82)	-0.04 (-1.92)	0.45 (23.04)	-0.21 (-7.85)		57%

Which factor's variation is explained the most by all other factors? (= highest R^2)

$\Downarrow$

CMA with $R^2 = 57\%$

$\Downarrow$

investment factor

A. The market factor
B. The size factor
C. The value factor
D. The profitability factor
E. The investment factor