CHULALONGKORN BUSINESS SCHOOL
FLAGSHIP FOR LIFE

CR. No.....

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Program: Full Time / Flexible

Master of Science in Finance **Final Examination of the 1/2021**

2604896 Comprehensive Exam **31 th October 2021, 9:00 am–12:00**

Penalties for Violating University Examination Regulations

1. A student found to be cheating on an exam will receive a "U" in the course, and that student will be required to withdraw from all other courses taken during the term. In addition, the student will have behavioral marks deducted that may result in full expulsion from the University.
2. In the case of suspicion of committing a fraudulent act, the student will receive a "U" in the course, and the student will have behavioral marks deducted.
3. Violation of any University regulations on examinations will be penalized according to Chulalongkorn University policies.

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1. This is a **CLOSED BOOK** examination.
2. All questions are essay type of question. Student's answer must be written by **the student's owned hand-writing** either on paper or iPad (or similar devices). The ink color must be either **black or blue**.
3. The paper consists of 4 subjects, namely,
    1. 2604639 Finance Theories
    2. 2604643 Derivatives and Risk Management
    3. 2604674 Financial Econometrics
    4. 2604697 Financial Markets, Institutions, and Instruments
4. Students are required to **answer 3 out of 4 subjects** . If students submit answers for more than 3 subjects, only the 3 subjects with the lowest scores will be considered.
5. To obtain the "S" grade for the Comprehensive Examination, students must pass at least 2 out of 3 subjects. The passing criterion for each subject is 50%.
6. To submit the answer, students must:
    (1) Save his/her work in **a single file**. The file must be in **"PDF" format**. If students write answers on paper, students must scan or take photograph of the paper and convert it into a PDF file before submission.

(2) The file name is "YY_XXXXXXXXXX", where YY is the exam seat number and XXXXXXXXXX is the student ID. For example, if your exam seat number is 5 and student ID is 5942987326, then the file name must be "05_5942987326".

(3) Submit the file back to the blackboard system. Students are allowed to submit their answers **only one time** (i.e., no resubmission is allowed).

(4) An additional 15 minutes will be added to the normal exam period for the submission process. Therefore, the exam paper must be submitted before 12:15 pm. **based on the time stamp on the Blackboard system**. A late submission will not be accepted and the paper will be considered as missing.

(5) Once submitted, it is highly suggested that students should logout from and then login back to the Blackboard system again to check whether the submission is completed.

7. This examination shall neither be shared nor disclosed to anyone at any time without permission of the instructor.

Name _____ ID _____

2604639 Financial Theories

There are 7 questions (page 3 to 5). Answer all the questions. Use only a pen in writing your answer (do not use a pencil). Any answer or part thereof written with a pencil will receive zero mark. Do not write your answers beyond the provided space. Write only one line of answers per line of space provided. The maximum possible points are indicated in each question. The full score is 100% and the passing score is 50%.

Use the following information to answer Questions (1.1) through (1.4). The stochastic dominance (SD) theorem and mean-variance (MV) criterion both are criteria of choice under uncertainty.

Question 1.1 (20% of total mark)

Discuss *two* ways in which the SD theorem and MV criterion differ from each other.

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Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

Question 1.2 (20% of total mark)

Based on the differences you identify in Question (1.1), discuss *whether* and *how* the SD theorem is superior to the MV criterion, or the MV criterion is superior to the SD theorem.

Note: Make sure to clearly discuss the rationale for your answer. Without a discussion of the rationale, the mark will be **zero**.

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_____

Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

Question 1.3 (10% of total mark)

Suppose there are two assets with the same expected payoff, A and B. Suppose further that A is more risky than B.

Under the SD theorem, how can investors identify that A is more risky than B?

Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

Question 1.4 (10% of total mark)

Consider assets A and B in Question (1.3). Under the MV criterion, how can investors identify that A is more risky than B?

Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

Question 2.1 (10% of total mark)

Describe one situation in which the adverse selection problem can arise.

Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

Question 2.2 (10% of total mark)

Discuss a consequence of the situation you described in your answer to Question (2.1).

Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

Question 2.3 (20% of total mark)

Discuss *how* (i.e., the mechanism through which) signaling can provide a solution to the problems discussed in Questions (2.1) and (2.2).

Note: Make sure to clearly discuss the mechanism that guarantees a solution.

Do not write your answer beyond this point. Answers beyond this point will not be marked. ==========

----- END OF FINANCIAL THEORY EXAMINATION -----

Name _____ ID _____

2604643 Derivatives and Risk Management

There are 4 questions (page 6 to 8). Answer all the questions. The maximum possible points are indicated in each question. The full score is 50 points and the passing score is 25 points.

Problem 1 The following table shows the spot interest rates in continuous compound:

1-month rate = 1.94%	4-month rate = 2.29%	7-month rate = 2.36%	10-month rate = 2.41%
2-month rate = 2.15%	5-month rate = 2.31%	8-month rate = 2.38%	11-month rate = 2.42%
3-month rate = 2.25%	6-month rate = 2.34%	9-month rate = 2.40%	12-month rate = 2.43%

a) (10 points) Compute the 6-month interest rate, 6 months forward (answer in annual compounding)

b) (10 points) Compute the 3-month interest rate, 9 months forward (answer in quarterly compound)

a.)

$e^{0.0243} = e^{\frac{0.0234}{2}} \cdot e^{\frac{X}{2}}$

$1.02466 = 1.01177 \cdot e^{\frac{X}{2}}$

$1.01268 = e^{\frac{X}{2}}$

$2 \ln 1.01268 = X$

$X = 0.02522$ (Cont.)

$e^{0.02522} = 1.02552$

$\therefore$ The rate = 2.552% Annualy

b.) $e^{0.0243} = e^{0.0234 \cdot \frac{3}{4}} \cdot e^{\frac{X}{4}}$

$4 \ln 1.0003 = X$

$X = 2.52\%$ cont

$= 2.552\%$ annualy

$(1 + \frac{X}{4})^4 = 1.02552$

$X = 0.25288\%$ Quarterly

Problem 2 Explain the relationship between the forward exchange rate, the spot exchange rate, the foreign interest rate, and the domestic interest rate. If possible, use an equation to help explain the relationship. (10 points)

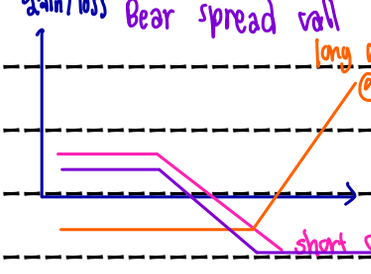
f.w) rate has to be non-arbitrage

Forward exchange rate = spot exchange rate $\times \frac{(1+r_h)^T}{(1+r_f)^T}$

Foward rate is traded at discount if $r_h < r_f$

premium >

Problem 3 Give an example of an option spread strategy. Also, briefly explain the benefit of the option spread strategy that you choose. (10 points)



limit loss & gain → max profit = premium receive

Problem 4 Give an example of a portfolio that is delta-neutral. Also, briefly explain the purpose of delta hedging. (10 points)

A delta-neutral portfolio is constructed to have a total delta of zero, meaning its value is insensitive to small changes in the underlying asset's price. The main purposes of delta hedging include managing risk, stabilizing portfolio value, facilitating arbitrage strategies, reducing capital requirements, and supporting complex trading strategies.

----- END OF DERIVATIVES AND RISK MANAGEMENT EXAMINATION -----

Name _____ ID _____

2604674 Financial Econometrics

There are 3 main questions (page 9 to 16). All the questions have to be answered by the student's own hand-writing in any color but red. Anything in red or not in the pdf file will not be read and graded. The maximum possible points are indicated in each question. The full score is 50 points, and the passing score is 25 points.

Q 1. (20 points) A researcher would like to examine the impact of ESG score on credit ratings of listed companies in Stock Exchange of Thailand (SET). Let

Rating = a measure of credit rating, where higher value implies better rating

ESG = ESG score

SET^{100} = dummy variable for a company being listed on SET100 index

X = a vector of all other control variables

a. Write down a regression equation if the researcher hypothesizes that the impact is linear in ESG. State the null and alternative hypotheses to test whether impact is positive.

$$Rating_i = \beta_0 + \beta_1 ESG_i + \beta_2 SET100_i + \beta_3 X_i + \varepsilon_i$$

$$H_0 : \beta_1 \leq 0$$

$$H_1 : \beta_1 > 0$$

b. Write down a regression equation if the researcher has a prior assumption that the impact is linear in ESG, but the impact may be different for the firms listed on SET100 and the others. State the null and alternative hypotheses to test whether the impact of those listed on SET100 is positive. State another null and alternative hypotheses to test whether the impact of those not listed on SET100 is lower than that of those listed.

$$Rating_i = \beta_0 + \beta_1 ESG_i + \beta_2 SET100_i + \beta_3 SET100_i \cdot ESG + \beta_4 X_i + \varepsilon_i$$

For firms listed on SET100;

$H_0: \beta_1 + \beta_3 \leq 0$

$H_1: \beta_1 + \beta_3 > 0$

For firms not listed on SET

$H_0: \beta_3 \leq 0$

$H_1: \beta_3 > 0$

from $\beta_1 < \beta_1 + \beta_3$

$0 < \beta_3$

$\beta_3 > 0$

2604674 Financial Econometrics

c. Write down a regression equation if the researcher has a prior assumption that the impact is non-linear in ESG. State the null and alternative hypotheses to test whether the impact is non-linear.

$$Rating_i = \beta_0 + \beta_1 ESG_i + \beta_2 ESG_i^2 + \beta_3 SET100_i + \beta_4 X_i + \varepsilon_i$$

$H_0: \beta_2 = 0$

$H_1: \beta_2 \neq 0$

d. Write down a regression equation that can be used to examine whether the average credit rating of the companies listed on SET100 is higher than the average of those not listed. State the null and alternative hypotheses to test it.

$$Rating_i = \beta_0 + \beta_1 SETWO_i + \beta_2 x_i + \varepsilon_i$$

$H_0 : \beta_1 \leq 0$

$H_1 : \beta_1 > 0$

Q 2. (15 points) An investor would like to test whether her investment strategy outperforms the market. Hence, she forms a portfolio based on the strategy and tests whether the abnormal return α is greater than zero. These are the results based on a large sample size:

	CAPM	Fama-French	Carhart
β_0 Abnormal Return (α)	0.180 (0.16)	0.096 (0.06)	0.098 (0.08)
β_1 $R_m - R_f$	1.240 (0.12)	1.320 (0.32)	1.330 (0.22)
β_2 *SMB*		0.762 (0.23)	0.862 (0.33)
β_3 *HML*		0.488 (0.58)	-0.008 (0.09)
β_4 *UMD*			0.448 (0.82)
R-squared	0.45	0.54	0.57
Adj *R*-squared	0.43	0.51	0.49

Standard errors in parentheses

a. Based on the given results, which model among the three fits the data the best? Explain your reason.

Adjusted R-squared is more preferred than R-square to determine the fitness of a model. This is because adjusted R-squared penalizes the addition of non-meaningful variables. Thus, Fama-French fits data the most as it has the highest adj R-squared.

2604674 Financial Econometrics

b. Based on the estimates of the model you selected in part a., compute a 99% confidence interval for the abnormal return. Use the constructed confidence interval to explain whether there is evidence at 1% significance level that the abnormal return exists.

$t\text{-stat} = \frac{0.096}{0.06} = 1.6 < 2.375$

Two-sided test:

99% confidence interval: $\hat{\beta} \pm se(\hat{\beta}) \cdot \text{critical value}$

$= 0.096 \pm 0.06 \cdot (z_{\alpha/2})$ → 0.5%

$= 0.096 \pm (0.06 \times 2.576)$

$\therefore$ 99% CI $\in (-0.0586, 0.2506)$

Fail to reject

$H_0: \beta_0 = 0$

$H_1: \beta_0 \neq 0$

β_1 of 0 is in the 99% CI.

Thus, we fail to reject H_0.

There is no significal abnormal return at significance level 1%.

$CI = \hat{\beta} \pm se(\hat{\beta}) \cdot C_{1\%}$

$= 0.096 \pm 0.06 \cdot 2.36$

$(-0.05, 0.2376)$

$\beta_1 = 0$ is in the CI

Can not reject $\beta_1 = 0$

c. Based on the estimates of the model you selected in part a., conduct a hypothesis test whether the beta of market excess return is higher than 1 using 10% significance level. Make sure you correctly state hypotheses, test-statistic and its distribution, p-value, critical value, rule to reject the null hypothesis, and conclusion of the test.

$H_0: \beta_1 = 1 \quad H_1: \beta_1 > 1$

$t = \frac{1.32 - 1}{0.92} = 1$

p-value $= 1 - 0.843 = 0.157$

critical value ≈ 1.282

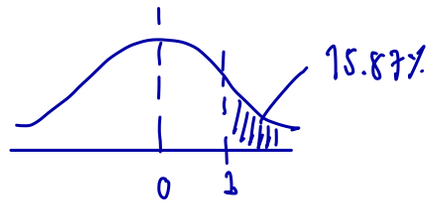
p-value > 0.1

fail to reject null hypothesis

- Hypothesis :

$H_0 : \beta_1 \leq 1$

$H_1 : \beta_1 > 1$



- t-stat $= \dfrac{\hat{\beta} - b}{se(\hat{\beta})} = \dfrac{1.32 - 1}{0.32} = 1 \sim N(0,1)$ based on large observations

- p-value $= prob(z > 1) = 1 - 0.8413 = 0.1587 > \alpha = 10\% \Rightarrow$ fail to reject H_0

- Critical value $= z_{10\%} = 1.285$

From the calculation, t-stat of 1 is less than critical value of 1.285. Moreover, p-value of 15.87% is greater than significance level of 20%. Thus, we fail to reject $H_0 : \beta_1 \leq 1$. There is insufficient evidence that impact of excess return on portfolio return is greater than 1.

Q 3. (15 points) Suppose a researcher would like to estimate the impact of $X1$, $X2$, and $X3$ on Y using the following regression model:

$$Y = \beta 0 + \beta 1 X1 + \beta 2 X2 + \beta 3 X3 + \varepsilon$$

For each of the following situations that he may face, explain what it is, whether/why it is a problem, and, if so, what could be a resolution to cope with it.

a. $X1 + X2 = X3$

- As X_3 is a linear combination of X_1 and X_2, multicollinearity occurs.
- Multicollinearity problem causes the estimated coefficient not unique.
- To solve multicollinearity, we can either drop X_1 + X_2 or X_3 from the model.

b. Heteroskedasticity — $Var[u|x]$ depends on X | $Var[u|x]$ is not constant across observation

- Heteroskedasticity doesn't affect the unbiasedness and consistency of OLS. However, it causes incorrect standard error that leads to wrong inference.
- There is two ways to solve this problem
  1. Use another estimator than OLS, which is GLS estimator
  2. Use another standard error, which is White's robust standard error.

2604674 Financial Econometrics

c. Measurement error in $X1$

- Measurement error in independent variable causes endogeneity problem as $\tilde{X}$ which can be observed is equal to $X + \varepsilon$ and hence $cov(\tilde{x}, \varepsilon) \neq 0$. ($\varepsilon$ noise)
- The result of measurement error is biased toward zero.
  - If we reject H_0 with $\beta = 0$: $\hat{\beta}^{OLS}$, then it is safe to say that we reject H_0 in population. However, if we fail to reject $H_0: \beta = 0$, then we cannot make conclusion and need to use new estimator
- we can use instrument variable (z) instead or use 2SLS or TSLS estimator.

d. *Y* has impact on *X*1

- The reverse causality leads to endogeneity problem as $cov(Y, \varepsilon) \neq 0 \rightarrow$ causes OLS estimator to be inconsistent & biased
- This can be solved by switch Y and X or use instrument variable.

e. Serial Correlation

- Residuals or error terms are correlated with each other ($Cov(v_t, v_{t-k}) \neq 0$)
- This causes incorrect standard error and lead to wrong inference. (OLS still consistent)
- Can be detected by Breusch-Godfrey test
- Solve by using Newey-West standard error.

----- END OF FINANCIAL ECONOMETRICS EXAMINATION -----

Cumulative Distribution of Standard Normal

z	0	1	2	3	4	5	6	7	8	9
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

Name _____ ID _____

2604697 Financial Markets, Institutions and Instruments

There are 3 main questions (page 17 to 19). Answer all the questions. The maximum possible points are indicated in each question. The full score is 50 points, and the passing score is 25 points.

Question 1: What is the Trinity of Impossibility? When countries in the Eurozone chose to adopt the single currency (the Euro), what did they expect to achieve and what did they have to sacrifice in terms of the Trinity of Impossibility? Explain [20 points]

Question 2: An Australian firm is considering whether to borrow money in AUD or JPY for 9 months. The current interest rate on JPY-loan is 4.0% pa, while AUD-loan is 6.0% pa. The current exchange rate between JPY and AUD is ¥69.94/A$. The firm forecasts that AUD will depreciate to ¥69.10/A$ at the end of month nine. *[15 points]*

2.1) Given that the objective is to borrow at the lowest expected interest rate, which currency should the firm borrow? (Show your calculation and answer to 4 decimal place)

2.2) Apart from the level of interest rate (as answered in Question 2.1), how could foreign exchange rate risk consideration also play an important role in making the above decision? Explain.

Question 3: Today is Monday 15th June 20XX. A bank quotes the following exchange rates. Use these rates to answer the following questions. (Note: answer all questions to 4 decimal points) *[15 points]*

USD/SGD spot rate ($S_0^{S\$/U\$}$):	0.9450 / 0.9820 SGD per USD
3-Month swap points:	+0.0120 / +0.0140 SGD per USD
6-Month swap points:	+0.0250 / +0.0275 SGD per USD

3.1) A customer wants to buy SGD 38,000 against USD spot. How many USD does it cost? When is the settlement date? *[5 points]*

$\frac{0.9450}{1} = \frac{38000}{X}$ $X = \frac{38,000}{0.945} = 40211.6402$

3.2) A Singapore importer has outstanding USD-account payables value at U$5,000,000 dues in 6 months' time. The importer would like to buy USD-Forward to hedge this account payables. What is the forward rate that the importer will get? When is the settlement date? *[5 points]*

$\frac{0.982^{f.swap}}{1} = \frac{X}{5000000}$ $X = (0.982 + 0.0275)(5m)$

3.3) As the bank quotes USD at a forward premium, the Singapore importer is better off buying USD spot rather than forward (i.e., the spot rate for USD is cheaper than the forward rate). Do you agree with this idea? Discuss. *[5 points]*

----- END OF FINANCIAL MARKETS, INSTITUTIONS AND INSTRUMENTS EXAMINATION -----