AFRICAN ECONOMIC RESEARCH CONSORTIUM

Collaborative Masters Programme in Economics for Anglophone Africa (Except Nigeria)

JOINT FACILITY FOR ELECTIVES (JFE) 2016
JUNE – SEPTEMBER

FINANCIAL ECONOMICS I

First Semester: Final Examination

Duration: 3 Hours   **Date: Tuesday, August 2, 2016**

INSTRUCTIONS:

1. Answer **ANY FOUR** questions.

2. All questions carry equal marks.

3. A formula sheet is provided at the end of this question paper.

Question 1:   **(Time Value of Money)**

Your friend, Leah Nomvete, has just been employed as an economist. Fortunately, her father only last year gifted her with a car on her 22nd birthday, exactly eleven months ago. Ms. Nomvete currently lives with her parents in a neighborhood south of the city. Her target is to move to the northern suburbs in her own three-bed house on her 30th birthday. In the meantime, she plans to set aside an equal amount of money on a monthly basis to enable her achieve this goal. Lately, she has been following property prices in the neighborhood of her interest very closely. Her boss, a renowned property investor, recently closed a deal on a property with design and features similar to what she has in mind just for ZAR 2,368,228 in that same neighborhood. Properties in the neighborhood have been appreciating at an average compound rate of 3% per year over the last several years. Property market analysts believe that this situation will prevail into the foreseeable future.

Ms. Nomvete plans to save the same amount of money at the *end* of every month beginning the first month of her 23rd birthday. She has identified a fund that currently pays interest at the rate of 6.5% per year, compounded monthly, on a savings plan.

(a) How much money does Ms. Nomvete have to save each month to enable her achieve the objective of owning her residential property at the end of her 30th birthday? (Assume that there are no brokerage commissions or legal fees on property purchase transactions). **(4 marks)**

(b) Suppose Ms. Nomvete has decided that she will *partially* finance the purchase by borrowing a loan from a bank on the terms 80% loan-to-value ratio (LTV) on her 30th birthday. This means that the bank can extend a loan amounting to not more than 80% of the property's value. The interest rate on residential loans is expected to be 11% per annum with equal *monthly instalment* payments over 25 years. Further, Ms. Nomvete

will have to pay legal costs amounting to 2% and bond fees amounting to 1% both based on the property value at the time of purchase. Since these costs cannot be borrowed, Ms. Nomvete must have adequate cash to pay for them separately. Her employer has promised to top up her savings by paying into the fund, on her 26th birthday, 30% of the amount accumulated as of that date.

(i) Under these circumstances, how much money does she have to set aside each month to meet her objective? **(5 marks)**

(ii) Compute Ms. Nomvete's expected *monthly* debt service. (Debt service is the total amount she is going to pay each month to cover both interest payments and principal repayments). The loan will be fully amortized. **(2 marks)**

(c) Ms. Nomvete has decided that she must move out of her parents' residence on her 30th birthday whether or not she is buying her own property. She has two options available: buying or renting the property on her 30th birthday. At the moment, leases on properties of similar attributes as her "dream-house" are available at approximately ZAR 15,000 per month in the northern suburbs. Five years ago, leases on similar properties could be signed at about ZAR 12,000 per month. If she does not buy her own residence, she is going to sign a ten-year lease agreement with a landlord in the same suburb at the prevailing rentals; the rate of change in lease rentals is expected to remain constant over time. If she buys the property, she will finance the purchase partially using debt on the terms specified in part (b) above. She will live in it for ten years and then sell it at the market price. However, like other property-owners, she must pay property taxes amounting to ZAR 2750 every month to the local government. She must also pay service levies and property insurance of ZAR 2250 per month. Utilities and household insurance will cost her ZAR 1500 each month; however, she will also have to pay the same amount as a tenant under the leasing contract.

(i) Estimate the rent payable on properties of the kind Ms. Nomvete is interested in when she is expected to sign the lease on her 30th birthday. Use the constant growth assumption. **(2 marks)**

(ii) Compute Ms. Nomvete's monthly net cash flows (include opportunity costs and monthly debt service) if she buys the property on her 30th birthday. **(3 marks)**

(iii) Compute her net proceeds from sale if she sells the property after ten years of occupation as she plans to. Ms. Nomvete expects to be in the 40% tax bracket for income taxation. Capital gains tax rate is 13.2%. Selling expenses average 4% of gross proceeds from property sales. **(3 marks)**

(iv) Compute Ms. Nomvete's net present value (NPV) from the property acquisition if she chooses the purchase option on her 30th birthday. Her required rate of return on investments of similar risk is 5.5% above the prime rate. The *current* prime rate is 10.75%; economic analysts are using a downward sloping yield curve (which can be estimated by a straight line with a slope of –0.05%). **(6 marks)**

Question 2: (Term Structure; Valuation)

(a) The table below shows yields-to-maturity on Treasury bonds as of August 1, 2016. All bonds pay coupon interest annually (at the end of each year) and are trading at par.

Term to Maturity (Years)	Yield to Maturity (%)
1	3.50
2	4.50
3	5.00
4	5.50
5	6.00
10	6.60

(i) Based on the data in the table, calculate:

1. The one-year, two-year, three-year and four-year *spot rates* of interest as of August 1, 2016. **(10 marks)**

2. The implied one-year *forward* rate of interest on August 1, 2019. **(2 marks)**

(ii) Assume that one year earlier, at August 1, 2015, the prevailing term structure for the Treasury securities was such that the implied forward one-year rate of interest at August 1, 2015, was significantly higher than the corresponding rate implied by the term structure at August 1, 2012. On the basis of the pure expectations hypothesis of the term structure, briefly discuss *two* factors that could account for such a decline in the implied forward rate. **(4 marks)**

(b) The constant-growth dividend discount model can be used both for the valuation of companies and for the estimation of the long-term total return of a stock.

Stock price information

Assume:	ZAR 20.00 = Price of a Stock Today
	8% = Expected Growth Rate of Dividends
	ZAR 0.60 = Annual Dividend One Year Forward

(i) Using *only* the preceding data, compute the expected long-run total return on the stock using the constant-growth dividend discount model. Show calculations. **(5 marks)**

(ii) Two factors that must be estimated in any valuation model are the *required rate of return* and *cash flows* over the life of the investment. Explain why *each* of these *two* factors is difficult to estimate for stocks than for fixed income securities. **(4 marks)**

Question 3: (Investment Decisions; Corporate Governance)

(a) Discuss, in detail, *two* major weaknesses of the IRR method that makes it unsuitable (relative to the NPV) for making value maximizing investment decisions for a firm.

(6 marks)

(b) Using suitable illustrations in each case, explain, how the following are treated in evaluating cash flows for investment decisions of a firm.

  (i) Opportunity costs

  (ii) Interest expense **(6 marks)**

(c) A key feature of fixed income securities is that investors, through their representative, the trustee, frequently insist that an issue's *indenture* contains some restrictive covenants.

  (i) Going by the arguments advanced under the Agency Theory, explain why investors may find it necessary to have restrictive covenants in an issue of fixed income securities. **(5 marks)**

  (ii) Giving *two* examples in each case, explain how the use of positive restrictive covenants *and* negative restrictive covenants might protect debtholders from "sneaky" actions of the issuing firm's shareholders. **(8 marks)**

Question 4: (Risk Aversion, Capital Markets)

(a) Describe the following axioms of rational choice:

  (i) Measurability

  (ii) Strong independence

  (iii) Unequal probability **(3 marks)**

(b) Since the marginal utility of wealth is positive, but declines with increasing wealth, it is expected that the *absolute risk aversion index should decrease with increasing wealth while the relative risk aversion should be constant*.

Using appropriate calculations, explain whether the following utility function is consistent with the above requirements.

$$U(W) = \alpha W - \beta W^2$$ **(5 marks)**

(c) Two particular securities, A and B, are known to lie on the security market line (SML). Security A, with a beta of 0.5, carries a risk premium of 4%. Security B has an expected return of 20% along with a beta of 1.75. Using this information, determine whether the following securities are correctly priced: **(7 marks)**

Security	Expected Return (%)	Beta
D	22	2.00
E	14	0.75
F	16	1.25

(d) Assume that the expected returns on securities can be described by the following two-factor index model:

$$E(R_i) = \lambda_0 + \beta_{i1}\lambda_1 + \beta_{i2}\lambda_2,$$

where the β_{ij} terms are the factor loadings specific to security i and the λ_j terms represent the risk premia for each factor's underlying security returns. We also know that securities A, B and C have the following risk and return information:

Security	$E(R_i)$	β_{i1}	β_{i2}
A	0.145	1.5	1.0
B	0.130	1.0	1.0
C	0.109	0.8	0.7

(i) Based on the above risk and return information, what are the equilibrium values of the λ_j's? **(7 marks)**

(ii) What would be the expected rate of return on a portfolio comprised of one-quarter security A, one-half security B, and one-quarter security C? **(3 marks)**

Question 5: (Futures and Forwards)

(a) You have observed the following prices in Kenya's interest rate and foreign exchange markets (*KES is the Kenyan currency, Shillings; Rand is the South African currency*):

Foreign exchange rates	Bid	Ask
Spot price of the South African rand	KES 12.00	KES 12.60
270-day forward price of the South African rand	KES 12.75	KES 13.70
Interest rates	Borrowing	Lending
Annualized yield on 270-day money market securities (KES)	6.26%	6.17%
Annualized yield on 270-day money market securities (rand)	5.02%	4.98%

(i) Explain two reasons that may cause the bid-ask spreads to be wider in the forward foreign exchange markets than in the spot foreign exchange markets. **(4 marks)**

(ii) Present computations to show that arbitrage opportunities exist, given the set of figures in the table. **(5 marks)**

(b) Taimi Boako, who manages a 95 million cedi equity portfolio in Accra, Ghana, currently forecasts that equity markets will decline soon. Taimi prefers to avoid transaction costs of making sales but wants to hedge 15 million cedi of the portfolio's current value using GSE-CI (Ghana Stock Exchange Composite Index) share index futures.

Because Taimi realizes that her portfolio will not track the GSE-CI 20-share index exactly, she performs a regression analysis on her actual portfolio returns versus GSE-CI 20 futures returns over the past year. The regression analysis indicates a risk-minimizing beta of 0.88 with an R^2 of 0.92.

Futures Contract Data	
GSE-CI index futures price	1,000
GSE-CI index value	990
GSE-CI index multiplier	250

(i) Using the data shown, calculate the number of futures contracts required to hedge 15 million cedi of Taimi's portfolio. Explain whether the hedge is long or short. Demonstrate that this strategy results in a riskless hedge. **(10 marks)**

(ii) Identify two alternative methods (other than selling securities from the portfolio or using futures) that replicate the strategy in part (a). Contrast *each* of the strategies from the futures strategy. **(6 marks)**

(Note: Cedi is the Ghanaian currency)

Question 6:   (Options)

(a) A stock has two possible ending prices: PUL 150 or PUL 90. A call option written on it has an exercise price of PUL 110. The option expires in one year. You choose to make a hedged investment by buying stock and selling calls.

(i) How would you create an exact offset in the value of your two positions?

(3 marks)

(ii) Suppose you hedge a portfolio of 1000 shares of stock with the sale of options. What is the value of this portfolio in one year? **(6 marks)**

(iii) Given that the initial price of this stock was PUL 95, how would the option be priced so that your hedged investment yields a risk-free rate of return of 10 percent? **(6 marks)**

(Note: PUL is the Botswanan currency, Pula)

(b) Chantal Tangeni is an economic analyst in Namibia. Namibia has bid to be the host country for an international sports tournament. The host country will be announced in three weeks. Jacob believes that the share price of Hotel Heinitzburg will be significantly influenced by the outcome of the bid to host the tournament. If Namibia is selected, she believes that Heinitzburg's share price will rise significantly. If Namibia is not selected, she believes that Heinitzburg's share price will fall significantly. Jacob wants to profit from her beliefs by implementing a straddle. She gathers the following information:

Hotel Heinitzburg Share and Options Data (NP represents Namibian pound)

Current share price of Severn Hospitality Ltd.	NP 8.80
Annual risk-free rate	1.50%
Price of one month call option, exercise price NP 9.00	NP 0.38
Price of one month put option, exercise price NP 9.00	NP 0.57

(i) Determine *each* of the following:

1. The profit per share on the straddle if Namibia wins the bid and Heinitzburg's share price doubles.

2. The *two* share prices of Heinitzburg at which breakeven for the straddle occurs.

Show your calculations in each case. **(6 marks)**

(ii) Explain why *each* of the following option strategies is *less* appropriate than a straddle, given Chantal's beliefs:

1. Bull spread

2. Short butterfly spread

(4 marks)

Question 7: (Portfolio Performance Evaluation)

(a) An analyst would like to evaluate portfolio X, consisting entirely of common stocks drawn from Zimbabwean stock market, using both Treynor and Sharpe measures of performance. The following table provides the average annual rate of return for portfolio X, the market portfolio (as measured by the Zimbabwean Stock Exchange Industrial index), and Zimbabwean Treasury bills during the past eight years:

Returns and risk

	Annual Average Rate of Return (%)	Standard Deviation of Return (%)	Beta
Portfolio X	10	18	0.6
ZSE Industrial Index	12	13	1.0
Treasury bills	6	–	–

(i) Calculate *both* the Treynor measure and the Sharpe measure for both Portfolio X and the Zimbabwean Industrial Index. **(4 marks)**

(ii) Briefly explain whether Portfolio X underperformed, equaled or outperformed the market on a risk-adjusted basis using *both* the Treynor measure and the Sharpe measure. **(2 marks)**

(iii) Based on the performance of Portfolio X relative to the market portfolio (calculated in part a), briefly explain the conflicting results when using the Treynor measure versus the Sharpe measure. **(3 marks)**

(iv) Explain *three* limitations of the two risk-adjusted performance measures you have used above. **(6 marks)**

(b) The stock price and dividend history of Khali Securities Ltd are as follows:

Investment values (Rs represents the Mauritian currency, rupees)

Year	Beginning of Year Price (Rs)	End of Year Dividend (Rs)
2012	100	4
2013	120	4
2014	90	4
2015	100	4

An investor buys three shares at the beginning of 2012, buys another two shares at the beginning of 2013, sells one share at the beginning of 2014 and sells all four remaining shares at the beginning of 2015.

(i) For this investor, determine the arithmetic *and* geometric time-weighted rates of return. **(8 marks)**

(ii) Under which situation is it appropriate to use the arithmetic average return? Why? **(2 marks)**

FORMULA SHEET FOR CMAP FINANCIAL ECONOMICS I

$$h = \frac{Market\ value\ of\ spot\ position}{Value\ implied\ by\ futures\ contract}$$

$$FVIFA_{k.n} = \frac{(1+k)^n - 1}{k}$$

$$P_C = \left[\frac{P_{Cu}\{(1+R_f) - d\}}{u - d} + \frac{P_{Cd}\{u - (1+R_f)\}}{u - d}\right] \div (1 + R_f)$$

$$k_S - g = D_1/P_0$$

$$1 + f_{t.t+1} = \frac{(1 + S_{0.t+1})^{t+1}}{(1 + S_{0.t})^t}$$

$$PVIFA_{k.n} = \frac{1 - \left(\frac{1}{1+k}\right)^n}{k}$$

$$1 + S_{0,n} = [(1 + r_1) \times (1 + r_2) \times\ \dots\ \times (1 + r_n)]^{1/n}$$

$$P_C = P_S N(d_1) - P_X e^{-rT} N(d_2)$$

$$d_1 = [\ln(P_S/P_X) + (r + 0.5\sigma^2) \times T] \div \sigma\sqrt{T}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$