Vivek Raj Case Scenario

Vivek Raj is a quantitative research analyst in HSMC bank. He is checking whether there is any relationship between the rate of change in price of commodities and the rate of change in the supply of money in the economy. He extracts the monthly data for last 5 years and runs a linear regression between the rate of price change in commodities and the rate of change in supply of money. The rate of change of price in commodities is a dependent variable and the rate of change in supply of money is an independent variable.

The result of ANOVA (analysis of variance) is shown in Exhibit 1.

Exhibit 1

	Coefficient	Standard error	t-statistic	p-value
Intercept	2.00%	0.54	?	<0.005
Rate of change in supply of money	0.82	0.14	?	<0.005

ANOVA	df	SS	MS	F	Significance F
Regression	-	235.50	-	-	<0.005
Error	-	85.00	-		
Total	-	320.50	-		
R^2	-				

Vivek Raj checks the result at 5% level of significance. He also finds out the confidence interval for regression coefficient. He shows the result to his manager and drafts his findings in a research report.

His manager asks him to calculate the confidence interval of the predicted values so that statistically 95% of the values lie in that confidence interval for 5% increase in supply of money. Vivek calculates the 95% confidence interval for the predicted value of the change in commodities price for a 5% change in supply of money.

His manager asks him about the assumptions taken by him in the linear regression analysis. Vivek explains the assumptions by assuming that the regression equation as:

$$Y_i = b_0 + b_1 X_i + e_i , \ i= 1, 2,...,n$$

Assumption 1: A linear relationship exists between the dependent and the independent variable in the parameters b_0 and b_1

Assumption 2: The independent variable, X, is not random

Assumption 3: The expected value of the residual term is zero {E (e) = 0}

Assumption 4: The variance of the residual term is constant for all observations {E (e_i^2) = σ_e^2}, i= 1, 2... n

Assumption 5: The error term, e, is uncorrelated across observations, {E $(e_i \ e_j)$ =0, j≠i}

Assumption 6: The error term, e, is normally distributed

1. What is the value of F-statistics in the table given in Exhibit 1?
   a) 2.77
   b) 20.93
   c) 160.91

2. What is the value of test statistics for the hypothesis test checking whether coefficient of rate of change in money supply is greater than 1?
   a) -1.28
   b) 3.70
   c) 5.86

3. What is the standard error of estimate (SEE) for the given regression analysis?
   a) 1.19
   b) 1.21
   c) 1.47

4. Which of the assumptions stated by Vivek ensures that the linear regression produces the correct estimates of b_0 and b_1?
   a) Assumption 1 and 2
   b) Assumption 2 and 3
   c) Assumption 1,2 and 3

5. What is the correlation coefficient between the dependent variable and the independent variable in the given regression analysis?
   a) 0.735
   b) 0.797
   c) 0.857

6. What is the confidence interval for the predicted value if the standard error of forecast is 1.85% for a 5% increase in the supply of money?
   a) 2.39% to 9.80%
   b) 2.47% to 9.72%
   c) 3.01% to 9.19%

Vinod Jayakumar Case Scenario

Vinod Jayakumar, CFA, is trying to predict the P/E ratio of a company using various fundamental factors associated with the stock. In his model, he has assumed that the predicted P/E would depend upon three independent variables. Those variables are dividend payout ratio, earning growth rate, and beta of a stock.

He runs regression on 50 stocks. The result of ANOVA is shown in Exhibit 1.

Exhibit 1

	Coefficient	p-value
Intercept	5.35	<0.005
Dividend payout	-0.32	0.095
Earnings growth rate	12.5	0.12
Beta	-0.60	0.15

ANOVA	SS	Significance F
Regression	72.8	<0.005
Error	24.7	
Total	97.5	
R^2	0.7467	
Adjusted R^2	-	

Vinod checks the heteroskedasticity, serial correlation and multicollinearity for the given regression analysis. He conducts the Durbin Watson test and Breusch- Pagan test. The results of those tests are given in Exhibit 2.

Exhibit 2
Durbin Watson Test

Durbin Watson Statistics	1.96
d_l	1.54
d_u	2.42

Breusch – Pagan Test

R^2 from the regression of residuals	0.032
Critical Chi-square value	3.841

Vineet Saini, who is colleague of Vinod Jayakumar, asks him about the ways to correct the heteroskedasticity, serial correlation, and multicollinearity in a multiple regression analysis.

Vinod: To correct heteroskedasticy, we use White corrected standard error and replace the standard error of independent variable with that error and again conduct a t-test using the original regression coefficient.

Vineet: What about multicollinearity and serial correlation?

Vinod: Serial correlation can be correcting by adjusting the specification of the model by incorporating a seasonal term. For correcting multicollinearity, one or two independent variables can be omitted from the original regression equation and the regression can be conducted again.

Vineet: If the above problems are with the multiple regression equations, then what kind of errors we can expect in out hypothesis testing?

Vinod: Heteroskedasticity and multicollinearity lead to too many Type I errors and serial correlation leads to too many Type II errors.

7.   What is the value of adjusted R^2 in the table given in Exhibit 1?
      a) 0.7009
      b) 0.7301
      c) 0.7622

8.   Which of the following combinations is correct?
      a) BP test: Heteroskedasticity, DW test: Serial correlation
      b) BP test: Serial correlation, DW test: Heteroskedastcity
      c) BP test: Serial correlation, DW test: Multicollinearity

9.   Which of the following is most likely to be present in the given multiple regression analysis?
      a) Heteroskedasticity
      b) Serial Correlation
      c) Multicollinearity

10.   Which of the correction method specified by Vinod Jayakumar is least accurate?
      a) Regarding serial correlation
      b) Regarding multicollinearity
      c) All are correct

11.   What is the predicted P/E value for a stock according to the multiple regression equation obtained from the above analysis? The stock is having dividend payout ratio as 0.60 and earnings growth rate as 0.08. The beta of the stock is 1.2.
      a) 5.438
      b) 5.822
      c) 6.878

12.   Is Vinod Jayakumar correct about the types of errors from the problems associated with the multiple regression analysis?
      a) Yes
      b) No, Heteroskedasticity and serial correlation: Too many Type I errors; Multicollinearity: Too many Type II errors
      c) No, Heteroskeadasticity: too many Type I errors; Serial correlation and multicollinearity: Too many Type II errors

Rahul Daga Case Scenario

Rahul Daga is a derivative trader. He mainly takes position in futures contracts. He trades all kinds of products ranging from Treasury bills to commodities. Most of his profits come from the arbitrage positions. Generally, markets are not that efficient and there are plenty of arbitrage opportunities available. He is looking at the Treasury bills futures for the arbitrage. The current market prices are given in the Exhibit 1.

Exhibit 1
Treasury Bills

Days to expiration	Quoted at a discount of
180 days	3.5%
270 days	4.0%

The 90-days T-bill futures contract which has 180 days to expiry is currently trading at 0.9910.

Rahul has also taken a long position in the futures contract of a bond with a delivery option. The conversion factor for the bond is 1.18. The bond is a semi-annual coupon paying bond. The coupon rate is 8% per annum. The risk-free rate is 5.0% per annum. The futures contract has 15 months to expiry and the bond has just paid a coupon. The bond is trading at $121.5 and has a face value of $100.

He looks at the forward prices and futures prices of the same underlying instrument with the same expiry period. He finds out that the forward prices are lower than the futures prices. But the difference is very small.

Rahul always finds it difficult to make the riskless arbitrage in Eurodollar contracts. This is due to the fact that the Eurodollar futures is structured like a T-bill contract as though the underlying were a discount instrument while the Eurodollar spot is an add-on instrument. Due to mismatch in the design of spot and futures instrument, it is difficult to use Eurodollar contract as a hedging instrument.

In the commodities market, the expected spot price of the oil is greater than the futures price and the spot price is lesser than the futures price. Rahul tells his colleague that the oil contract is in normal backwardation and also in contango.

His colleague asks him what the reason behind the futures contract to be in backwardation. Rahul explains that when the benefits of holding the assets are less than the opportunity cost of holding the assets plus the additional holding costs, then the contract comes into backwardation.

His colleague asks him about the benefits of holding an asset. Rahul tells that there can be two kinds of benefits: Monetary and Non-monetary benefits.

The monetary benefits include dividends, coupons etc. The non-monetary benefits include convenience yield. Convenience yield means that the holder of an asset is benefitting from holding the asset. It is subjective. An example could be the gold as an underlying instrument. The holder can use it as ornaments for the period of the contract. Similarly, if a machine is hold as an underlying asset, it could be used by the holder.

His colleague: What is the main difference between the forward and futures contract considering the risk as a basis?
Rahul: The forward contracts have more credit risk and the futures contracts have almost zero credit risk. The futures contracts have almost zero credit risk because of marked to market feature. They are daily marked to market. Because of which the losing position generally doesn't default as the total movement in a day is quite less. The clearinghouse acts as an counterparty and they demand some margin amount in your account. So, the chances are default is extremely low.

13. What is the no-arbitrage price of the T-bill futures contract which has 180 days to expiry?
    a) 0.9873
    b) 0.9892
    c) 0.9910

14. Is there any arbitrage possible in the T-bill futures contract? If yes, then how much profit can be made at the end of 270 days from today?
    a) No arbitrage profit is possible
    b) Yes, $3,756.45
    c) Yes, $3,770.53

15. If the current market T-bill futures price is lesser than the no-arbitrage futures price, then what transactions should be done to make arbitrage profit?
    a) Long T-bill futures, short longer maturity T-bill, long shorter maturity T-bill
    b) Long T-bill futures, long longer maturity T-bill, short shorter maturity T-bill
    c) Short T-bill futures, long longer maturity T-bill, short shorter maturity T-bill

16. What is the no-arbitrage futures price for the bond with a delivery option?
    a) $98.89
    b) $102.49
    c) $102.66

17. What is the most likely reason for the difference between the forward price and the futures price?
    a) The correlation between the interest rates and the underlying asset is zero
    b) The correlation between the interest rates and the underlying asset is positive
    c) The correlation between the interest rates and the underlying asset is negative

18. Which of the following statement made by Rahul is least accurate?
    a) Regarding contango and normal backwardation
    b) Regarding backwardation
    c) Regarding credit risk of the contracts

Pallavi Jain Case Scenario

Pallavi Jain, CFA, is working in Citibank as interest rate analyst. She deals in forward rate agreements. The company needs a loan worth $2 million for 6 months after 3 months. She looks at the various interest rates for different periods. The company wants to book loan at the current forward rate implied by the interest rates. The interest rates are given in Exhibit 1.

Exhibit 1
Interest Rates at the beginning of the contract

90 days	3.5%
180 days	4.0%
270 days	4.5%
360 days	5.0%

She enters into the forward rat agreement on the behalf of company. After 30 days the interest rate in the market changes. The interest rates after 30-days are given in Exhibit 2.

Exhibit 2
Interest rates after 30-days of the contract

60 days	4.0%
150 days	4.5%
240 days	5.0%
330 days	5.5%

The interest rates after 90-days i.e. end of the forward rate of agreement are given in Exhibit 3.

Exhibit 3
Interest rates at the end of forward rate agreement

90 days	5.0%
180 days	5.5%
270 days	6.0%
360 days	6.5%

Pallavi's manager Tejal Joshi asks her about whether there was any other way to lock in the interest rates apart from FRA. Pallavi replies that interest rate can also be locked in by using swaptions.

Tejal: What is the difference between hedging via swaptions and hedging via forward rate agreement?

Pallavi: In forward rate agreement, we don't have to pay a premium but in swaption we have to pay a premium. Also, in case of forward rate agreement, our interest rate is locked in a way that we have to pay that much interest. While in case of swaption, we may have additional benefit of paying lower interest rate than the locked in interest if the swaption expires worthless.

Pallavi was researching forward market for fixed income securities. She found out that very forward contracts are underpriced in the market and few are overpriced in the market. She went straight to her manger and informed her about opportunity to make arbitrage profit.

Her manager asks her about the credit risk of the forward position and also the relation between the market value of forward contract and the credit risk amount.

Pallavi: Any party long or short can have credit risk. The party which is in loss bears the credit risk. The credit risk amount is generally lesser than the market value of the contract.

19. What is the interest rate at which the company locked in the loan?
   a) 4.46%
   b) 4.72%
   c) 4.96%

20. What is the value of forward rate agreement to the company after the end of 30 days?
   a) $3,303.71
   b) $3,413.84
   c) $3,527.63

21. What is the total profit realized by the company at the end of forward rate agreement contract?
   a) $4,672.91
   b) $5,288.28
   c) $5,433.70

22. Which of the statement made by Pallavi Jain is least accurate about the difference between swaption and forward rate agreement?
   a) Statement regarding the inflexibility of forward rate agreement about the locked-in interest
   b) Statement regarding the possibility of lower interest rate in case of swaption
   c) All the statements made by her are correct

23. Which of the following arbitrage would be done in case when the forward contract is underpriced?
   a) Cash and carry arbitrage
   b) Reverse cash and carry arbitrage
   c) Either of the above

24. Which of the statements made by Pallavi is most accurate about the credit risk?
   a) About which party can have the credit risk
   b) About which party bears the credit risk
   c) About the relation between the credit risk amount and market value of the forward contract

Arjun Gupta Case Scenario

Arjun Gupta is a CFA level II candidate. He is doing valuation for a company, Tram International. Tram International is an airline company and has been into the business for a considerable period of time. The company is currently not paying a dividend but is expected to pay a dividend after 5 years on a regular basis. An excerpt from the company's Management Discussion & Analysis has been given in the Exhibit 1.

Exhibit 1
MD&A

> The company is growing at a considerable rate. The growth rate is expected to slow down in coming years because of competition and business scenario. We are committed to do good for our shareholders. We have decided to pay dividends after 5 years. The dividend payout ratio will be kept constant at 50% forever so that sustainable growth can be fuelled by the retained earnings.

The management of the company has been accurate and credible in its forecasts in previous years. They have been successful in implementing everything said by them. The company's earnings growth rate was 18% in the concluding year. The management thinks that the earnings growth rate of the company will fall from 18% to 8% linearly at a rate of 2% per annum in next 5 years. After 5 years, the growth rate is expected to remain constant at 8% per annum.

Additional details about the company have been provided in Exhibit 2.

Exhibit 2
Tram International

Earnings per share	$5.00
Target D/E ratio	0.667
WACC	10%
Before-tax cost of debt	10%
Marginal tax rate	40%
Beta	1.2
Market risk premium	5.0%

Arjun shows his valuation to his manager, Thomas. Thomas asks that why the company is not paying the dividend from the next year.

Arjun: The Company is currently in the high growth phase. It is going to use all of the retained earnings to fuel that growth. That's why it would not pay a dividend in next 5 years. After 5 years, the earnings growth rate would subside and the company would need less retained earnings and then it can pay the dividends.

Thomas: So, the company is trading off growth with dividend payouts.

Arjun: Yes. It is beneficial for the stockholders that company reinvests its money if the company has good opportunities to invest and can earn higher ROE than the required rate of return.

Thomas: What are the factors that contribute to the ROE?

Arjun: The profit margin, asset turnover and financial leverage affect the ROE. The higher the value of those factors, the higher is the ROE. For a company, the ROE is higher than the required rate of return in the initial growth period and it eventually subsides to the level of required rate of return.

Thomas: What will happen if the ROE falls below the required rate of return by equity holders?

Arjun: The net income of the company will become negative in that case.

25. Which dividend discount model is the most appropriate model for valuing Tram International?
    a) Gordon growth model
    b) Two stage dividend discount model
    c) H-model

26. What is the cost of equity for Tram International?
    a) 11.00%
    b) 12.67%
    c) 18.00%

27. What is the value of the company per share using dividend discount model?
    a) $56.08
    b) $61.27
    c) $93.98

28. Is the statement made by Arjun that the net income of the company would become negative when ROE is less than required rate of return by equity holders, correct?
    a) Yes
    b) No
    c) Can't say

29. When the company would start the payment of dividends, what percentage of required return will be provided by the dividend yield?
    a) 36.84%
    b) 50.00%
    c) 63.16%

30. What would have been the value of the stock if the company has planned to start the dividend payout from the next year and managing the exact same growth rate in earnings?
    a) $66.97
    b) $68.79
    c) $77.68