

**Second Midterm Exam**

No points will be given by simply writing down formulas, and writing down definitions or irrelevant statements from the book, or saying "yes," will get you zero points. Justify all your answers. If you cannot prove something give some intuition. Good luck. Reminder: this is an open book exam, but no open notes.

Time: 1hr 45 minutes.

I. Problems (15 points each).

1. Chambers Inc will receive EUR 10,000,000 in 180 days. It considers using (1) a forward hedge, (2) a money market hedge, or (3) no hedge. Chambers develops the following information:

\*  $S_t = 1.10$  USD/EUR

\* The 180-day forward rate of the euro,  $F_{t,180}$ , is equal to 1.09 USD/EUR

\* The interest rates, for a 180-day holding period, are as follows:

deposit rate: 4% in Germany., and 6% in the U.S.

borrowing rate: 5% in Germany, and 7% in the U.S.

\* Chambers Inc. forecasted the future spot rate in 180 days as follows:

Possible Outcomes	Probability
1.06 USD/EUR	10%
1.09 USD/ EUR	30%
1.11 USD/EUR	40%
1.17 USD/EUR	20%

Carefully describe each strategy and cash flows (if possible, calculate sure amounts and expected values). Which hedging strategy would you recommend to Chambers Inc? Do preferences matter for your strategy recommendation? Justify your answer.

**ANSWER:**

1) Forward hedge (sell EUR forward at  $F_{t,180} = 1.09$  USD/EUR).

Firm will receive EUR 10 M \* (1.10 USD/EUR) = **USD 10.9 M** in 180 days.

2) Money market hedge (borrow EUR at 5%, convert to USD, deposit in U.S. at 6%)

Firm will borrow EUR 10 M / (1 + 0.05 \* 180/360) = EUR 9.7561 M

Firm will convert to USD EUR 9.7561 M \* 1.10 USD/EUR = USD 10.73171 M (amount to deposit)

Firm will receive USD 10,731,710 \* (1 + 0.06 \* 180/360) = **USD 11,053,660** (*domintes FH*)

3) No Hedge (do nothing; just wait)

Possible Outcomes	Probability	Amount to receive
1.06 USD/EUR	10%	EUR 10.60 M
1.09 USD/ EUR	30%	EUR 10.90 M
1.11 USD/EUR	40%	EUR 11.10 M
1.17 USD/EUR	20%	EUR 11.70 M

$E[\text{Amount to receive}] = \mathbf{USD 11.11 M}$

Recommendation: **No Hedge**; but *preferences matter*. A risk averse manager may not like the 40% chance of getting an equal or better outcome with the FH than with the NH.

2. Mr. Jose is the owner of an organic chocolate chain in California. Mr. Jose exports chocolate to New Zealand, payments are denominated in NZD. Mr. Jose is worried about a potential depreciation of the NZD against the USD in November, exactly **4 months** from now. He wants to set up an option hedge. Mr. Jose's November receivables are NZD 500,000. The USD/NZD exchange rate is 1.5950 USD/NZD.

A. Calculate Mr. Jose's TE in November.

B. Suppose **monthly** changes in the USD/NZD,  $e_t$ , follow a Normal distribution with mean zero and standard deviation .15. Derive the VAR(mean, 97.5%) for Mr. Jose's transaction exposure. (Hint: Use log approximation for returns)

C. Suppose Mr Jones is offered the following options with November maturity

X (Strike Price)	type	premium (in USD):
1.55	call	USD 0.065
1.61	call	USD 0.01
1.57	put	USD 0.005
1.61	put	USD 0.028

i) at the money (closest in-the-money) November hedge.

ii) out-of-the money November hedge.

(Specify strike prices, total premium costs and worst case scenario.) Briefly discuss the advantages and disadvantages of each strategy.

(A)  $TE = NZD\ 500,000 * 1.5950\ USD/NZD = \text{USD } 797,500$

(B) 4-mo mean =  $0 * 4$

4-mo SD =  $.15 * \text{sqrt}(4) = .30$

95% C.I. for NTE =  $[USD\ 797,500 * (1 + (0 - 1.96 * .30)), USD\ 797,500 * (1 + (0 + 1.96 * .30))]$   
 $= [USD\ 328,570, USD\ 1,266,430]$

VAR(mean, 97.5%) =  $USD\ 328,570 - USD\ 797,500 = USD\ 468,930$

(C)

■ ATM ( $X_c = 1.61\ USD/NZD$ ;  $p_p = USD\ 0.028/NZD$ )

Total premium paid =  $NZD\ 500,000 * USD\ 0.028/NZD = USD\ 14,000$

Worst case scenario = Cap =  $NZD\ 500,000 * 1.61\ USD/NZD = USD\ 805,000$

Advantage: High floor. Disadvantage: High cost.

■ OTM ( $X_c = 1.57\ USD/NZD$ ;  $p_p = USD\ 0.005/NZD$ )

Total premium paid =  $NZD\ 500,000 * USD\ 0.005/NZD = USD\ 2,500$

Worst case scenario = Cap =  $NZD\ 500,000 * 1.57\ USD/NZD = USD\ 785,000$

Advantage: Lower cost. Disadvantage: Lower floor.

3. Mac Inc., a U.S. firm, plans to invest in a new project that will be located either in Venezuela or in Colombia. Assume the U.S. risk free rate is 3%. You have the following data on expected returns, volatility, correlations, and weights for each project:

	Mac	Venezuela	Colombia
Expected return	10%	24%	35%
Standard deviation	15%	30%	45%
Correlation with existing Mac's portfolio	1.00	.32	.12
Weight on overall portfolio	-	.25	.10
Beta	.90	1.10	1.40

- A. Based on the Sharpe Ratio, which project would you recommend to Mac?  
 B. Based on the Treynor Ratio, which project would you recommend to Mac?  
 C. Is Mac, under both criteria, better off without adding any project?

**ANSWER:**

**A.**

◦ Venezuela

$$E[r_{MAC+Ven}] = w_{EP} * E[r_{MAC}] + (1 - w_{EP}) * E[r_{Ven}]$$

$$= .75 * .10 + .25 * .24 = \mathbf{0.135}$$

$$\sigma^2_{MAC+Ven} = w_{MAC}^2(\sigma_{MAC}^2) + w_{Ven}^2(\sigma_{Ven}^2) + 2 w_{MAC} w_{Ven} \rho_{MAC, Ven} \sigma_{MAC} \sigma_{Ven}$$

$$= (.75)^2 * (.15)^2 + (.25)^2 * (.30)^2 + 2 * .75 * .25 * 0.32 * .15 * .30 = 0.023682 \Rightarrow \sigma_{MAC+H} = \mathbf{.1539}$$

$$SR_{MAC+Ven} = E[r_{MAC+Ven} - r_f] / \sigma_{MAC+Ven} = (\mathbf{0.135} - 0.03) / \mathbf{.1539} = \mathbf{0.682}$$

◦ Colombia

$$E[r_{MAC+Col}] = \mathbf{0.125}$$

$$\sigma_{MAC+Col} = 0.1473$$

$$SR_{MAC+Col} = (\mathbf{0.125} - \mathbf{0.03}) / 0.1473 = \mathbf{0.645} < SR_{MAC+Ven} \Rightarrow \text{Venezuela!}$$

**B.**

$$\beta_{MAC+Ven} = w_{MAC} * \beta_{MAC} + (1 - w_{Ven}) * \beta_{Ven}$$

$$= .75 * .90 + .25 * 1.10 = \mathbf{.95}$$

$$TR_{MAC+Ven} = E[r_{MAC+Ven} - r_f] / \beta_{MAC+Ven} = (\mathbf{0.135} - 0.03) / \mathbf{.95} = \mathbf{0.111}$$

◦  $\beta_{MAC+Col} = 0.95$

$$TR_{MAC+Col} = (\mathbf{0.125} - \mathbf{0.03}) / .95 = \mathbf{0.1} < TR_{MAC+Ven} \Rightarrow \text{Venezuela!}$$

**C.**  $SR_{MAC} = (0.1 - \mathbf{0.03}) / .15 = \mathbf{.4667} < SR_{MAC+Ven} \& SR_{MAC+Col}$   
 $TR_{MAC} = (0.1 - \mathbf{0.03}) / .90 = \mathbf{.078} < TR_{MAC+Ven} \& TR_{MAC+Col}$

$\Rightarrow$  No! Mac is not better off without adding any project.

4. Cerceo, an Irish beverage company, wants to refinance debt amounting to USD 200 million. An investment bank suggests issuing a straight bond, with annual coupon payments. The investment bank has the following data available:

Irish government bond yields: 4-year 4.75 % (p.a.)

U.S. Treasury government bond yield: 4-year 5.25 % (s.a.)

German government bond yield: 4-year 4.75 % (s.a.)

Cerceo Euro-Eur bond yield (outstanding debt): German government bonds + 205 bps (s.a.)

Cerceo Euro-USC bond yield (outstanding debt): US T-bond + 220

Given the current tight market conditions, an investment bank suggests: a 4-year full-coupon USD Eurobond and an issue price of 100% (P=100).

(1) Following usual practices for Eurobonds, set the coupon rate.

$$YTM_{\text{Cerceo}} = .0525 + .0220 = 0.0745 \text{ (s.a.)} \quad (\text{or } 7.45\% \text{ semi-annual yield})$$

$$\text{Coupon (p.a.)} = (1 + 0.0745/2)^2 - 1 = \mathbf{0.07589} \quad \Rightarrow 7.589\% \text{ annual coupon}$$

(2) A year from now, there is a resolution to the Ukraine crisis in Europe. What would the effect of this crisis be on the value of the bond? Briefly explain your logic.

Lower European uncertainty (risk ↓) ⇒ Country risk ↓ ⇒ YTM in Europe ↓ ⇒ Bond Price ↑

(3) Two years from now, the Irish government has a unexpected big deficit. What would the effect of this deficit be on the value of the bond? Briefly explain your logic.

Unexpected Irish government deficit ⇒ Country risk ↑ ⇒ YTM in Ireland ↑ ⇒ Bond Price ↓

(4) Three years from now, Cerceo wants to buy back the bond. If the yield to maturity for similar bonds is 6% and  $S_t = 1.10$  USD/EUR, how much does Kelly have to pay (in EUR) for the bond buyback?

$$P = (1 + \mathbf{.07589}) / (1 + .06) = 1.014991$$

$$\text{Amount to pay (in EUR)} = 1.014991 * \text{USD } 200 \text{ M} / 1.10 \text{ USD/EUR} = \text{EUR } 184.5438$$

5. Tyron Corporation, a U.S.-based MNC, has a subsidiary in Mexico that manages oil fields. The subsidiary believes it could also enter into the gas business. The following data has been compiled for the analysis (in Mexican pesos, MXN):

- Initial outlay: MXN 60 million
- Life of the project: 3 years
- Revenue per year: MXN 40 million
- Cost of Goods per year: MXN 10 million
- Depreciation: 10% of initial outlay
- Salvage value: MXN 25 million
- Exchange rate: 20 MXN/USD
- Forecasted exchange rates:  $E[S_{t+1}] = 20$  MXN/USD;  $E[S_{t+2}] = 21$  MXN/USD;  $E[S_{t+3}] = 22$  MXN/USD.
- The Mexican government imposes a 25% tax on profits.
- The Mexican government also imposes a 10% withholding tax on any funds remitted to the U.S. parent house (excluding salvage value).
- The U.S. government imposes a 10% tax on remitted funds, excluding salvage value. There is no tax credit allowed.
- The required rate of return is 12%.

- What is the evaluation of the project for Tyron Corporation's Mexican subsidiary?
- What is the evaluation of the project for Tyron Corporation?
- Does Tyron's decision depend on salvage value? (Calculate  $SV^{BE}$ )
- Would you recommend the project to Tyron Corporation?

i) (in millions)

	Year 1	Year 2	Year 3	SV
Gross Profit	MXN 30	MXN 30	MXN 30	
Depreciation	MXN 6	MXN 6	MXN 6	
EBT	MXN 24	MXN 24	MXN 24	
Tax (25%)	MXN 6	MXN 6	MXN 6	
EAT	MXN 18	MXN 18	MXN 18	
Free Cash Flows (EAF + Dep)	<b>MXN 24</b>	<b>MXN 24</b>	<b>MXN 24</b>	<b>25</b>
NPV ( $k=12\%$ )	$= 24/1.12 + 24/1.12^2 + 24/1.12^3 + 25/1.12^3 - 60 = \text{MXN } 15.43846 \text{ M} > 0 \Rightarrow \text{Yes!}$			

ii)

CF to be remitted	<b>MXN 24</b>	<b>MXN 24</b>	<b>MXN 24</b>	<b>25</b>
withholding tax (10%)	MXN 2.4	MXN 2.4	MXN 2.4	
Net CFs to be remitted	<b>MXN 21.6</b>	<b>MXN 21.6</b>	<b>MXN 21.6</b>	<b>25</b>
Exchange Rate (USD/NMXN)	1/20	1/21	1/22	1/22
Net CFs (in USD)	USD 1.08	USD 1.029	USD 0.98	USD 1.1364
Net CFs After Tax (10% tax)	<b>USD .972</b>	<b>USD .9261</b>	<b>USD .88364</b>	<b>USD 1.1364</b>
NPV ( $k=12\%$ )	$= .972/1.12 + .9261/1.12^2 + .884/1.12^3 + 1.136/1.12^3 - 60/20 = \text{USD } 0.04396 \text{ M} > 0 \text{ (Yes!)}$			

iii)  $SV^{BE} = \text{USD } 1.0746 \text{ M} < SV = \text{USD } 1.13 \text{ M (high)} \Rightarrow \text{Yes!}$

iv)  $NPV > 0 \Rightarrow \text{Yes!}$

## II. CASE (25 points)

Questions are based on the distributed article. Briefly answer the following questions:

Note: No points will be given by simply writing lines from the article.

1) Suppose Qualtrics acquisition is financed by a Eurobond USD 1 billion issues with 5 year maturity. The spread over U.S. T-bonds was set in the range 375 to 400 bps. The issue was oversubscribed. Assume the 5-year U.S. T-bond rate is 4.75% (s.a.). Set a YTM and a coupon rate for the Eurobond, assuming the bond is issued at par ( $P=100$ ).

Since issue is oversubscribed, I select the spread on the low end: 3.75%

$$\text{YTM (s.a.)} = 0.0475 + 0.0375 = 0.085 \text{ (s.a.)} \quad \Rightarrow \text{(or 8.50\% semi-annual)}$$

$$\text{Coupon (p.a.)} = (1 + 0.085/2)^2 - 1 = 0.0868 \quad \Rightarrow 8.68\% \text{ annual coupon}$$

2) Use the information from Question 2 above, where you have set  $k_d$ . Qualtrics has a beta of 1.73. The U.S. stock market has an average ERP ( $= (k_M - k_f)_{US}$ ) of 3.85%, with a 15% standard deviation. The U.S. tax rate is 22%. Calculate the cost-of-capital ( $k_c$ ) of Qualtrics.

$$\text{Debt} = \text{USD } 1 \text{ B}$$

$$\text{Equity} = \text{USD } 11.5 \text{ B}$$

$$D/(D+E) = 1/12.5 = 0.08$$

$$k_{f,USD} = .0475$$

$$k_d = k_f + \text{spread} = 0.0868$$

$$k_e = k_f + \beta (k_M - k_f) = .0475 + 1.73 * (.0385) = \mathbf{0.1141} \text{ (or 11.41\%)}$$

$$k_{WACC} = D/(E+D) k_d (1-t) + E/(E+D) k_e = .08 * .0868 * (1 - .22) + .92 * \mathbf{0.1141} = \mathbf{0.1104} \quad (\approx 11.04\%)$$

3) Qualtrics wants to report the cost-of-capital in CAD. Assume, the expected U.S. inflation is 4%, while the Canadian inflation is 3%. Compute  $k_c$  (in CAD).

$$k_c \text{ (in CAD)} = k_c \text{ (in USD)} + E[e_{f,t}] = \mathbf{0.1104} + (.04 - .03) = \mathbf{0.1204}$$

4) Suppose that the U.S. Fed increases interest rates in the next quarter to continue fighting inflation. Should Qualtrics' cost of capital increase or decrease? Briefly explain.

If  $k_{f,USD} \uparrow \Rightarrow k_{c,Qual} \uparrow$

5) Is CPP's cost of capital increasing or decreasing after Qualtrics' acquisition? Briefly justify your answer.

CPP is diversifying the portfolio  $\Rightarrow k_{c,CPP} \downarrow$

**PHILADELPHIA OPTIONS**

Friday June 23, 2020

		Calls		Puts	
		Vol.	Last	Vol.	Last
<b>Australian Dollar</b>					<b>94.90</b>
<b>10,000 Australian Dollars -cents per unit.</b>					
93	Sep	19	2.17	10	0.50
94	Aug	20	1.09	16	1.04
95	Sep	12	1.45	8	1.60
95	Aug	30	1.18	11	1.25
97	Sep	4	0.62	2	2.53
<b>British Pound</b>					<b>131.51</b>
<b>10,000 British Pounds -cents per unit.</b>					
129	Sep	8	5.74	4	0.63
130	Aug	19	0.82	...	...
131	Sep	12	1.64	5	3.01
133	Aug	21	1.30	13	4.27
134	Sep	14	0.95	10	5.05