International Financial Management FINA 4836
Rauli Susmel Spring 2017

First Midterm Exam – Solutions to Practice Questions

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 20 minutes.

I. Problems (10 points each).

1. Assume you are given the following exchange rates S_t=1.054 USD/EUR and S_t=1.369 AUD/EUR.
i. What is the cross rate USD/AUD?
ii. Suppose the 180-day forward rate is $F_{t,180}$=1.08 USD/EUR. Calculate the forward premium. Does the forward rate contain a premium or a discount?
iii. Suppose Kwiki Bank quotes S_t=.81 USD/AUD. Is arbitrage possible? (Why?)
iv. If yes, describe a triangular arbitrage strategy and determine an arbitrageur's profits.

ANSWER:
i. S_t^I = 1.054 USD/EUR /1.369 AUD/EUR = 0.769905 USD/AUD

ii. $p = (F_{t,T} - S_t)/S_t * (360/T) = (1.08 - 1.054)/1.054 * 2 = 0.04933586$ $\Rightarrow p > 0$, a premium.

iii. $S_t^I \neq S_t^{KB}$ = .81 USD/AUD $\Rightarrow$ Yes, arbitrage is possible.

iv. Triangular arbitrage (Key: $S_t^{KB} > S_t^I$ $\Rightarrow$ KB overvalues the AUD against the USD).

Triangular arbitrage strategy (simultaneously done):
1. Borrow AUD 1
2. Sell AUD/Buy USD at S_t = .81 USD/AUD. $\Rightarrow$ **Get USD .81**
3. Sell USD/Buy EUR at S_t = 1.054 USD/EUR. $\Rightarrow$ Get USD .81/1.054 USD/EUR = EUR 0.7685
4. Sell EUR/Buy AUD at S_t =1.369 AUD/EUR $\Rightarrow$ Get EUR .7685*1.369 AUD/EUR = AUD 1.05208
5. Return AUD 1 loan. Keep profits (π):

π = AUD 1.05208 - AUD 1 = AUD .052076 (or 5.21% per AUD borrowed)

2. It is February 2017. A Big Mac costs CZK 80 in the Czech Republic, while it costs USD 4.8 in the U.S. The spot rate is 25 CZK/USD (CZK= Czech Koruna).

(a) According to PPP, what should be the USD/CZK exchange rate in February 2017?

(b) Take the USD as the domestic currency. Calculate the real exchange rate, R_t. What is the over/under-valuation of the CZK relative to the USD?

(c) According to the R_t, which country is more efficient?

(d) The GDP per capita in the Czech Republic is CZK 440,000. Translate the GDP per capita in CZK to (nominal) USD and to PPP USD prices.

(e) Suppose in March 2017, the price of the Big Mac increases to CZK 88 in the Czech Republic, while it decreases to 4.56 in the U.S. According to the *linearized* version of PPP, what should the USD/CZK exchange rate be in March 2017?

(f) Assume that in March 2017 the exchange rate is. 045 USD/CZK. Generate a trading signal based on PPP.

ANSWER:

(a) $\mathbf{s_t^{PPP}}$ = USD 4.8/CZK 80 = **0.06 USD/CZK** (or 16.66667 CZK/USD)

(b) $\mathbf{R_t} = S_t P_f / P_d$ = [(1/25) USD/CZK * CZK 80]/USD 4.8 = 0.6667 ⇒ CZK undervalued by 33.3%

(c) $\mathbf{R_t} < 1$ ⇒ Czech Republic is more efficient.

(d) GDP per capita (in USD, nominal) = CZK 440,000 * (1/25) USD/CZK = USD 17,600
GDP per capita (in USD, PPPl) = CZK 440,000 * **0.06 USD/CZK** = USD 26,400

(e) I_{US} = (4.56/4.80-1) = -0.05
I_{CZ} = (88/80-1) = .10
$e_{f,T}^{PPP} \approx I_{US} - I_{CZ}$ = -.15
$\mathbf{s_{Mar\ 17}^{PPP}} = S_{Feb\ 17} * [1 + e_{f,T}^{PPP}]$ = (1/25) USD/CZK x [1 + (-.15)] = **0.034 USD/CZK**

Note: You could have also calculated:
$\mathbf{s_{Mar\ 17}^{PPP}} = \mathbf{s_t^{PPP}} * [1 + e_{f,T}^{PPP}]$ = **0.06 USD/CZK** x [1 + (-.15)] = **0.051 USD/CZK**

(f) $S_{t=Mar\ 17}$ = 045 USD/CZK > $\mathbf{s_{Mar\ 17}^{PPP}}$ **= 0.034 USD/CZK**
⇒ According to PPP, the CZK is overvalued at S_t = 045 USD/CZK
⇒ Trading signal: Sell CZK/Buy USD

3. Suppose you use monthly Swiss and U.S. data from January1971 to January 2017. You fit the following regression: s_t (CHF/USD) = $(S_t - S_{t-1})/S_{t-1} = \alpha + \beta (I_{SWIT} - I_{US})_t + \varepsilon_t$.

$R^2 = 0.022127$
Standard Error (σ) = .034494
Residual SS (RSS) = 0.63198
Observations = 539

	Coefficients	Stand Error
Intercept	-0.00096	0.001550
$(I_{SWIT} - I_{US})$	1.142955	0.395672

(i) Are the signs of the coefficients consistent with PPP?

(ii) Using individual t-tests, test PPP at the 5% level.

(iii) Assume the sum of $\{s_{f,t} - (I_{SWIT} - I_{US})_t\}^2$ during the estimation period is 0.63291 –i.e., SSR(H_0). Using an F-test, test PPP at the 5% level.

(iv) Suppose S_{Jan17} = 1.01 CHF/USD and $(I_{SWIT} - I_{US})_{Jan17}$ = .0035. Assume inflation rates follow a Random Walk, that is $E_t[I_{SWIT} - I_{US}]_{t+1} = [I_{SWIT} - I_{US}]_t$. Using the regression model, forecast the exchange rate for Feb 2017 (S_{Feb17}).

(v) What is your Random Walk forecast for $S_{Feb\ 17}$?

(vi) Suppose S_t = 1.02 CHF/USD. Looking at (iv) and (v), which forecast has the lowest squared error?

ANSWER:
(i) Intercept should be 0 (no sign per se); slope should be 1 (positive). Slope is OK.

(ii)
t(α=0): -0.00096/0.001550 = **-0.619** ⇒ cannot reject H_0
t(β=1): (1.142955-1)/ 0.395672 = **0.3612967** ⇒ cannot reject H_0

(iii)
F(α=0 & β=1): [(0. 63291 - 0.63198)/2]/ [0.63198/(539-2)] = **0.3951154** ⇒ cannot reject H_0

(iv) $E_{Jan\ 17}[s_{f,t=Feb\ 17}]$ = -0.00096 + 1.142955 $E_{Jan\ 17}[(I_{SWIT} - I_{US})_{t=Feb\ 17}]$ = -0.00096 + 1.142955 * **.0035** = **0.0030403**

$E_{Jan\ 17}[S_{,t=Feb\ 17}]$ = 1.01 CHF/USD x (1 + **0.0030403**) = **1.013071 CHF/USD**

(v) $S^{RW}_{t=Feb\ 17}$ = 1.01 CHF/USD

(vi)
squared error (PPP) = (1.02 - **1.013071 CHF/USD**)^2 = .000048 <= PPP model lower squared error
squared error (RW) = (1.02 - 1.01)^2 = .0001

4. Ms. Benes is a U.S. arbitrageur. The one-year interest rate offered in the U.S. is 1%, while the one-year interest rate offered in Brazil is 17%. The spot rate is **3.90 BRL/USD**. Beckham Bank offers Ms. Benes a one-year forward contract at **4.10 BRL/USD**.

(1) Determine the arbitrage-free one-year forward contract exchange rate.
(2) Can Ms. Benes make a risk-free profit? If yes, describe a covered arbitrage strategy.
(3) Determine Ms. Benes's profits.
(4) Calculate the forward premium and compare it to the interest rate differential. Based on these numbers, what kind of capital flows will the U.S. economy experience?

ANSWER:

(1) $F^{IRP}_{t,1-yr}$ = **3.90 BRL/USD** * (1+.17)/(1+.01) = **4.517822 BRL/USD**

(2) $F^{IRP}_{t,1-yr} \neq F^{BB}_{t,1-yr}$ **= 4.10 BRL/USD** ⇒ Yes, arbitrage is possible.

(3) Covered arbitrage strategy (Key: BB undervalues USD forward at BRL/USD):
1) Borrow USD 1 at 1% for 1 year. ⇒ At T=1-year, repay: **USD 1.01**
2) Convert to BRL at S_t = 3.90 BRL/USD ⇒ (Get BRL 3.90)
3) Deposit BRL 3.90 at 17% for 1 year. ⇒ Get BRL 3.90 * (1.17) = BRL 4.563
4) Sell BRL/Buy USD forward at $F_{t,1\text{-}yr}$ **= 4.10 BRL/USD**
⇒ BRL 4.563/**4.10 BRL/USD** = **USD 1.112927**

π = **USD 1.112927** – **USD 1.01** = **USD .102927**. (or **10.29% per USD borrowed**)

(4) $p = (F_{t,T} - S_t)/S_t * (360/T) = (4.10 - 3.90)/3.90 * 1 = 0.05128205$
$i_d - i_f = .17 - .01 = .16$
$\Rightarrow p < i_d - i_f$ ⇒ capital inflows to the domestic economy
⇒ *capital outflows* from US to Brazil.

5. Chambers Inc has a **GBP 10,000,000** payable in in 180 days. It considers using (1) a forward hedge, (2) a money market hedge, (3) an option hedge, (4) a collar, or (5) no hedge. Chambers develops the following information:

S_t = **1.61 USD/GBP**
Interest USD = 5% - 5.25%
Interest GBP = 6% - 6.5%
$F_{t,180\text{-day}}$ = **1.60 USD/GBP**
Put (X_p = 1.565 USD/GBP; p_p = USD .01)
Call (X_c = 1.58 USD/GBP; p_c = USD .04)

Distribution for S_{t+90}

S_{t+180} (USD/GBP)	Probability
1.56	.30
1.59	.60
1.63	.10

A. 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.

B. Describe the exposure of Chambers. Given the information above, formulate a range for transaction exposure.

C. Suppose a consultant tells you the distribution of monthly changes in the USD/GBP exchange rate is $s_t \sim N(0,.03^2)$. Calculate the VaR(mean, 97.5%).

ANSWER:

• **PART A**

1. FH – Buy forward GBP
   Amount to be paid in 180 days = **GBP 10M** * **1.60 USD/GBP** = **USD 16M**

2. MMH –Borrow DC, convert to FC, deposit in foreign bank
   Today, we do the following: (1) Borrow USD at 5.25
   (2) Convert to GBP at 1.60 USD/GBP
   (3) Deposit in British Bank at 6%
   MMH Calculations (we go backwards):
   Amount to deposit = **GBP 10M**/[1 + .06*180/360] = **GBP 9.708M**
   Amount to borrow = **GBP 9.708M** * **1.61 USD/GBP** = **USD 15.62988M**
   Amount to repay = **USD 15.62988M** *(1 + .0525*180/360) = **USD 16.04138M**

Compare FH vs MMH: **FH is better** (MMH dominated)

3. Option Hedge –Buy GBP calls: X_c= **1.58 USD/GBP**, p_c = USD .04/GBP
   Cap = **GBP 10M** * **1.58 USD/GBP** = **USD 15.8M**
   Total premium cost = Total premium + OC = 10M*USD .04*(1+.05*.5) = **USD .41M**

Scenarios

S_{t+180} (USD/GBP)	Probability	Exercise?	Amount paid (Net of cost, in USD)
1.56	.30	No	USD 15.6M + **.41M** = USD 16.01M
1.59	.60	Yes	USD 15.8M + **.41M** = USD 16.21M

1.63	.10	Yes	USD 15.8M + **.41M** = USD 16.21M	<= *cap*

E[Amt to be paid in 180 days] = **USD 16.15M**
Compare FH vs OH: **FH** is better always**.** (Preferences do not matter.)

4. A collar:
Buy GBP calls: X_c = **1.58 USD/GBP**, p_c = USD .04/GBP
Sell GBP puts: X_p = **1.565 USD/GBP**, p_c = USD .01/GBP
Cap = **GBP 10M** * **1.58 USD/GBP** = **USD 15.8M**
Floor = **GBP 10M** * **1.565 USD/GBP** = **USD 15.65M**
Total premium cost = Total premium + OC = 10M*USD .03*(1+.05*.5) = **USD .31M**

Scenarios

S_{t+90} (USD/GBP)	Probability	Amount paid (Net of cost, in USD)	
1.56 (put exercised)	.30	USD 15.65M + **.31M** = USD 15.96M	<= *floor*
1.59 (call exercised)	.60	USD 15.8M + **.31M** = USD 16.11M	
1.63 (call exercised)	.10	USD 15.8M + **.31M** = USD 16.11M	<= *cap*

E[Amt to be paid in 180 days] = **USD 16.05M** (OH dominated by CH)
Compare FH vs CH: **FH** is better**.** (Preferences may matter.)

5. No Hedge –leave position open; that is, do nothing and wait.
E[Amt] = **GBP 10M** * [1.56 * (.3) + 1.59 * (.6) + 1.63 * (.1)] = **USD 15.88M**
Compare FH vs OH: **NH** is better; but *preferences matter***.**

• **PART B**
TE: **GPB 10M** * 1.61 USD/GBP = **USD 16.1M**
Range for NTE: [**USD 15.6M, USD 16.3M**]

• **PART C**
VaR(mean, 97.5%) = **USD 16.1M** * [1.96 * (.03 * sqrt(6))] = **USD 2.31888M**

6. Kramerica Company does business in the United States and New Zealand. In attempting to assess its economic exposure, it compiled the following information. Today's exchange rate is S_t = **0.50 USD/NZD.**

a. Kramerica's U.S. sales are somewhat affected by the value of the New Zealand dollar (NZD), because it faces competition from New Zealand exporters. It forecasts the U.S. sales based on the following three exchange rate scenarios:

Exchange Rate of NZD	Revenue from U.S. Business (in millions)
0.48 USD/NZD	**USD 100**
0.50 USD/NZD	**USD 105**
0.54 USD/NZD	**USD 110**

b. Its New Zealand dollar revenues on sales to New Zealand invoiced in New Zealand dollars are expected to be **NZD 600 million**.
c. Its anticipated cost of goods sold is estimated at **USD 200 million** from the purchase of U.S. materials and **NZD 100 million** from the purchase of New Zealand materials.
d. Fixed operating expenses are estimated at **USD 30 million**.
e. Variable operating expenses are estimated at 20 percent of total sales (after including New Zealand sales, translated to a dollar amount).
f. Interest expense is estimated at **USD 20 million** on existing U.S. loans, and the company has no existing New Zealand loans.

i. Create a forecasted income statement for Kramerica Co. under each of the three exchange rate scenarios. Explain how Kramerica's projected earnings before taxes are affected by possible exchange rate movements.
ii. Calculate the CF elasticity (to changes in S_t). Interpret the CF elasticity.
iii. Explain how it can restructure its operations to reduce the sensitivity of its earnings to exchange rate movements without reducing its volume of business in New Zealand.

ANSWER:
(i)

Forecasted Income Statement for Kramerica (in millions)

	0.48 USD/NZD	**0.50 USD/NZD**	**0.54 USD/NZD**	
Sales				
U.S.	**100M**	**105M**	**110M**	
NZ	288M	300M	324M	(= **NZD 600M** * S_t)
Total	**388M**	**405M**	**434M**	
COGS				
U.S.	**200**	**200**	**200**	
NZ	48	50	54	(= **NZD 100M** * S_t)
Total	248	250	254	
Gross Profit	**140**	**155**	**180**	
Op. Expenses				
U.S. Fixed	**30**	**30**	**30**	
U.S. Variable	77.6	81	86.6	(= **Total Sales** * .20)
Total	107.6	111	116.6	
EBIT	32.4	42.0	63.2	
Interest Expense	**20**	**20**	**20**	
EBT	**12.4**	**22.0**	**43.2**	

As the NZD appreciates against the USD there is an increase in EBT. If Kramerica is a U.S. firm it benefits. If it is a NZ firm, it is adversely affected. Kramerica could reduce its EE without reducing its NZ revenues by *shifting* expenses to New Zealand.

(ii) CF elasticity = $\frac{\%\text{ change in EBT}}{s_t}$

CF elasticity (from **0.50** to 0.48) = $\frac{(12.4-22)/22}{(.48/.50-1)} = \frac{-0.4363}{-.04} = 10.90909$

CF elasticity (from **0.50** to 0.54) = $\frac{(43.2-22)/22}{(.54/.50-1)} = 12.04545$

Average CF elasticity = (10.90909 + 12.04545)/2 = **11.47727** (not entirely Kosher average)

Interpretation: On average, a 1% depreciation of the NZD increases Kramerica's EBT by **11.5%.** If Kramerica is a U.S. firm, it behaves like a **net exporter**.

(iii) Kramerica could reduce its EE without reducing its NZ revenues by *shifting* expenses to New Zealand. Kramerica can borrow in NZ.