APPENDIX O (SELECTED QUESTIONS FROM OLD EXAMS)

Midterm 2

M2.I   Short questions (10 points each)

1. (**CHAPTER X**). Suppose JRV Corp is considering a project in Colombia (T=5 years), which requires an investment of COP 1000M (COP: Colombian peso). JRV is planning to use the usual 70/30 D/E split. Colombia has a 25% effective corporate tax rate. To calculate the cost of capital, JRV gathers the following data (all annualized):
  JRV can borrow in Colombia at 8% and in the U.S. at 3.5%.
  5-year government (risk-free) rates: 6.5% in Colombia and 2.5% in the U.S.
  Effective corporate tax rate in Colombia: 25%
  Expected Colombian stock market return: 13%
  U.S. stock market return: 8%
  Beta of project: 1.3
  $E[I_{Col}] = 5\%$
  $E[I_{US}] = 2\%$
  Stock market volatility: 35% in Colombia, 15% in the U.S.
  Bond market volatility: 26% in Colombia, 12% in the U.S.

a. Using WACC, calculate the cost of capital for the Colombian project.
b. Suppose JRV does not trust the expected return reported for Colombia and decides to use the Relative Equity Market Approach to estimate the Colombian risk premium ($k_M - k_f$). Recalculate the cost of capital for the Colombian project.
c. JRV believes the project would not have full exposure to Colombian country risk, since 80% of its production would be exported to the U.S. Assume that exports contribute 18% to Colombian GDP. Recalculate the cost of equity and the cost of capital under this scenario.
d. Continuation from c. JRV estimates the 1st-year free cash flows (FCF) to be COP 150M. Suppose that 1/3 of those FCF are used to pay for capital expenditures to expand and for replacing worn out assets; the rest is considered a dividend payment to JRV. JRV believes the project would produce dividends perpetually, growing 2% per year. Should JRV undertake the project?

ANSWER:
a) $k_c = D/(E+D) \, k_d \, (1-t) + E/(E+D) \, k_e = .70*.08*(.75) + .30*[.065 + 1.3*(.13-.065)] = 0.08685$

b) $(r_M - r_f)_{Col}$ (in USD) $= (r_M - r_f)_{US} \times \sigma_{Col}/\sigma_{US} = (.08-.025) * .35/.15 = \mathbf{0.12833}$
    $(r_M - r_f)_{Col}$ (in COP) $= (r_M - r_f)_{Col}$ (in USD) $+ (E[I_{Col}] - E[I_{US}]) = \mathbf{0.12833} + .03 = \mathbf{0.15833}$
    $k_c = .70*.08*(.75) + .30*[.065 + 1.3*(\mathbf{0.15833})] = 0.12325$

c) $CER_{Col} = (r_M - r_f)_{Col}$ (in USD) - $(r_M - r_f)_{US} = \textcolor{red}{\textbf{0.12833}}$ - $(.08-.025) = \textcolor{green}{\textbf{0.07333}}$

$\lambda_{JRV-Col} = .20/.82 = \textcolor{orange}{\textbf{0.2439}}$

$k_{e,Col}$ (in USD) $= r_{f,US} + \beta (r_M - r_f)_{US} + \lambda_{JRV-Col} \, CER_{Col}$
$$= .025 + 1.3x(.08-.025) + \textcolor{orange}{\textbf{0.2439}}*(\textcolor{green}{\textbf{0.07333}}) = \textbf{0.1144}$$

$k_{e,Col}$ (in COP) $= k_{e,Col}$ (in USD) $+ (E[I_{Col}] - E[I_{US}]) = \textbf{0.1144} + .03 = \textcolor{purple}{\textbf{0.1444}}$

$k_c = .70*.08*(.75) + .30*[.065+1.3*(\textcolor{purple}{\textbf{0.1444}})] = \textcolor{blue}{\textbf{0.1178}}$

d) NPV (in COP M) $= -1,000 + (2/3)*150*[1.02/(1+\textcolor{blue}{\textbf{0.1178}})]/[1-(1.02/(1+ \textcolor{blue}{\textbf{0.1178}}))]$
$$= 42.945 > 0 \Rightarrow \text{YES!}$$

2. (CHAPTER X). Mac Inc., a U.S. firm, plans to invest in a new project that will be located either in Panama or in Costa Rica. 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	Panama	Costa Rica
Expected return	11%	21%	35%
Standard deviation	12%	22%	50%
Correlation with existing Mac's portfolio	1.00	.35	.10
Weight on overall portfolio	-	.30	.15
Beta	.90	1.20	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?

A.
○ Costa Rica

$E[r_{BOYD+CR}] = w_{EP}*E[r_{MAC}] + (1- w_{EP})*E[r_{CR}]$
$= .85*.11 + .15*.35 = 0.146$

$\sigma^2_{MAC+CR} = w_{MAC}^2(\sigma_{MAC}^2) + w_{CR}^2(\sigma_{CR}^2) + 2\, w_{MAC}\, w_{CR}\ \rho_{MAC,CR}\, \sigma_{MAC}\, \sigma_{CR}$
$= (.85)^2*(.12)^2 + (.15)^2*(.50)^2 + 2*.85*.15*0.10*.10*.50 = 0.01756$
$\Rightarrow \sigma_{MAC+CR} = sqrt(0.01556)$

$SR_{MAC+CR} = E[r_{MAC+CR} - r_r]/ \sigma_{MAC+CR} = (.146-.03)/.1325 = $ **0.8754**

○ Panama

$E[r_{MAC+Pan}] = .70 * 0.12 + .30*.22 = .14$
$\sigma_{MAC+Pan} = 0.1237$
$SR_{MAC+Pan} = (.14-.03)/0.1237 = $ **0.88950** $> SR_{MAC+CR}$ $\qquad \Rightarrow$ Panama!

B.
○ $\beta_{MAC+CR} = w_{MAC} *\beta_{MAC} + w_{CR}*\beta_{CR}$
$= .85*.90 + .15*1.40 = 0.975$

$TR_{MAC+CR} = E[r_{MAC+CR} - r_r]/ \beta_{MAC+CR} = (.146-.03)/0.975 = $ **0.1190**

○ $\beta_{MAC+Pan} = 0.99$
$TR_{MAC+Pan} = (.14-.03)/.99 = $ **0.1111** $> TR_{MAC+CR}$ $\qquad \Rightarrow$ Costa Rica!

C.
$SR_{MAC} = (.11-.03)/.12 = $ **.667** $< SR_{MAC+CR}$ & $SR_{MAC+Pan}$
$TR_{MAC} = (.11-.03)/.90 = $ **.089** $< TR_{MAC+CR}$ & $TR_{MAC+Pan}$ $\qquad \Rightarrow$ No! Mac is not better off without adding any project.

3. (CHAPTER X). Dennis Corporation, a U.S.-based MNC, has a subsidiary in Nicaragua that manages coffee fields. The subsidiary believes it could also enter into the sugar export business. The following data has been compiled for the analysis (in cordobas (NIO), Nicaragua's currency):
• Initial outlay: NIO 80 million
• Life of the project: 3 years
• Revenue per year: NIO 45 million
• Cost of Goods per year: NIO 10 million
• Depreciation: 10% of initial outlay
• Salvage value: NIO 10 million
• Exchange rate: 25 NIO/USD
• Forecasted exchange rates: $E[S_{t+1}]$=22 NIO/USD; $E[S_{t+2}]$=20 NIO/USD; $E[S_{t+3}]$=18 NIO/USD.
• The Nicaraguan government imposes a 20% tax on profits.
• The Nicaraguan government also imposes a 10% withholding tax on funds remitted to the U.S. parent house (<u>including salvage value</u>).
• The U.S. government imposes a 10% tax on remitted funds, excluding salvage value. There is no tax credit allowed.
• All the cash flows will be remitted to the parent company.
• The required rate of return is k=12%.

i.- What is the evaluation of the project for Dennis Corporation's Nicaraguan subsidiary (in NIO and including only local taxes)?
ii.- What is the evaluation of the project for Dennis Corporation (in USD, including all taxes)?
iii. Does Dennis's decision depend on salvage value? (Calculate SV^{BE})
iv.- Would you recommend the project to Dennis Corporation?

i) (in millions)

	Year 1	Year 2	Year 3	SV
Gross Profit	NIO 35	NIO 35	NIO 35	
Depreciation	NIO 8	NIO 8	NIO 8	
Earnings Before Taxes	NIO 27	NIO 27	NIO 27	
Tax (25%)	NIO 5.4	NIO 5.4	NIO 5.4	
Earnings After Taxes	NIO 21.6	NIO 21.6	NIO 21.6	
+Depreciation	NIO 8	NIO 8	NIO 8	
Free Cash Flows (EAF + Dep)	**NIO 29.6**	**NIO 29.6**	**NIO 29.6**	**10**

NPV (k = 12%) = **NIO -1.788M** < 0 $\Rightarrow$ No!

ii) (in millions)

	Year 1	Year 2	Year 3	SV
Cash Flows in NIO	**NIO 29.6**	**NIO 29.6**	**NIO 29.6**	**10**
withholding tax (10%)	NIO 2.96	NIO 2.96	NIO 2.96	
Net CFs to be remitted	NIO 26.64	NIO 26.64	NIO 26.64	
US tax (10%)	NIO 2.664	NIO 2.664	NIO 2.664	

After-tax Net CFs	NIO 23.976	NIO 23.976	NIO 23.976	
Exchange Rate of NIO	USD 1/22	USD 1/20	USD 1/18	USD 1/18
After-tax Net CFs (in USD)	**USD 1.0898**	**USD 1.1988**	**USD 1.332**	**USD .3559**

NPV (k = 12%) = **USD 0.03271M** > 0 $\Rightarrow$ Yes!

iii) Yes! **SV^{BE}** = **USD 0.505 M** (or **NIO 9.083M**). High & close to reported SV by subsidiary.
iv) The NPV is small, but positive => Yes; but the dependence on SV is worrisome.

4. (**CHAPTER X**). Suppose Telefónica (TEF) is considering offering cellular phone service in Panamá, El Salvador, Guatemala, Nicaragua and Honduras. The success of the investment, with a 10-year horizon, depends on the number of subscribers. TEF determines two states for the numbers of subscribers: "high growth" or "low growth." If the state is "high", the expected NPV of future cash flows is **EUR 80M** per market; if the state is "low," the expected NPV of the future cash flows is **EUR 20M** per market. Suppose, the probability of a high number of subscribers is 50% and after one year TEF knows learns the state (high growth or low growth) for the whole investment. Suppose the upfront initial investment is **EUR 45M** per market if investing in one market. A joint investment in all markets reduces the total upfront investment by 5%. Evaluate the investment under the 3 situations described in A, B & C, using a discount rate of k=15%:

A. TEF invests in one market only, say Panamá.
B. TEF decides to test one market, say Panamá, first. After one year, if successful in test market –i.e., number of subscribers is high-, TEF enters the other **4** markets. TEF learns from the investment in Panamá: with this knowledge, now, the upfront investment in additional markets is reduced by 10%, while the probability of high increases to 60% in additional markets.
C. TEF decides to invest in all the markets simultaneously.
D. Explain why the results B & C are different.

A. (in EUR M)
E[NPV] = **-45** + [(.50)***20** + (.50)***80**]/ 1.15 = **-1.521739** < 0.　　　$\Rightarrow$ No to project in Panamá.

B. (in EUR M)
E[NPV] = **-45** + [(.50)***20**+(.50)***80**]/ 1.15 + (.50)*{**-45***(.90)/1.15 + [(.40)***20**+(.60)***80**]/ 1.15^2}***4**
　　　= **12.73157** > 0.　　$\Rightarrow$ YES! TEFF should enter sequentially (Panama first, others later).

C. (in EUR M)
E[NPV] = {**-45***(.95) + [(.50)***20** + (.50)***80**]/ 1.15}***5** = **3.641304** > 0.
　　　　　　　　　$\Rightarrow$ YES to simultaneous project, but sequential entry is better.

D. Scenario B values the real option (learning), which is ignored in scenario C.

5. (CHAPTER XIII). Charlie Kelly, an Irish design 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 1.25 % (s.a.)
German government bond yield: 4-year 1.75 % (s.a.)
Kelly Euro-Eur bond yield (outstanding debt): German government bonds + 185 bps (s.a.)

(A) Given the current tight market conditions, an investment bank suggests: a 5-year full-coupon USD Eurobond and an issue price of 100% (P=100). Determine the coupon.

YTM = risk free rate + spread = .0125 (s.a) + .0185 (s.a.) = .0305 (s.a.)
YTM (p.a.) = $(1+.0305/2)^2$ = 0.03073   => since P=100 => Coupon = YTM = **3.073%**

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

$CR_{Europe}\uparrow$ $\Rightarrow YTM_{Europe}\uparrow \Rightarrow P_{bond}\downarrow$

(C) Two years from now, the Irish government has a budget surplus. What would the effect of this budget surplus be on the value of the bond? Briefly explain your logic.

Budget surplus = good news: $CR_{Ireland}\downarrow$ $\Rightarrow YTM_{Irelande}\downarrow \Rightarrow P_{bond}\uparrow$

(D) Three years from now, Kelly 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?

Note: T=2, two payments left.
   $\Rightarrow$ P = [0.03073/1.06 +1.03073/1.06^2]* USD 200 M /1.10 USD/EUR = **EUR 181.7357M**

6. (CHAPTER XIII). It is January 2. You are the manager of a Eurobond portfolio worth USD 28 million. You are worried about interest rate volatility in the next twelve months. The average duration of the portfolio is 7.8 years with an annual YTM of 6.8%. The December T-bond futures price is currently 108-25, with an annual yield of 7.2%, and the cheapest-to-deliver bond has a duration of 7.1 years.

A. Using December T-bond futures contracts, how should you hedge against changes in interest rates in the next 12 months?

B. Suppose interest rates decreased during the 12-month period the hedge was established. Was the decision to hedge justified?

ANSWER:

A.

N = [S D$_S$ (1+YTM$_F$)]/[F D$_F$ (1+YTM$_S$)] =
= [USD 28,000,000x7.8x(1.072)]/[USD 108,781.25x7.1x(1.068)] = 283.83
$\Rightarrow$ Short 284 contracts to hedge the Eurobond portfolio.

B. Since interest rates decreased, the Eurobond portfolio's value increased. A no-hedge strategy would have been more profitable. The hedge, however, was established to maintain the value of the portfolio and, therefore, the decision to hedge seems justified.

7. (CHAPTER XIII) It is June 15. A Treasury bond is trading at a price of 92'14 and has a 8% coupon payable on August 1 and February 1. Short-term interest rates as of June 15 are 5% for two-months or less and 5.5% for three months. Calculate the forward price of the bond (F) calculated to September 1.

ANSWER:

P+A1		C	31 days	F+A2
Today (June 15)		T$_1$=46 days		T$_2$=77 days
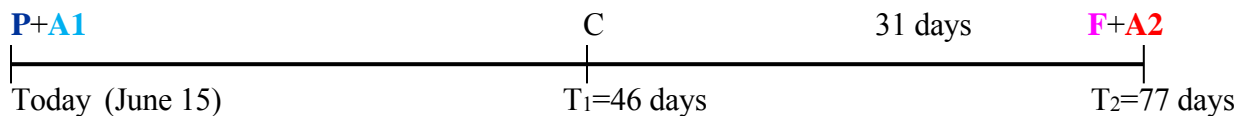
P = 92.4375
r$_1$ = .05
r$_2$ = .055
C = .08
T$_1$ = 15 + 31 = 46
T$_2$ = 15 + 31 + 31 = 77

A1 = .08/2 x 134/181 x 100 = 2.9613
A2 = .08/2 x 31/184 x 100 = 0.6739

F= (92.4375+2.9613)(1+.055x77/360) - .08/2*[(1+.055x77/360)/(1+.05x46/360)] – 0.6739 = 95.80695

8. (CHAPTER XIII) Mr. Splinter, manager of One Foot Portfolio, has JPY 1,500,000,000 in a stock portfolio whose composition matches the Nikkei 225 and JPY 2,000M in a bond portfolio with a modified duration of 6.2 years. Mr. Splinter believes Japanese interest rates are going to be significantly reduced in the next three months by the Bank of Japan. He also expects the Japanese stock market to remain at the actual level for the next three months. Assume that the JGB CDB bond contract with a modified duration of 7.9 years, and it is trading at 93.50. The face value of JGB futures bonds is JPY 10M. Assume the three-month Nikkei 225 is trading at 18015 (the multiplier is equal to USD 5, and the exchange rate is .0098 USD/JPY). Assume transaction costs are high enough to prevent Mr. Splinter to change his portfolio allocation for three months. Calculate the number of T-bond futures contracts and stock index futures contracts needed to take advantage of the change in interest rates. (Specify which contracts he is going to sell and which contracts he is going to buy).

ANSWER:
• Number of 3-mo. JGB contracts to buy to increase One Foot Portfolio's bond position by JPY 1.5B.

$N = 6.2$ (JPY 3.5B – JPY 2.0B)/[7.9 x .9350 x 0.01B] = 125 contract $\Rightarrow$ buy 125 JGBs futures

• Now, take a JPY 1.5B short position in stocks, using 3-mo Nikkei futures.

N = JPY -1.5B/[18,015 x 5/.0098] = - 163.2 contracts $\Rightarrow$ Short 163 Nikkei futures.

9. (CHAPTER XIV) Suppose the term structure of interest rates is flat in the United States and Peru. The dollar interest rate is 6% per year while the Peruvian nuevo sol interest rate (PEN) is 15%. The current exchange rate is USD 1 = PEN 2.25. Under the terms of a swap agreement, Banco Wiese, a financial institution, pays 10% per year in PEN and receives 5% per year in USD. The principals in the two currencies are USD 10 million and PEN 22 million. Payments are exchanged every year. The swap will last two more years. What is the value of the swap to Banco Wiese?
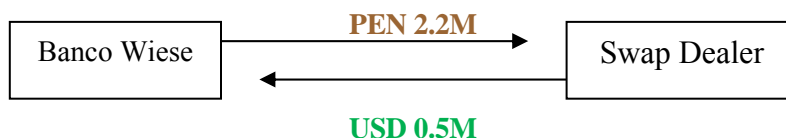
ANSWER:
i_{USD} = .06
i_{PEN} = .15
S_t = .4444 USD/PEN
freq = annual
Coupons:
       - 10% PEN (payment = .10 * PEN 22M = **PEN 2.2M**
       - 5% USD (payment = .05 * USD 10M = **USD 0.5M**

PEN 2.2M

| Banco Wiese | → | Swap Dealer |

USD 0.5M

$B_{USD} = $ **USD 0.5M**$/(1.06) + $ **USD 10.5M**$/(1.06)^2 = $ **USD 9,816,661**
$B_{PEN} = $ **PEN 2.2M**$/(1.15) + $ **PEN 24.2M**$/(1.15)^2 = $ **PEN 20,211,721**

Value of Swap (Banco Wiese) = **USD 9,816,661** – **PEN 20,211,721** * **.4444 USD/PEN** = **USD 833,674**.

10. (CHAPTER XIV) CEMEX is a leading Mexican construction company. CEMEX has USD 200 million of short-term debt. CEMEX has decided to refinance the USD short-term debt with a straight 2-year 11% Euro-USD bond. Each bond has denomination of USD 1,000. Market competitive pressures have recently driven down the commissions paid for issuing straight bonds to 1½%. An investment bank approaches CEMEX and offers to issue a similar straight bond, but with tradeable four-year currency warrants attached giving entitlement to European USD/MXP calls. Each bond of USD 1,000 has a detachable warrant giving the holder the right to receive the difference between (1) the USD equivalent of MXP 10,000 at the rate of 0.09 USD/MXP and (2) the USD equivalent of MXP 10,000 at the then prevailing exchange rate. To value the USD/MXP put, you should use the Black-Scholes formula with the following inputs: the exchange rate is .10 USD/MXP, the strike price USD is .09 USD/MXP, the USD risk-free rate is 6%, MXP risk-free rate is 10%, and the annual USD/MXP volatility during the past four years was 20.60%.

A. Following standard market practices, calculate the cost of funds.
B. Discuss the advantages and disadvantages of the proposed 2-year CEMEX bond.
C. Propose a solution to reduce currency risk.

ANSWER:
A.
• Currency warrants (using the Black-Scholes formula for currency options):
Call = $C = S\,e^{-r_{fx}T}\,N(d1) - X\,e^{-r_{dx}T}\,N(d2)$
$d1 = 0.07354$ $\Rightarrow N(d1) = 0.5292$
$d2 = -0.33866$ $\Rightarrow N(d2) = 0.3674$
$C = .10 \times e^{-.10 \times 4} \times 0.5293 - .09 \times e^{-.06 \times 4} \times 0.3674 = $ USD .0095 per MXP
$P = C - S\,e^{-r_{fx}T} + X\,e^{-r_{dx}T} = $ USD .0132 per MXP.
Warrant price: USD 0.0132 per MXP, or USD 132 per bond (13.2% per bond).

• Cost of funds
T = 2 years.
Issue price = 100% + 13.2% = 113.20%
CFs: net receipt at issue = USD 200,000,000 (1.132 - .0150) = USD 223,400,000
        annual coupon payments = USD 22,000,000.
        principal repayment = USD 200,000,000.
Cost of funds (including commissions) = 4.73%

B.
Advantage: Low cost of funds. The cost of funds is 627 bps below the usual cost of funds for CEMEX.
Disadvantage: CEMEX gets exposed to FX risk. The USD/MXP puts have a moderate probability of being exercised at maturity, since they are already in-the-money.

C.
A solution to minimize currency risk is to sell a 4-year USD/MXP forward contract. Using IRPT, we obtain $F_{t,4}$ = .0862 USD/MXP. Therefore, if CEMEX sells MXP forward at this rate, CEMEX fixes the USD cost of its currency play (sells MXP 2,000,000,000 for USD 172,400,000).

11. (CHAPTER XIV) Laudrup F.C., a Danish fund, holds a British stock portfolio on which it earns a volatile equity return which is highly correlated with the FT-100 index (the U.K. stock index). This return is in GBP. The manager of Laudrup, Mr. Piazza, decides to have all foreign income in the form of fixed-rate DKK. You work for Mr. Piazza. Present in an exhibit your proposed structured solution to Mr. Piazza's problem.

ANSWER:
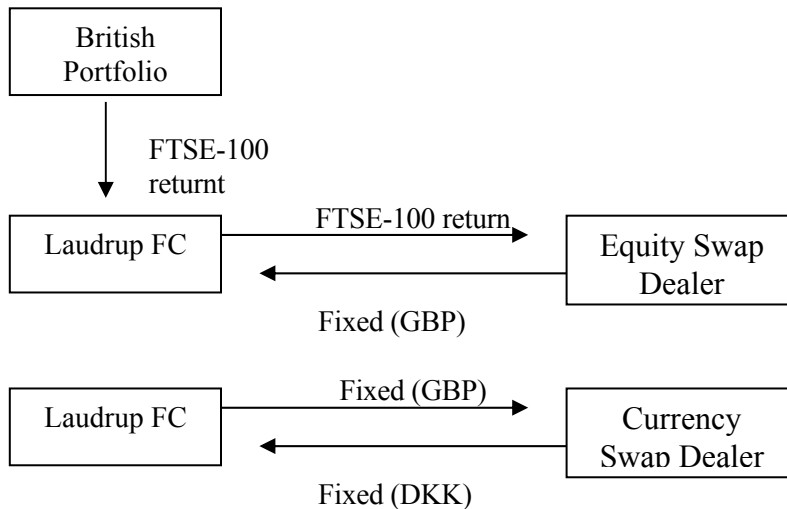
12. (CHAPTER XIV) Artesano Ltd., a Peruvian firm, produces copper bracelets. Artesano buys a quarter million pounds of copper a year. The price of a pound of copper in international markets is in USD. The manager of Artesano, Mr. Cobre, is uneasy about the short-term exchange rate exposure and decides to fix the price of a pound of copper in terms of soles (PEN) for two years. You work for Mr. Cobre. A commodity swap dealer offers a two-year mid-quote price of USD .85 per pound of copper (the dealer spread is USD .12). Two-year swap interest rates are available at a rate of 7% against 6-mo. LIBOR. Two-year PEN-for-USD currency swaps are available at a rate of 18% against 6-mo. LIBOR. The current exchange rate is 2.81 PEN/USD.
A. Present in an exhibit your proposed structured solution to Cobre's problem.
B. Determine the price of copper in terms of PEN.

ANSWER:
A. Structured Solution
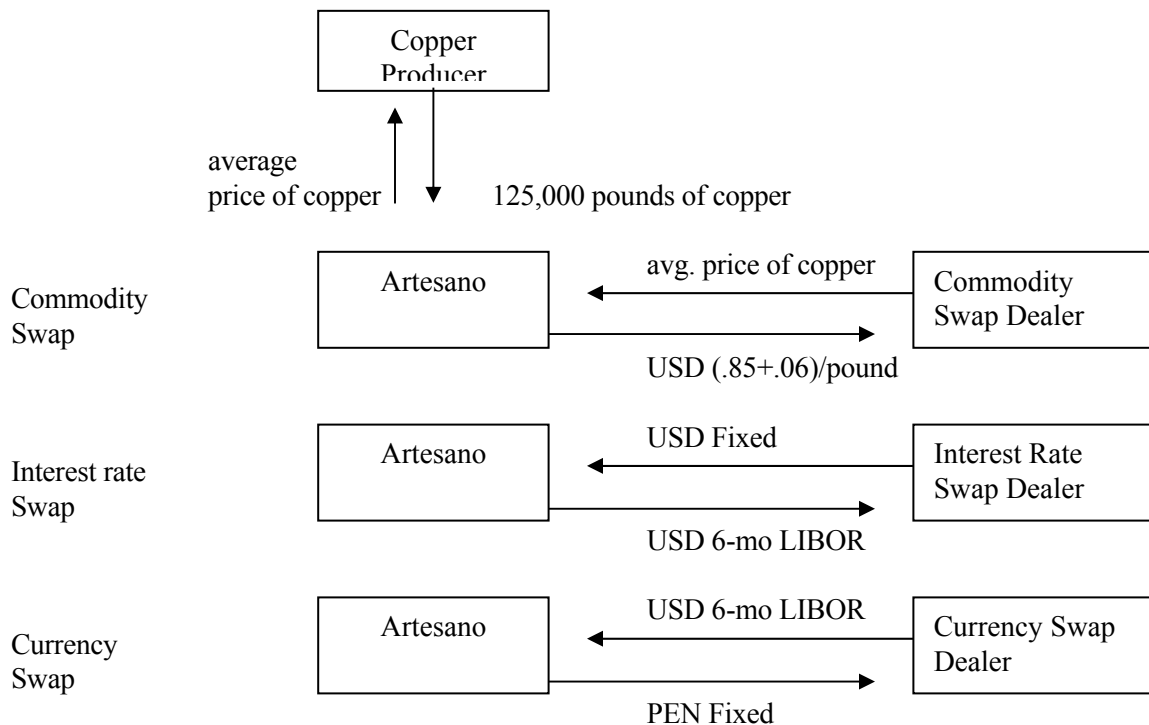
B. Price of coffee in terms of PEN.
(1) Fixed semiannual payments to commodity swap dealer:125,000 x USD .91 = **USD 113,750.**
(2) Notional principal on a USD interest rate swap: USD 113,750 / .035 = USD 3,250,000.
(3) PV of CFs: PV(**113,750**,.035,4 periods) = **USD 417,813.**
(4) Translate to PV of CFs PEN: **USD 417,813** x 2.81 PEN/USD = **PEN 1,174,053.9**
(5) Coupon on the fixed-rate side of PEN-for-USD swap:
　　　Coupon(PV=**1,174,053.9**,.09,4 =periods) = **PEN 362,394**
(6). Price of copper = **PEN 362,394**/125,00 = 2.90 PEN/pound of copper.

13. (CHAPTER XIV) (Adapted from Riskpublications.com) During the first semester of the year 1999, the cost of swapping a medium term Eurobond to USD was 5bp to 6bp, which was considered too high for many USD borrowers. While increased EUR exposure was attractive for U.S. companies, the cost was considered too high. In June 1999, liquidity improved in the currency swap market and U.S. borrowers took advantage of the diminished costs between the EUR and USD. Simeone Insurance raises USD 4 billion annually to fund its programmes. It is a regular in the international markets, and swaps all debt back to floating dollars. On July 1, 1999, Simeone priced EUR 300 million of four-year EMTN debt via CSFB and ING Barings. The proceeds were swapped into floating USD. The Euronotes yielded 5.39% annually re-offered and 5.45% all-in-cost. With interest-rate swap bids around 5.41% at the time, Simeone could have achieved around Euribor plus 4bp. The basis (flexible-for-flexible) swap to USD was 1bp at most, and perhaps even flat. The borrower confirmed that LIBOR plus 5bp had been achieved --several basis points better than Simeone would have been able to hit just a week earlier. Draw a diagram showing the all the cash flows involved in the operation that allowed Simeone to borrow at LIBOR plus 5bps.

ANSWER:
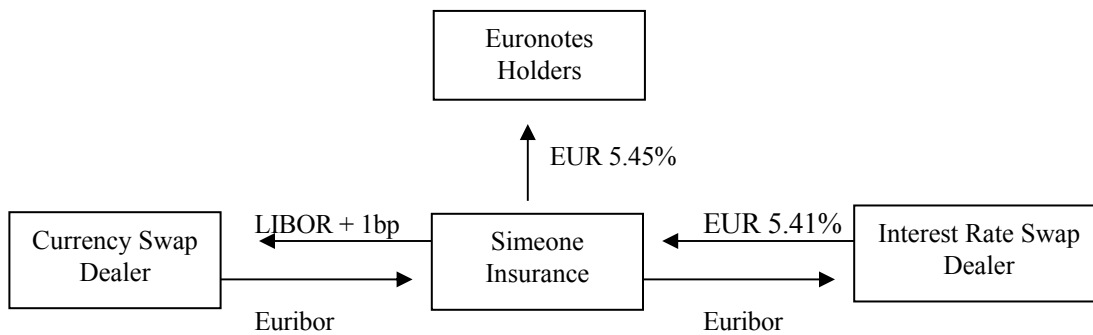
14. (CHAPTER XIV) Shell wants to increase its fixed-rate DEM debt, while UBS wants to increase its DEM floating-rate debt. Shell can borrow at 7.5% fixed or at FIBOR. UBS can borrow at 5.6% or at 1% below FIBOR. You are a swap dealer. Design an interest rate swap agreement between Shell and UBS that benefits both parties.

ANSWER:
• Swap deal:
Shell issues floating debt at FIBOR and makes coupon payments to UBS at 6%
UBS issues fixed-rate debt at 5.6% and makes (FIBOR-1) payments to Shell

• Cost of borrowings:
Shell: $FIBOR + 6.0 - (FIBOR-1.0) = 7.0\%$ ($< 7.5\%$)
UBS: $5.6 + (FIBOR-1) - 6.0 = (FIBOR-1.40\%)$ ($< FIBOR - 1\%$)

15. (CHAPTER XIV) Suppose the term structure in Switzerland and the U.S. is flat. The annual CHF interest rate is 4%, while the annual USD interest rate is 5.2%. Goyco Corp., a U.S. firm, has entered into a currency swap where it receives 5.5% annually in USD and pays 4.3% annually in CHF. The principals in the two currencies are USD 15 million and CHF 25 million. The swap will last for another four-years. The exchange rate is .60 USD/CHF.

A. Value this currency swap using the forward currency contract decomposition.
B.- Three years from now, the exchange rate is .70 USD/CHF. What is the market valuation of the last year of the swap exchanges for Goyco Corp.? (Recall that the market valuation is the present value of the difference between what is stipulated in the contract and the market valuation of those payments).

ANSWER:

A.- $F_{t,1}$ = .60 USD/CHF x (1.052)/(1.04) = **.6069 USD/CHF**
  $F_{t,2}$ = .60 USD/CHF x $(1.052)^2/(1.04)^2$ = **.6139 USD/CHF**
  $F_{t,3}$ = .60 USD/CHF x $(1.052)^3/(1.04)^3$ = **.6210 USD/CHF**
  $F_{t,4}$ = .60 USD/CHF x $(1.052)^4/(1.04)^4$ = **.6282 USD/CHF**

Annual exchanges:
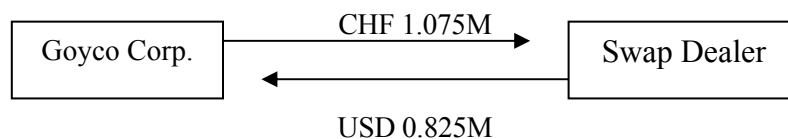
$V_{\text{1st-year}}$ = [USD 0.825 – CHF 1.075 M x **.6069 USD/CHF**]/(1.052) = USD .164052
$V_{\text{2nd-year}}$ = [USD 0.825 – CHF 1.075 M x **.6139 USD/CHF**]/$(1.052)^2$ = USD .149143
$V_{\text{3rd-year}}$ = [USD 0.825 – CHF 1.075 M x **.6210 USD/CHF**]/$(1.052)^3$ = USD .135216
$V_{\text{4th-year}}$ = [USD 15.825 – CHF 26.075 M x **.6282 USD/CHF**]/$(1.052)^4$ = USD -.453395

Value of swap(Goyco) = $V_{\text{1st-year}}$ + $V_{\text{2nd-year}}$ + $V_{\text{3rd-year}}$ + $V_{\text{4th-year}}$ = USD-.004984.

The value of the swap for Goyco is USD –4,984.

B.- Now, the swap has one year left to maturity.
$F_{t,1}$ = .70 USD/CHF x (1.052)/(1.04) = **.7081 USD/CHF**
$V_{\text{4th-year}}$ = [USD 15.825 – CHF 26.075 M x **.7081 USD/CHF**]/(1.052) = USD –2.50771

Goyco's value of the swap in the last year of the agreement goes significantly up.

16. (CHAPTER XV) Consider a Swiss bank facing the following operations:
a. Lend money to Unilever at LIBOR + 1%.
b. Option of borrowing money at LIBOR + ½% with a cap of 10% or borrow at LIBOR + 2/3%.
c. Sell a cap option at 10% to Roche for 5/8% a year.
Should the bank engage in cap packaging?

ANSWER:
Bank's net income:
• Cap: (LIBOR+1) - min(LIBOR+1/2,10) + 5/8 – max(0,LIBOR-10)

      if LIBOR < 10% $\Rightarrow$ (LIBOR+1) – (LIBOR +1/2) + 5/8 = 1.125

      if LIBOR > 10% $\Rightarrow$ (LIBOR+1) – 10 + 5/8 - (LIBOR -10) = 1.625

• No cap: (LIBOR+1) – (LIBOR+2/3) = 1/3

YES! Swiss bank should engage in cap packaging.

17. (CHAPTER XV) On January 10, a Eurobank is offered HKD 200 million of twelve-month deposit by a customer at the bank's bid rate. The bank does not want to be exposed to gap risk.
At the current market, the other rates are these:

	Cash			FRA	
	bid	asked		bid	asked
9 months	8.500	8.625	9x12	8.70	8.80
12 months	8.750	8.825			

Do you advise the bank to take the twelve-month deposit? Show your calculations.

ANSWER:
From Jan 12 to Jan 12 $\Rightarrow$ T=365.
Financing Cost = HKD 200 M x 365/360 x .0875 = HKD 17,743,055.56

From Jan 12 to Oct 12 $\Rightarrow$ T=273. From Oct 12 to Jan 12 $\Rightarrow$ T=92.
Interest earned = HKD 200M x [(1 + .0850 x 273/360) x (1 + .0870 x 92/360) – 1] = HKD 17,624,958.

Financing Cost > Interest earned $\Rightarrow$ NO!

18. (CHAPTER LN XVII) You are a U.S. investor, whose U.S. portfolio tracks the U.S. market perfectly. You are considering investing in the following foreign stock markets:

Market	Return (%)	SD	β_{WORLD}
Mexico	.16	2.10	.62
U.K.	.09	1.05	.84
Hong Kong	.14	1.50	.49
U.S.	.10	1.11	1.03
WORLD	.12	1.01	1.00
R_F	.05		

R_F is the U.S. one-year Treasury Bill rate, that is, the risk free rate. β_{WORLD} is the beta of the foreign market with the World Index.

(A) Based on a risk-adjusted performance measure (RVOL and RVAR), rank the performance of the four markets.

ANSWER:

	RVAR	RVOL
Mexico	.05236	.1774
UK	.0381	.0476
HK	.06	.1837
US	.045	.05

(B) Assume you add to your U.S. portfolio, which tracks the U.S. market, all markets with a higher RVOL than the U.S. RVOL. You give a weight of 10% to each foreign market in your expanded portfolio. What is the risk of your expanded portfolio? Is the risk of your expanded portfolio lower than before?

ANSWER:
   Add Mexico and Hong Kong.
   $\beta_p = \Sigma_i \omega_i \beta_i = .80 \times (1.03) + .10 \times (0.62) + .10 \times (0.49) = .935$ (lower β!)

19. (CHAPTER LN XVII) Boyd Inc., a U.S. Mutual fund, plans to invest in a new market portfolio that will follow the Venezuelan market or the Colombian market. If the Venezuelan market portfolio is selected, it will constitute 45% of the firm's total funds. If the Colombian market portfolio is selected, it will constitute only 15% of the firm's total funds. Assume the U.S. risk free rate is 4%. You have the following data on expected returns for each project:

	Boyd	Venezuela	Colombia
Expected return	11%	25%	35%
Standard deviation	20%	30%	55%
Correlation with existing Boyd's portfolio	1.00	.40	.10
Weight on overall portfolio	-	.45	.15
Beta	.90	1.20	1.40

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

ANSWER:
1. Colombia

$E[r_{BOYD+Col}]$ = $w_{EP}*E[r_{BOYD}]$ + $(1- w_{EP})*E[r_{col}]$
          = .85*.11 + .15*.35 = **0.146**

$\sigma^2_{BOYD+Col}$ = $w_{BOYD}^2(\sigma_{BOYD}^2)$ + $w_{Col}^2(\sigma_{Col}^2)$ + 2 w_{BOYD} w_{Col} $\rho_{BOYD,Col}$ σ_{BOYD} σ_{Col}
          = $(.85)^2*(.20)^2$ + $(.15)^2*(.55)^2$ + 2*.85*.15*0.10*.20*.55 = 0.0385
          => $\sigma_{BOYD+Col}$ = $(0.0385)^{1/2}$ = 0.1962

$\beta_{BOYD+Col}$ = $w_{BOYD}*\beta_{BOYD}$ + $(1- w_{Col})*\beta_{Col}$
          = .85*.90 + .15*1.40 = **0.975**

$SR_{BOYD+Col}$ = $E[r_{BOYD+Col} - r_r]/$ $\sigma_{BOYD+Col}$ = (**.146** - .04)/**.1962** = **0.5401**
$TR_{BOYD+Col}$ = $E[r_{BOYD+Col} - r_r]/$ $\beta_{BOYD+Col}$ = (**.146** - .04)/**0.975** = **0.1087**

2. Venezuela
$E[r_{BOYD+Ven}]$ = 0.173
$\sigma_{BOYD+Ven}$ = 0.2054
$\beta_{BOYD+Ven}$ = 1.035
$SR_{BOYD+Ven}$ = (.173-.04)/0.2054 = 0.6475 > $SR_{BOYD+Col}$ = **0.5401**
$TR_{BOYD+Ven}$ = (.173-.04)/1.035 = 0.1285 > $TR_{BOYD+Col}$ = **0.1087**

A. Under the SR measure, the Venezuelan project is superior.
B. Under the SR measure, the Colombian project is superior.
C. SR_{BOYD} = (.11-.04)/.2 = .35 < $SR_{BOYD+Col}$ < $SR_{BOYD+Ven}$
        TR_{BOYD} = (.11-.04)/.90 = .0778 < $TR_{BOYD+Col}$ < $TR_{BOYD+Ven}$
Under both measures, Boyd is not better off without international diversification!

M2.II   <u>Long questions</u> (20 points each)

1. (CHAPTER XV). Consider a three-year interest rate cap of 9% on annual (1 year) LIBOR. The cap amount is $10 million. The cap trades on January 28 for effect on January 30. v=.15. At the time the cap is purchased, offered rates on time deposit are:

Period   Offered Rate
1 year   8.25
2 year   8.50
3 year   8.75

Value the cap. (Hint: there are two options in the cap. To apply the Black-Scholes formula, check the Normal Table on the last page of this exam).

ANSWER:
Option #1:   f = [(1+.085 x 365x2/360)/(1+.0825 x 365/360)-1]x360/365 = **.080746.**
                 df = (1 + .085 x 365x2/360) = **1.17236.**

d1 = -.648347 $\Rightarrow$ N(d1) = **.25838**
d2 = -.798347 $\Rightarrow$ N(d2) = **.21233**
call = 1/(**1.17236**) x [**8.0746** x (**.25838**) – 9 x (**.21233**)] = **.149531**

Value = **.149531**/100 x 365/360 x USD 10,000,000 = **USD 15,160.803**

Option #2:   f = [(1+.0875 x 365x3/360)/(1+.085 x 365x2/360)-1]x360/365 = .07890.
                 df = (1 + .0875 x 365x3/360) = 1.26615.

d1 = -.51440 $\Rightarrow$ N(d1) = .303486
d2 = -.72653 $\Rightarrow$ N(d2) = .233756
call = 1/(1.26615) x [7.89 x (.303486) – 9 x (.233756)] = .22961

Value = .22961/100 x 365/360 x USD 10,000,000 = **USD 23,279.703**

Value of cap = Value option #1 + Value option #2 = **USD 15,160.803** + **USD 23,279.703** = **U**SD 38,440.51

2. (CHAPTER XIII). Consider the two deliverable French government bonds (BTNs) in Table 1. You want to determine on July 1, 1999, the cheapest to deliver BTN against the Sep.1, 1999 MATIF's BTN futures contract. Assume a 7% short rate.

TABLE 1

Maturity	Coupon	cf	Future	Sept. Price	bpv
Sep. 15, 2008	9%	1.3625	93'08	126'05	.051
Mar. 15, 2009	8%	1.1837	93'08	109'01	.092

B.- Now, consider a French issued Eurobond with a basis point value of .240. What is the number of LIFFE's BTN futures contracts needed to hedge EUR 40,000,000 in face value of the Eurobond on July 1, 1999?

ANSWER:

P+A1   F+A2'   C
├──────────────────────────────────┼──────────────────────────────────┤
0   T$_2$=62
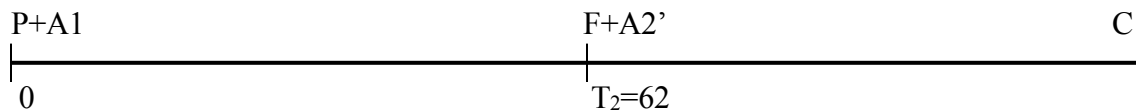
• Sep 15, 2008
Coupon = .09   (It's a French bond, annual coupon payments. See Table IX.E)
A1 = .09 x 288/365 x 100 = 7.10137   (Day count actual/365. See Table IX.E)
A2'(accrued interest from 7/1 to 9/1) = .09 x 62/365 x 100 = 1.52877

F = (126.1563 + 7.10137) (1+.07x62/360) – 1.52877 = 133.3354 (No coupon payment from 7/1 (t=0) to 9/1.)

I = Z x cf = 93.25 x 1.3625 = 127.0531.
BAC = F – I = 133.3354 – 127.0531 = 6.2823

• Mar 15, 2009
Coupon = .08
A1 = .08 x 107/365 x 100 = 2.34521
A2'(accrued interest from 7/1 to 9/1) = .08 x 62/365 x 100 = 1.35891

F = (109.0313 + 2.34521) (1+.07x62/360) – 1.35891 = 112.3348

I = Z x cf = 93.25 x 1.1837 = 110.380025
BAC = F – I = 112.3348 – 110.380025 = 2.0575. (Cheapest to Deliver!)

B.-
hedge ratio = -(bpv$_{bond}$/bpv$_{CDB}$)xcf = -(.240/.092) x 1.1837 = -3.0879

Number of contracts = EUR 40,000,000 x –3.0879/EUR 100,000 = -1235.16 contracts.

That is, I need to short 1,235 contracts.

3. (CHAPTER XV) Consider a nine-month interest rate floor of 6% on 3 mo. LIBOR. The floor amount is $10 million. The floor trades on August 27 for effect on September 1. Assume v=.10. At the time the floor is purchased, offered rates on time deposit are:

Period	Offered Rate
3 month	6.05
6 month	6.30
9 month	6.65

Value the floor.

ANSWER:

Option #1: : f = [(1+.0630 x 181/360)/(1+.0605 x 91/360)-1]x360/90 = 6.4541

df = (1 + .0630 x 181/360) = 1.03167

d1 = 1.48601 ⟹ N(d1) = .93136
d2 = 1.43608 ⟹ N(d2) = .92451
call = 1/(1.030167) x [6.4541 x (.93136) – 6 x (.92451)] = 0.44971
put = call + 1/df x (X – f) = .0096383
Value = .0096383/100 x 90/360 x USD 20,000,000 = USD 481.92

Option #2: f = [(1+.0665 x 272/360)/(1+.0630 x 181/360)-1]x360/90 = 7.1206

df = (1 + .0665 x 272/360) = 1.05024

d1 = 2.4668 ⟹ N(d1) = .99318
d2 = 2.3964 ⟹ N(d2) = .99172
call = 1/(1.05024) x [7.1206 x (.99318) – 6 x (.99172)] = 1.06806
put = call + 1/df x (X – f) = .0010829
Value = .0010829/100 x 91/360 x USD 20,000,000 = USD 54.75

Value of floor = Value option #1 + Value option #2 = USD 536.67

4. (CHAPTER XV) On November 5, a swap dealer wants to price a one-year fixed-for-floating interest rate swap against the 3-month LIBOR, that starts on March 97. The fixed rate will be paid semiannually and is quoted bond basis. Find the swap coupon rate. Get the appropriate rates from the attached WSJ clip.

ANSWER:

	Price	Implied LIBOR	#days covered
Mar 97	94.64	5.36	92
Jun	94.69	5.31	92
Sep	94.64	5.36	91
Dec	94.49	5.51	91

(1) Swap is 12-mo. Then, n=4. Need to calculate Implied 1-yr LIBOR

$f_{0,12} = [(1+.0536 \times (92/360)) \times (1+.0531 \times (92/360)) \times (1+.0536 \times (91/360)) \times (1+.0551 \times (91/360))]^{360/366} - 1$
    $= .0549373$ (money market basis).

(2) Converts this money market rate to its effective equivalent.

$FRE_{0,12} = .0549373 \times (365/360) = .055703.$ (bond basis)

(3) K=2 (semiannual payments) equivalent semi-annual bond basis.

$SC = [(1.055703)^{1/2} - 1] \times 2 = .054948$ (semi-annual bond basis)

Therefore the swap coupon mid-rate is 5.50%. ¶

5. (CHAPTER XIII) Platini Co., one of the largest French perfume manufacturers in the world, wants to refinance debt amounting to GBP 100 million. An investment bank suggests issuing a straight bond with equity warrants attached. The investment bank has the following data available:

GBP gilts yields:	2-year 4.99 (s.a.);	3-year 5.75 (s.a.)
FRF government bond yield:	1-year 6.5% (p.a.)	
Platini GBP-Eurobond yield:	GBP gilts + 90 bps	
Current Platini's share price (P_0): FRF 75		
Historic dividend yield:	3.00%	
Historic stock price volatility:	2-year 15.50%;	3 year 17.00%.
Outstanding warrants		
Outstanding life:	2½ years	
Current price (W_0):	FRF 7.40 (GBP 0.73)	
Exercise price (X):	FRF 90	
Current exchange rate:	10.10 FRF/GBP (.099 GBP/FRF).	

Given the current tight market conditions, the investment bank suggests:

1. For the warrants: an equity content of 100%, an *exercise ratio* equal to 1, and a 3-year warrant (X=FRF 85).
2. For the bond: a 2-year full-coupon bond, denominations of GBP 5,000, and an issue price of 100%.

Total commissions are 2%. Due to competitive pressures, the investment bank decides to forgo 1% of the selling concession.

The investment bank also assumes a conversion exchange rate based on the current exchange rate.

Following usual market practices:

i.-   Write down the following generic terms for the issue:

Amount of equity raised:	GBP 100,000,000 x 1 x 10.10 FRF/GBP= FRF 1,010,000,000
Number of shares created on exercise:	FRF 1,010,000,000/FRF 85 = 11,882,353.
Number of warrants per bond:	11,882,353 x 1/20,000 = 594.11765
Value of the warrants attached to each bond of GBP 5,000:	594.11765 x FRF 12 = FRF 7,129.41 = GBP 705.81
	(705.81/5,000 = 14.12% of nominal amount of each bond)

ii.-   Calculate the information required below to complete the pro forma of Platini's issue:

1. The bond

Coupon:	5 7/16 (≈5.41%)
Yield:	5.95%
Issue price:	100 (but bonds are sold at 99)

2. The warrants

Price of warrant:	FRF 12
Exercise price:	FRF 85
Period of exercise:	3-yr
Exercise premium:	14.12
Global premium:	29.33 (=[85+12)/75])
Issue price (bond and warrants):	114.12 (100 + 14.12)
Cost of funds (based on total issue price less commissions):	-0.006 (negative!)

ANSWER:
- Pricing the new warrants:

      a) outstanding warrants' global premium: $GP = (90 + 7.40)/75 = 1.299 (\approx 30\%)$

      b) new warrants: theoretical price (Black-Scholes): FRF 11.25

                        GP-implied price: $W_{new} = 75 \times (1.30) - 85 = $ FRF 12.40

      $\Rightarrow$ Any price between 12.40 and 11.25 is fine. Say, we fix $W_{new} = $ FRF 12.

- Pricing the new bond:

      a) Convert s.a. yield on a p.a. yield: $(1+.0499/2)^2 - 1 = .0505$.

      YTM (p.a) = 5.05 + 0.90 = 5.95. $\Rightarrow$ coupon=5.95 (if bond sold at P=100).

      b) P=99, then coupon is reset at 5.41% or 5 7/16.

6. (Chapter LN XVII) Mr. Fleichman is an investor of foreign nationality who has an account with a small Luxembourg bank. He does not pay taxes on his account. He only cares about U.S. dollar returns. Table 1 contains information about his account for June 1998 and for June 1999. The Cicely Index Fund has a passive approach and tracks the FT-Actuaries World Index, which has risen 2.8% last year. You should answer the following question:

i.   What is the total return on his portfolio?
ii. What are the sources of this return, i.e., how much is capital appreciation, yield and currency movements?
iii. How good is the manager in selecting securities?
iv. Would you recommend Mr. Fleichman to change to the Cicely Index Fund?

ANSWER:

(i)   • USA $\quad$ $P_0 = 82,950$
$\qquad\qquad\qquad P_1 = 84,275 \quad \Rightarrow \quad p_{USA} = .0159740$
$\qquad\qquad\qquad D_1 = 5,260 \quad\;\; \Rightarrow \quad d_{USA} = .0634117 \qquad\qquad \Rightarrow r_{USA} = .0793852$
$\qquad\qquad\qquad s_{USA} = 0 \qquad\;\; \Rightarrow \quad c_{USA} = 0$

$\qquad$ • JAPAN $\quad$ $P_0 = 19,150,050$
$\qquad\qquad\qquad P_1 = 19,550,000 \Rightarrow \quad p_{JAP} = .02088770$
$\qquad\qquad\qquad D_1 = 0 \qquad\qquad \Rightarrow \quad d_{JAP} = 0 \qquad\qquad\qquad \Rightarrow r_{JAP} = -.06264$
$\qquad\qquad\qquad s_{JAP} = -0.08181 \Rightarrow \quad c_{USA} = -.0835217$

$\qquad$ • GERMANY $\quad$ $P_0 = 297,600$
$\qquad\qquad\qquad P_1 = 301,500 \quad \Rightarrow \quad p_{JAP} = .01310484$
$\qquad\qquad\qquad D_1 = 20,100 \quad\; \Rightarrow \quad d_{JAP} = .0675403 \qquad\qquad \Rightarrow r_{JAP} = -.127225$
$\qquad\qquad\qquad s_{JAP} = 0.04310 \quad \Rightarrow \quad c_{USA} = -.0465795$

$r = \Sigma_j \, \omega_j \, r_{jD} = \Sigma_j \, \omega_j \, (p_j + d_j + c_j) = .1779 \times (.0793852) + .4518 \times (-.06264) + .3702 \times (.27225) = .0329208$

(ii) $r = \;\; \Sigma_j \, \omega_j \, p_j + \Sigma_j \, \omega_j \, d_j + \Sigma_j \, \omega_j \, c_j = .017130 + .036284 + (-.020498) = .032921$

(iii) Security selection $= \Sigma_j \, \omega_j \, (p_j - I_j) = -.01272$

(iv) Yes, the Cicely Fund outperformed the World Index (3.28% > 2.80%). The security selection performance, however, was not very good. The success of the Cicely Fund was based on country selection.

Table 1

Account Valuation for Mr. Fleichman, June 1998.

Security	Number of securities or nominal	Market Price	Dividend	Total (USD)
Equity				
U.S.				17.79%
AT&T (USD)	1,000	50.250		50,250
GTE (USD)	500	30.000		15,000
NY Times (USD)	800	22.125		17,700
Japan				45.18%
Mitsubishi (JPY)	1,000	6,500		71,500
Sony (JPY)	2,200	5,750		139,150
Germany				33.59%
DBenz	(DEM)	3,000	90.00	156,600
Bonds				3.43%
Government 7%	30,000	92%		16,008
Total				466,208

JPY 1= USD .0110 US. Index = 100
DEM 1= USD .5800 Japan Index = 100
DEM Bond Index = 100 German Index = 100

Account Valuation for Mr. Fleichman, June 1999.

Security	Number of securities or nominal	Market Price	Dividend	Total (USD)
Equity				
U.S.				
AT&T (USD)	1,000	51.325	3.51	54,835
GTE (USD)	500	30.500	2.22	16,360
NY Times (USD)	800	22.125	0.80	18,340
Japan				
Mitsubishi (yen)	1,000	6,900		69,690
Sony (yen)	2,200	5,750		127,765
Germany				
DBenz (DEM)	3,000	91.00	6.00	176,055
Bonds				
Government 7%	30,000	95%	2,100	18,513
Total				481,558

JPY 1 = USD .0101 US. Index = 102
DEM 1 = USD .6050 Japan Index = 105
DM Bond Index = 101 German Index = 101