Sensorveiledning/Assessment Guidelines/Løsningsforslag

1) Forward Exchange Rate and Forward Premium or Discount

This exercise requires precision in how the exchange rate is represented, given the information on which country is 'home country' and given that indirect quotation is to be used. It also requires precision in stating the general formula for a forward rate, and for the forward premium or discount. Then of course correct numerical calculation is required. Furthermore it is important that all symbols that are used are defined, unless they are already defined in the exercise text.

a) $F_n^{£/\$} = S^{£/\$} \frac{[1+\left(i^{£} \frac{n}{360}\right)]}{[1+\left(i^{\$} \frac{n}{360}\right)]}$

b) Substituting numerical values we obtain $F_{180}^{£/\$}$ = £ 0.624/$

c) Here again precision is required and defining all symbols used, unless already defined in the exercise text. Given that Canada is the 'home country' and Indirect Quotation is to be used the general formula is

$$f^{£} = \left(\frac{Spot - Forward}{Forward}\right)\left(\frac{360}{n}\right) 100$$

d) Here it is a matter of (i) correct substitution and calculation and (ii) interpreting the results

Numerical substitutions lead to $f^{£} = -7.69$

In the interpretation it would be best if students know the conventional phrasing: UK£ selling (180) forward at a discount of 7.69 …» and also say something that indicates that they know that this means that the markets expect UK£ to decline in value relative to CA$.

2) Purchasing Power Parity and Exchange Rate Pass-Through

This exercise requires a demonstration of understanding of concepts, the use of those concepts in analysis, accurate calculation and interpretation of results

a) Here students should correctly handle the exchange rate according to the specifications given in the exercise text and represent it as Yen/USD, and divide the Yen price by the spot exchange rate.

$$\frac{Yen\ \ 4\,000\,000}{Yen\ 120.00/USD} = \boldsymbol{USD\ 33\,333}$$

b) There are a number of ways to arrive at the result and they should be accepted as long as they do not contain errors.

USA: Expected 2% annual inflation rate during the time period under consideration.

Japan: Expected 0% annual inflation rate during the time period under consideration. (No price change).

The PPP-implied exchange rate is

$\frac{Y120/USD}{1.04}$ = **Yen 115.38462/USD.** **(**So Yen is expected to rise in value relative to USD, as predicted by, for example, the International Fisher Effect.)

c) Here students should demonstrate an understanding about what price and what exchange rate to use and whether to divide or multiply by the exchange rate. Here again there are several paths to arrive at the answer. Here is one:

100% exchange rate pass-through means that Purchasing Power Parity (PPP) holds. So the relevant exchange rate is the PPP-implie exchange rate, which we computed in an earlier sub-question.

We have $P^{\$}_{\text{one year later}} = P^{Yen}_{\text{one yearlater}}$ divided by the implied PPP exchange rate.

Note that $P^{Yen}_{\text{one yearlater}}$ is the same as the original Yen price because Japan has 0% inflation rate.

So we have: $P^{\$}_{\text{one year later}}$ = Yen 4 000 000 divided by Yen 115.38462/USD = **USD 34 667**

d) Here we consider 60% pass-throuh. Again there are several paths to arrive at the answer. Here is one:

Let x denote the percent change in price in USA and consider the following equation:

x/0.04 = 0.6, where 0.04 represents the inflation rate in USA over the relevant 1 year period and 0.6 represents 60% exchange rate pass-through.

So we have x = (0.6)(0.04) = 0.024.

x = 2.4%. This is the percent change of the US price within the one year of observation with 60% exchange rate pass-through.

To calculate what under these conditions is the USD price at the end of the one year period under consideration:

(USD 33 333)(1.024) = **USD 34 133** US price with 60% pass-through.

e) This sub-questions required interpretation. The more perspectives are explained clearly, the better.
Among the explanatory angles are:
The per unit revenue clearly declines when we move from 100% exchange rate pass-through to 60% pass-through: The per unit price with 60 percent pass-through is USD 34 113, while with 100% pass-through it is USD 34 667, a decline in per-unit-sold revenue of USD 34 667 – USD 34 113 = USD 554.

However the company's revenue also depends on how many units are sold, as we have:

Profit = (Price per unit sold)(Number of units sold).

It is likely that reducing exchange rate pass-through from 100% to 60% is meant to mitigate the negative impact (downward sloping demand curve) of a higher local price in USD, while car exporters from other countries, and US-produce car manufacturers may not raise their prices. So this is a market-share consideration together with a 'price-elasticity-of-demand' type of consideration

Other considerations may be that the exchange rate development that prompt an only partial exchange rate pass-though also cause potential component imports from the USA to become cheaper. So that Toyota maybe reduces its cost of production, and thus can afford a lower sales price.

(Price per unit sold)(Number of units sold) – (Per unit cost of production)(Number of units produced).

Other things equal, if the left term equals the right term, profit would stay the same in spite of only 60% pass-through. (It should be kept in mind, though, that the sub-question asks about impact on revenue – not profit.)

3) Investment Alternatives

This exercise requires correct application of exchange rates and interest rates, and a demonstrated understanding of the concept of Interest Rate Parity.

Note that interest rates are not 'per annum' but are given already adjusted for the 90-day period

a) Alternative 1: The relevant interest rate is 2% per 90 days.

(€ 10 000 000)(1.02) = **€10 200 000** Principal and interest at the end of 90 days. **€200 000** in earnings.

Alternative 2: The relevant interest rate is 10% per 90 days. At the beginning of the 90-day period the spot exchange rate is €1.50/ £ and the 90-day forward exchange rate is €1.01/£.

Step 1: Convert euros into pound sterling at the spot rate. $\frac{€\ 10\ 000\ 000}{€1.50/£} = £6\ 666\ 667.$

Step 2: Invest in the £- money market for 90 days at an interest rate of 10%.

(£ 6 666 667)(1.10) = £ 7 333 334 principal plus interest after investing for 90 days in the £-money market.

Step 3: Convert principal plus interest back into euros at the forward rate.

$\left(£\ 7\ 333\ 334\right)\left(\frac{€1.01}{£}\right) = €\ \mathbf{7\ 406\ 667.}$ This investment leads to a loss of € 2 593 333 due to the severe decline in the pound sterling.

So, clearly, investing in the €-money market is the superior strategy for this investor.

Of course, these three steps can be collapsed into one.

b) This is an extreme case of Interest Rate Parity NOT holding, with a large opportunity for arbitrage. A complete answer consists of an explanation of the concept of interest rate parity and a demonstration of why in this case IRP is not satisfied.

4) Option Profit Diagram

The solution requires an understanding of the profit diagram. In particular it requires an understanding that the profit diagram of the seller is dependent on decisions that are made by the buyer of a put option. It is important that, if students use symbols, they must define the meaning of all the symbols that they use, unless that is already given in the exercise text.

a) Profit diagram for the seller of a put opion.

b) The horizontal axis measures the spot price of the underlying asset.

c) The vertical axis measures the profit to the seller of the put option, measured in some currency or in 'points'.

d) $-(E - S_T)$ + Premium, or, equivalently, $S_T - E$ + Premium, where E denotes the exercise price (contract price) and S_T denotes the Spot price at time T, with T denoting the expiration date of the option.

e) The rising part of the profit diagram is valid for the case that the buyer chooses to exercise the option. This means that the buyer has an advantage from exercising the option. So, the seller has a disadvantage for the corresponding values of the spot price (measured on the horizontal axis). On the rising part of the profit graph we have $S_T \leq E$.

The horizontal part of the profit graph is valid for the case that the buyer chooses to NOT exercise the option, because it would be financially damaging to do so. This means the buyer's losses are limited to losing the premium, which in our case is 4000 currency units – which is what the seller collects as profit. This is the maximum profit that the seller can get. On the horizontal part of the profit graph we have $E \leq S_T$.

f) B is the relevant point. Point B has the same value, measured on the horizontal axis, as point C. Point C is the 'kink' point, where the rising portion of the profit graph turns into the horizontal portion. The terms "In the money" and "Out of the money" refer to the buyer's perspective of when it is advantageous to exercise the option, and when not.

For $S_T < B$ we have $S_T < E$ and the option is 'in the money'.

For $S_T > B$ we have $S_T > E$ and the option is 'out of the money'.

g) Profit function: $-(E - S_T)$ + Premium, or, equivalently, $S_T - E$ + Premium, where the premium has value 4000.

So we need numbers for S_T and for E, such that

$0 < S_T - E + 4000 < 4000$. So $(S_T - E)$ needs to be negative but not too large a negative number,

$-4000 < S_T - E < 0$

For example, E = 20 000 and S_T = 18 000 would work.

$S_T - E + 4000$ then becomes: 18 000 – 20 000 + 4000 = **2000**