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International Finance

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Solutions

1. This question relates to the following learning objectives; describe the types of risks that foreign exchange traders face and how these risks can be managed (Question (a)); describe the relationships between put prices, call prices and forward rates and be able to apply the put-call-forward parity formula; calculate both the unhedged and the hedged return on foreign currency bonds and equities (Question (b)); describe how the foreign exchange market is organized and how trades take place in the interbank and the retail segments of the market (Question (c)); graph the payoffs of a futures contract as a function of the price of the underlying asset, graph similar payoff profiles or combinations of futures contracts, and be able to show how futures contracts can be used to hedge an open risky position (Question (d)).

   (a) True! The variance of the return on a portfolio with 2 risky assets and when the covariance is zero is given by $\sigma^2 = x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2$ where $x_2 = 1 - x_1$. If we assume that $\sigma_1^2 = \sigma_2^2$ we have $\sigma^2 = \sigma_1^2(x_1^2 + (1 - x_1)^2)$. We can then conclude that $x_1^2 + (1 - x_1)^2 < 1$ unless $x_1 = 1$ or 0. it makes sense to diversify even in this situation.

   (b) False! Selling a put option gives the buyer of the put option the right to sell the underlying asset to the writer in the future. This is an example of a naked or uncovered put which represents potentially unlimited risk.

   (c) False! Order flows have no immediate effect on quotes if these order flows contain private information. But if the order flows are public knowledge to all dealers, then there will be an effect. Private information is transmitted from customers to dealers and then dealers use this private information to trade in the interdealer market creating order flows between dealers which will transmit and make private

information public to all dealers (information aggregation). There is also the possibility that dealers initiate sell or buy orders when the spot rate reaches a certain limit, so called feedback trading, such that there is a causal link from quotes to order flows.

(d) True! Marking to market means that profits and losses are paid every day at the end of trading and is equivalent to closing out a contract every day, paying off losses or receiving gains and writing a new contract.

2. This question focuses on central bank intervention and relates mainly to the learning objective "describe the channels by which central bank intervention can affect the exchange rate and summarize the empirical evidence on these channels".

(a) First of all it is important to distinguish between non–sterilized and sterilized official intervention. A non–sterilized official intervention is when the monetary authorities buy or sell foreign exchange such that the monetary base is affected whereas a sterilized official intervention is when the monetary authorities buy or sell foreign exchange and sterilize the effects on the monetary base by simultaneously sell or buy domestic bonds. There is a consensus in the literature that non–sterilized official intervention will, through its effect on the monetary base, affect the exchange rate and the interest rate. However, there is a controversy concerning the effects of sterilized official intervention. There are two possible channels through which sterilized interventions may affect exchange rates, the portfolio balance channel or the signalling channel.

The portfolio balance channel: This channel is based on the portfolio balance model where domestic and foreign assets are not perfect substitutes. Investors diversify their portfolios holding both domestic and foreign currency assets. Official sterilized intervention is carried out as a foreign exchange operation (buy or sell foreign bonds) where the effects on the monetary base is sterilized by an open market operation (sell of buy domestic bonds) such that the monetary base is unchanged. In other words, there is a swap of foreign bonds for domestic bonds (or the opposite) in the portfolios held by the central bank and the households.

The signalling channel: According to this approach, official intervention serves as a signal of future monetary policy by providing the foreign exchange market with new relevant information. It is assumed that the current exchange rate is a function of current and discounted expected future fundamentals. An intervention on the foreign exchange market sends a signal to the market participants about future fundamentals. If future fundamentals change, the current exchange rate will also change. Sterilized interventions affect expectations about future movements

in the relative money supply, income and interest rates with a feedback effect on the exchange rate. This effect also occurs in the standard monetary models, where foreign and domestic bonds are perfect substitutes. An underlying assumption is that the monetary authority has superior information and that they can reveal this information to the market by intervening on the foreign exchange market.

Empirical evidence on the portfolio balance channel: Tests of the portfolio balance approach to official intervention are usually based on tests of the portfolio balance model or tests of the assumption of perfect substitutability. Empirical results suggest that there is only weak evidence supporting the portfolio balance channel. One example, which is included in the curriculum, is the paper by Dominguez and Frankel where they find that domestic and foreign bonds are not perfect substitutes and that official intervention indeed affects the exchange rate.In addition they find that the volatility of exchange rates also affects the exchange rate and the risk premium leading to their conclusion that the portfolio balance channel cannot be rejected.

Empirical evidence on the signalling channel: One approach to test this channel is to test whether there is a high and positive correlation between official intervention and future monetary policy. In other words, if the signalling channel works then official intervention should give a signal of future changes in monetary policy. The main conclusion from the literature is that the signalling channel cannot be rejected. One approach in the literature is to test whether official intervention affect expectations about future exchange rates. This hypothesis cannot be rejected. In one interesting study by Dominguez and Frankel, also included in the curriculum, they distinguish between reported intervention and announcements of the Federal Reserve in support or against the US dollar. Their results suggest that the signalling channel cannot be rejected. Other papers often find similar results but results are dependent on sample periods, methods and data. There are more empirical evidence supporting the signalling approach than the portfolio balance approach.

(b) The aim of monetary policy in Denmark is to ensure that the krone remains stable vis-à-vis the euro. Nationalbanken (the Danish Central Bank) is responsible for monetary policy whereas the government conducts its fiscal policy and economic policy in general so as to achieve stable economic development and in accordance with the fixed exchange rate. Danmarks Nationalbank can influence the krone rate by adjusting its monetary–policy interest rates and/or by intervening on the foreign exchange market. These two policy measures are seen as substitutes. In order to support the value of the krone Nationalbanken sells foreign currency and

buys kroner. As a result the krone will have a tendency to strengthen. Whether or not interventions are sterilized depends on market conditions. If the currency market is stable, then interventions are sterilized whereas if the market is turbulent then interventions are non–sterilized.

(c) Secret interventions can be defined as "Foreign exchange operations that are not disclosed to the market participants (at least not contemporaneously)". The main question in this context is whether it is possible to keep interventions secret. It is argued in the literature that the central bank can decide not to reveal that they have intervened and that there are ways for the central bank to hide interventions from foreign exchange brokers. Central bank trading can be mistakenly viewed as private trades by traders. The trend among central banks is to adopt more transparent policies but Bank of Japan still relies on secret interventions.

Comparing to the two main approaches to central bank interventions discussed in (a) above, we can conclude that if interventions are secret, then there is no signal to the market that could change market expectations, in other words, the signalling channel breaks down. This implies that central bankers disregards the signalling channel and relies on the portfolio channel. But this implication is not supported by empirical evidence. According to a recent central bank survey, most central banks agree that intervention affects exchange rates through the signalling channel, not the portfolio balance channel. They also regard consistency of policies and reputation as important. At the same time they are neutral or agree with the three arguments presented above on the reasons for keeping an intervention secret.

There are three main arguments as to why a central bank would prefer to intervene in secrecy:

- to minimize the effects of an unwanted intervention operation (the decision to intervene is taken outside the central bank or is considered inconsistent with other macroeconomic policies, for both these reasons it may be optimal for the central bank to intervene in secrecy, the reputation of the central bank could be affected otherwise),

- perceived risk and volatility in the foreign exchange market (if the market is turbulent it may be risky for the central bank to announce its intentions in particular when its reputation is not very strong),

- and a portfolio adjustment argument (it may be the case that the central bank only want to adjust its foreign exchange portfolio in order to acquire reserves needed in future interventions, not to move the exchange rate in a

particular direction).

It is often argued that only the second argument is valid. Central banks in industrial countries are relatively independent which makes it less likely that they have to carry out inconsistent interventions. The last argument may not be very likely to be used as arguments for secret interventions either. It cannot explain why there are so many secret interventions. Therefore, only the second argument seems valid.

Empirical evidence: Recent empirical evidence suggests that, (i) the proportion of secret interventions is much lower for coordinated operations than for unilateral interventions, and (ii) there is an increased frequency of secret operations in the foreign exchange market, in particular on the YEN–USD market. The empirical analysis in the paper by Beine and Bernal, included in the curriculum, study the motives for using secret interventions and the intervention policies of the Bank of Japan which is the most active central bank in the foreign exchange market. They find a large proportion of secret interventions. They find that interventions larger than an annual average level, coordinated interventions and if the central bank intervenes over a number of trading days are likely to be detected by traders. Such interventions cannot be kept secret. They also find that if past interventions have been successful then a secret intervention is less likely. The results also suggest that the central bank decides to intervene secretly if the intervention is inconsistent with reducing the misalignment. However, a surprising result is that the central bank relies less on secret interventions if previous interventions were not successful, the opposite to what can be expected.

3. This question focuses on hedging using options and forwards and relates to the learning objectives; calculate both the unhedged and the hedged return on foreign currency bonds and equities;, "graph the payoffs of a futures contract as a function of the price of the underlying asset, graph similar payoff profiles or combinations of futures contracts, and be able to show how futures contracts can be used to hedge an open risky position", and "show that a simple option can be replicated by borrowing/lending and holding of a fractional position in the underlying asset and that this replicating portfolio can be used to construct an option, price an option and hedge an option position".

(a) The Danish importer has to pay SEK next month and considers two alternative hedging strategies, buy a call option or buy a forward contract. A third alternative is to leave the position unhedged. In the question it is said that the strike price of the option is equal to the forward exchange rate. The graph below shows the

costs in DKK of these three alternatives. In the graph B is the strike price which is equal to the forward exchange rate.
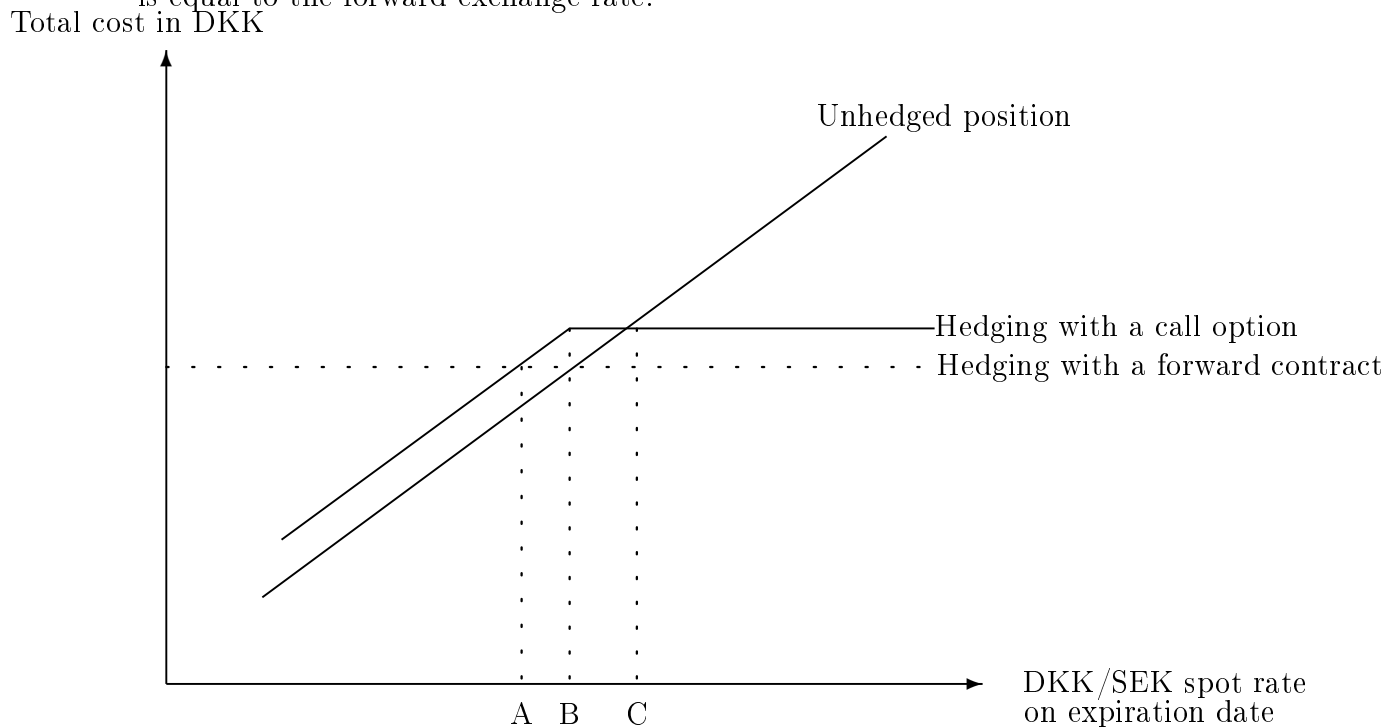
Total cost in DKK

What are the advantages/disadvantages of the two hedging strategies? For a forward contract, the cost is constant. Hedging with a call option: More expensive than forward hedging, the importer has to pay a premium and the total cost is equal to the premium plus the strike price. This cost always exceeds the cost of a forward contract if the exchange rate depreciates. The advantage is that the cost is limited when using a call option compared to an unhedged position. If the exchange rate falls (the DKK appreciates) then hedging using options is better than using forwards, but it is optimal to be unhedged.

(b) Distinguish between the following three scenarios: (i) when the value of SEK is expected to rise, (ii) when the value of the SEK is expected to fall, and (iii) when there is an expected movement up or down in the value of the SEK but there is also a high probability of a move in the opposite direction.

If (i) is most likely, i.e., when the exchange rate is expected to increase (a depreciation) then a forward hedge is optimal. If (ii) is most likely, i.e., the exchange rate falls (appreciates) then it is optimal to be unhedged. Finally, if (iii) is most likely then hedging using an option may be optimal since costs are limited if there is a sharp increase in the spot rate. If the spot rate falls, some of the benefits are captured even though an unhedged position reduces cost even more. We also note that if the exchange rate does not move outside the range AC, then it is not

optimal to use options to hedge. hedging using options is optimal when there is considerable uncertainty, i.e., when large swings in the spot rate are likely.

(c) To derive the Put–Call Parity Condition we apply the concept of replicating portfolios. Buy a call option and sell a put option at the same strike price is the same as a long forward position (agree to buy currency forward). The payoff is illustrated in the following graph:
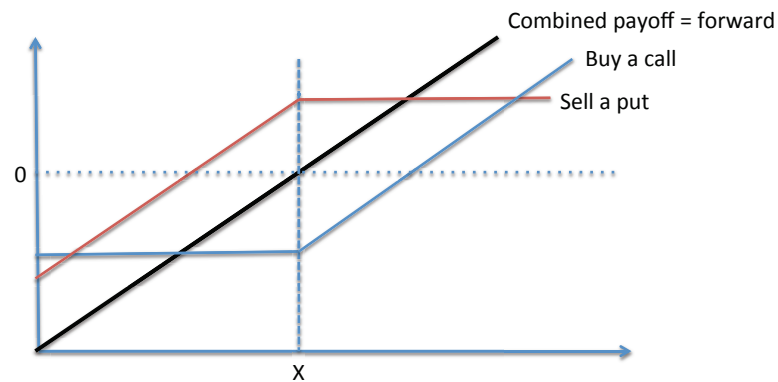
Next, we write down the cash flows periods 1 and 2.

	Cash flow period 1	Cash flow period 2	
		$S_2 \leq K$	$S_2 \geq K$
Option portfolio			
Buy a call	$-C$	0	$S_2 - K$
Sell a put	P	$S_2 - K$	0
Total	$P - C$	$S_2 - K$	$S_2 - K$
Forward contract			
Borrow home currency	Ke^{-r_d}	$-K$	$-K$
(PV of strike price in period 2)			
Buy spot and invest abroad	$-S_1 e^{-r_f}$	S_2	S_2
Total	$Ke^{-r_d} - S_1 e^{-r_f}$	$S_2 - K$	$S_2 - K$

For arbitrage reasons, the same return must be priced equally. We must pay the same price to obtain period 2 cash flows. This implies that

$$P - C = Ke^{-r_d} - S_1 e^{-r_f}$$

which is the Put-Call parity. We also know that UIP implies that

$$F_{1,T} = S_1 e^{(r_d - r_f)T}$$

which can be inserted into the Put–Call parity

$$P - C = \frac{K - F_{1,T}}{e^{r_d T}}$$

which is the Put–Call–Forward parity.

Buying a call option is equal to buying a put option and a forward contract. Buying a put option is equal to buying a call option and selling a forward contract.