Mid-Term Exam: Practice Set and Solutions

What to do this practice exam.

Students had 75 minutes to answer questions 1 to 6. There was 1 bonus to be gained in the toughest question (5 points). When asked to "argue briefly", students were expected to answer in no more than 10 lines but in no fewer than 3.

Students were not allowed to collaborate with any other person while taking the exam. It was closed book, but each student was allowed to bring in a calculator and one A4 sheet. One side of the sheet could contain anything the student wished, but had to be handwritten by him/her (no photocopying).

Good luck in prepping for your own MT!
Question 1. (7.5 points)

The spot rate on the Canadian Dollar is currently $0.7245-50 / 1C$.

a. (2 points) What is the bid price of the Canadian dollar in European terms?

b. (1.5 points) Calculate the spot percentage bid-asked spread.

c. (2 points) Suppose the 180-day forward rate is $0.7350-60/1C$. Can you explain the difference between the percentage spot and forward bid-ask spreads?

d. (2 points) Compute the forward “swap rate” in points and the (annualized) percentage premium or discount at which the CAD is trading against the USD.
Question 2. (10 points)

In 2007, the 6-month interest rate in the US was about 5.25% and expected inflation about 2.5%. Meanwhile, the equivalent interest rate in Japan was 0.5%, and inflation about -0.5% (deflation). All rates are annualized.

**a.** Intuitively, should the $ have been trading at a forward discount or premium against the Yen? What assumptions did you use to answer the question? Explain briefly.

(Hint: do you need all the information provided?)

**b.** Formally compute the annualized forward discount or premium at which the $ will sell against the Yen.
**Question 3. (7.5 points + 5 bonus points)**

You are a financial adviser to Toyota Motor Company. Toyota *must* sell 10,000,000 SF in exchange for Yen for delivery in 90 days.

You are given the following spot exchange rates:

- SF in Zürich : 1.2502-05 SF / $1
- ¥ in NY : 100.50-55 ¥ / 1$

Suppose that the annualized 3-month interest rates available to Toyota are:

- for SF deposits or loans : 2.125%-2.25%
- for $ deposits or loans : 1%-1.125%
- for ¥ deposits or loans : 0.06125%-0.125%

At the same time, a bank in Tokyo is quoting the following 90-day forward cross rate:

80.85-90 ¥/ 1SF

**a. (7.5 points)** Would you recommend that Toyota trade with this Japanese bank? Explain intuitively.

**b. (2.5 points + 5 bonus points)** Would you recommend that Toyota trade with this Japanese bank? Explain formally.

(Hint: What is Toyota’s alternative to trading with the banker? Can Toyota construct a “synthetic forward” by borrowing and lending?)
Question 3. (additional space)
**Question 4. (5 points)**

ABB, a Swiss company, wants to purchase telecom equipment from Nihon T&T, a Japanese company. Nihon T&T quote a price of 75,000,000 SF to be paid in 2 equal semi-annual SF installments of 37,500,000 SF, beginning 6 months from now. Nihon T&T quotes an alternative price of ¥5 billion to be paid also in 2 equal semi-annual ¥ installments of ¥2.5 billion, beginning 6 months from now. Suppose that ABB can trade at the following spot or forward rates (#SF/1¥):

<table>
<thead>
<tr>
<th></th>
<th>90 days</th>
<th>180 days</th>
<th>270 days</th>
<th>360 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>spot</td>
<td>0.0150</td>
<td>0.0149</td>
<td>0.0148</td>
<td>0.0147</td>
</tr>
</tbody>
</table>

Assuming ABB cares about the all-in cost in Swiss Francs, do you have enough information to tell which quote should ABB pick? (Hint: compare apples to apples).
Question 5. (5 points)

Suppose that, at the open of the CME on 10-08-09 (today), you went short a single March-2010 Euro futures contract (notional: 125,000 Euros). The agreed upon price (i.e., the futures rate) was 1.46$/€.

At the trading close today, the March futures price has fallen to 1.45$/€, and you decide to keep your short position open.

Under marking to market, what happens to you at the end of the day if the initial and maintenance margins are the same? **Choose one of the possibilities below and explain briefly:**

1. there is no cash flow, and you hold a futures position that has now risen in value by $1,250
2. there is no cash flow, and you hold a futures position that has fallen in value by $625
3. you receive $1,250 from the long party
4. you receive $1,250 and a new futures contract priced at $1.45 (in replacement of the original futures contract with a price of $1.46)
5. you must pay over $1,250 to the long party in the futures contract
6. you must pay $1,250 and receive a new futures contract priced at $1.45 (in replacement of the old futures)
7. none of the above
**Question 6. (5 points)**

In 2002, the U.S. government significantly decreased personal taxes on dividend income. What would you expect the consequences of this tax cut on the U.S. current account balance to have been? Explain briefly.
Mid-Term Exam Practice Set: Solutions

Question 1. (7.5 points)

The spot rate on the Canadian Dollar is currently $0.7245-50 / 1C$.

a. (2 points) What is the bid price of the Canadian dollar in European terms?

Answer

The quote provided is in American terms, and the asked USD price of the CAD is $0.7250. The bid price of the Canadian dollar in European terms is therefore 1/0.7250 CAD/USD.

b. (1.5 points) Calculate the spot percentage bid-asked spread.

Answer

The bid-ask spread is: (0.7250-0.7245)/0.7250 = 0.069%

c. (2 points) Suppose the 180-day forward rate is $0.7360-60/1C$. Can you explain the difference between the percentage spot and forward bid-ask spreads?

Answer

The spot bid-ask spread is quoted as 5 points ("pips"), while the forward bid-ask spread is twice as much (10 points or "pips"). Percentage-wise, the ratio is similar. The difference is likely due to risk, in particular differences in the liquidity of the markets for spot vs. 6-month-out delivery.

d. (2 points) Compute the forward “swap rate” in points and the (annualized) percentage premium or discount at which the CAD is trading against the USD.

Answer

Without loss of generality, let us focus on the offered (i.e., ask) rates. Note that we would get qualitatively similar answers with the mid-point and the bid rate.

<table>
<thead>
<tr>
<th>Outright rate</th>
<th>swap rate (in “points”)</th>
<th>annualized fwd premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>spot</td>
<td>0.7250</td>
<td></td>
</tr>
<tr>
<td>180-day fwd</td>
<td>0.7360</td>
<td>+110</td>
</tr>
</tbody>
</table>
**Question 2. (10 points)**

In 2007, the 6-month interest rate in the US was about 5.25% and expected inflation about 2.5%. Meanwhile, the equivalent interest rate in Japan was 0.5%, and inflation about -0.5% (deflation). All rates are annualized.

**a.** Intuitively, should the $ have been trading at a forward discount or premium against the Yen? What assumptions did you use to answer the question? Explain briefly.

(Hint: do you need all the information provided?)

**Answer**

The inflation information is irrelevant: from covered interest rate parity, we know that the $ should sell at a discount against the ¥ roughly equal to the interest rate differential between the US and Japan. Put differently, given that the forex market is efficient, then the $ in 2007 should have been trading at a forward discount in order to offset the higher interest rate in the US.

**b.** Formally compute the annualized forward discount or premium at which the $ will sell against the Yen.

**Answer**

Formally, let $s_t$ and $f_{t,T}$ denote, respectively, the spot and 6-month forward rates in American terms ($\#$/1¥). Then the forward premium at which the ¥ should trade should be equal to:

\[
\frac{f_{t,T} - s_t}{s_t} = \left( i - i^* \right) \frac{T}{360} \frac{1}{1 + i^* \frac{T}{360}} = \frac{5.25\% - 0.5\%}{1 + 0.5\% \frac{180}{360}} = 2.37\%
\]

The formula can be rewritten to yield the forward discount at which the $ should be trading against the ¥:

\[
\frac{1}{f_{t,T}} - \frac{1}{s_t} = \left( i^* - i \right) \frac{T}{360} \frac{1}{1 + i \frac{T}{360}} = \frac{0.5\% - 5.25\%}{1 + 5.25\% \frac{180}{360}} = -2.31\%
\]

That is, the dollar should be at a 2.31% 6-month forward discount against the ¥. On an annualized basis, we should have the dollar trading at a 4.62% 6-month forward discount.
Question 3. (7.5 points + 5 bonus points)

You are a financial adviser to Toyota Motor Company. Toyota must sell 10,000,000 SF in exchange for Yen for delivery in 90 days.

You are given the following spot exchange rates: SF in Zürich: 1.2502-05 SF / $1

¥ in NY: 100.50-55 ¥ / 1$ 

Suppose that the annualized 3-month interest rates available to Toyota are:

for SF deposits or loans: 2.125%-2.25%
for $ deposits or loans: 1%-1.125%
for ¥ deposits or loans: 0.06125%-0.125%

At the same time, a bank in Tokyo is quoting the following 90-day forward cross rate: 80.85-90 ¥/1SF

a. (7.5 points) Would you recommend that Toyota trade with this Japanese bank? Explain intuitively.

Answer

Intuitively, Toyota is trying sell the SF for the highest number of Yen it can get in 90 days. Given this objective, it is clear that Toyota should sell the SF at the forward price proposed by the Japanese bank.

To see this intuitively, notice that the cross spot rate is approximately 80 Yen per Swiss franc (100/1.25). The 90-day forward is approximately 1% higher (80.80 vs. 80), i.e., the Swiss franc is being quoted by the Japanese bank at a 1% forward premium to the Yen.

Looking at interest rates, though, the franc should be trading (and should be quoted) at a discount (rather than a premium) of about 0.5% (about 2% divided by 4).

The answer is thus clear: the Swiss franc is being quoted forward by the Japanese bank at a rate that is too high, relative to what it should be – since Toyota is selling the SF, it should lock in the highest Yen price and trade with the Japanese bank.

b. (2.5 points + 5 bonus points) Would you recommend that Toyota trade with this Japanese bank? Explain formally ().

(Hint: What is Toyota’s alternative to trading with the banker? Can Toyota construct a “synthetic forward” by borrowing and lending?)

Answer

To see Toyota’s range of possible approaches, let’s see what it wants to do:
Question 3. (continued)

<table>
<thead>
<tr>
<th>cash-flows today</th>
<th>cash-flows in 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>nothing (in net terms)</td>
<td>- SF 10m</td>
</tr>
<tr>
<td></td>
<td>+ max possible number of Yen</td>
</tr>
</tbody>
</table>

Alternative 1 is to simply sell the SF forward (at the Japanese bank’s bid cross FX rate):

<table>
<thead>
<tr>
<th>cash-flows today</th>
<th>cash-flows in 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>nothing</td>
<td>- CHF 10m</td>
</tr>
<tr>
<td></td>
<td>+ JPY 808,500,000</td>
</tr>
</tbody>
</table>

Alternative 2 is to more complicated – creating a synthetic forward, using a synthetic cross spot rate. The key to keeping track of what one needs to do, it to keep in mind at the desired pattern of cash-flows (look at the top of the page)

<table>
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<tr>
<th>cash-flows today</th>
<th>cash-flows in 3 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. + SF 9,944,065 (*)</td>
<td>- SF 10m</td>
</tr>
<tr>
<td>b. - SF 9,944,065</td>
<td>none</td>
</tr>
<tr>
<td></td>
<td>+ ¥799,183,124 (**)</td>
</tr>
<tr>
<td>c. - ¥799,183,124 (invest ¥)</td>
<td>+ ¥799,305,499 (***)</td>
</tr>
<tr>
<td>Total: nothing (net)</td>
<td>- CHF 10m</td>
</tr>
<tr>
<td></td>
<td>+ JPY 799,305,499</td>
</tr>
</tbody>
</table>

799.35m is clearly a worse return on the SF10m than the 808.5m from the simple forward sale. Toyota should go with the latter solution.

(*) PV of SF 10m at 2.25% for 90 days
(**) first convert the 9,944,065 SF into $ at the spot rate of 1.2505 CHF/1USD, then convert the dollars into Yen at 100.50 JPY/USD.
(***) return from the Yen deposit at at 0.06125% for 3 months.
**Question 4. (5 points)**

ABB, a Swiss company, wants to purchase telecom equipment from Nihon T&T, a Japanese company. Nihon T&T quote a price of 75,000,000 SF to be paid in 2 equal semi-annual SF installments of 37,500,000 SF, beginning 6 months from now. Nihon T&T quotes an alternative price of ¥5 billion to be paid also in 2 equal semi-annual ¥ installments of ¥2.5 billion, beginning 6 months from now. Suppose that ABB can trade at the following spot or forward rates (#SF/1¥):

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<tbody>
<tr>
<td></td>
<td>0.0151</td>
<td>0.0150</td>
<td>0.0149</td>
<td>0.0148</td>
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</tr>
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Assuming ABB cares about the all-in cost in Swiss Francs, do you have enough information to tell which quote should ABB pick? (Hint: compare apples to apples).

**Answer:**

In short, the answer “yes”: given those prices, one alternative clearly dominates the other.

To see this, notice that (given it wants no foreign exchange risk) ABB has two alternatives – taking the SF quote, which implies two cash outflows of SF37.5m each (one at t=6mo, another at t=12mo); or, accepting to be invoiced in Yen and hedge the resulting exposure using 6-month and 12-month forwards.

**Alternative 1:**

<table>
<thead>
<tr>
<th>time (months)</th>
<th>SF Cash flow (paid directly to Nihon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t=6</td>
<td>-SF 37.5m</td>
</tr>
<tr>
<td>t=12</td>
<td>-SF 37.5m</td>
</tr>
</tbody>
</table>

**Alternative 2**

<table>
<thead>
<tr>
<th>time (months)</th>
<th>Yen Cash flow (paid directly to Nihon)</th>
<th>Forward hedge</th>
<th>Net cost to ABB</th>
</tr>
</thead>
<tbody>
<tr>
<td>t=6</td>
<td>-¥ 2.5bn</td>
<td>-¥ 2.5bn</td>
<td>¥0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-SF 37.25m</td>
<td>-SF 37.25m *</td>
</tr>
<tr>
<td>t=12</td>
<td>-¥ 2.5bn</td>
<td>-¥ 2.5bn</td>
<td>¥0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-SF 36.75m</td>
<td>-SF 36.75m **</td>
</tr>
</tbody>
</table>

It is clear that alternative 2 is better, as the net cash outflow is lower both at time t=6 and at time t=12.

*: = 2.5bn @ 0.0149 CHF/1JPY

**: = 2.5bn @ 0.0147 CHF/1JPY
**Question 5. (5 points)**

Suppose that, at the open of the CME on 10-08-09 (today), you went short a single March-2010 Euro futures contract (notional: 125,000 Euros). The agreed upon price (i.e., the futures rate) was 1.46$/€.

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5. you must pay over $1,250 to the long party in the futures contract
6. you must pay $1,250 and receive a new futures contract priced at $1.45 (in replacement of the old futures)
7. none of the above

**Answer:**

The answer is 4 – as the contract is marked to market daily, you receive $1,250 (you were short, so you benefited from the drop in the Euro’s dollar value) and your old futures contract at 1.46 is replaced by a new contract, identical in all respects except for the fact that its price is now $1.45.

**Question 6. (5 points)**

In 2002, the U.S. government significantly decreased personal taxes on dividend income. What would you expect the consequences of this tax cut on the U.S. current account balance to have been? Explain briefly.

**Answer:**

As we know, \( X-M = (T-G) + (S-I) \).

Spelling out the formula, the current account balance (\( eXports - iMports \)) must equal the sum of the net savings of the government (\( Taxes - Gvt spending \)) and of the private sector (domestic Savings – Investment).

As a dividend tax cut takes place, \( T \) is likely to drop along with the change (at least in the short term). As a result, the CA balance should worsen. In practice, the mechanism through which this worsening takes place is that \( iMports \) likely go up.