General Instructions.

Please form groups of three to five people in order to solve either of the two cases proposed for GS#1. The due date for this first group assignment is Tuesday, March 29 at 6PM. Completion requires the return of two electronic files: a write-up in MS Word as well, ideally, as supporting Excel spreadsheets.

The first case is a HBS case on MetallGesellschaft, using the information in Marthinsen’s case textbook on “Risk Takers – Uses and Abuses of Derivatives”.

Alternatively, you may solve the following case. If so, please answer Questions 1 to 3 in the attached pages. To handle the three questions that make up this assignment, each group will need to download actual interbank market information from Bloomberg (or from some other source), for every banking business day in the last six years (March 1, 2005 through March 1, 2011):

(i) Bid and asked exchange rates (spot and 1-, 3-month and 6-month forwards) for four currency pairs: JPY/USD (Japanese Yen); USD/EUR (Euro); USD/GBP (Pound Sterling); and CHF/USD (Swiss Franc).

(ii) The 1-, 3- and 6-month interbank asked interest rates (LIBOR) for the relevant five currencies: USD, JPY, EUR, GBP, and CHF.

(iii) The 1-month, 3-month and 6-month interbank bid and asked interest rates (LIBID) for the following three currencies: US Dollar, Euro, pound sterling.

To get the necessary data, you may go to the KSB Financial IT Lab. Prof. Octavian Ionici, the lab director, may be contacted (oionici@american.edu) if you have questions regarding the data. He shall hold a review session in the KSB Financial IT Lab on the following date:

Thursday, March 17th from 3:00PM to 5:00PM (during my own OH)

Please note that any assistance that Prof. Ionici may provide is limited to questions related to obtaining the FX and IR data – his assistance does NOT include what to do with the data (for questions regarding the assignment itself, please ask me).

Remember that NO collaboration is allowed between groups (of course, maximum collaboration is expected within a given group). If you have any doubts about the honor code that governs the completion of this assignment, please consult the course syllabus or me!

Good Luck!
**Question 1: bid-ask spreads (20 points)**

a. How wide are the percentage bid-asked spreads for those four currency pairs, at various contract maturities?
   
   **Hint:** Compare the means and/or medians of the daily percentage bid-asked spreads in a small table like the one below:

<table>
<thead>
<tr>
<th>MEANS</th>
<th>JPY/USD</th>
<th>USD/EUR</th>
<th>USD/GBP</th>
<th>CHF/USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>spot</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>1-month</td>
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<td>3-month</td>
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<tr>
<td>6-month</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEDIANS</th>
<th>JPY/USD</th>
<th>USD/EUR</th>
<th>USD/GBP</th>
<th>CHF/USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>spot</td>
<td></td>
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<td></td>
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<tr>
<td>1-month</td>
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<tr>
<td>3-month</td>
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<tr>
<td>6-month</td>
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</tbody>
</table>

b. Do the mean/median spreads widen with contract maturity? Are the spread generally higher for some of the currencies? Can you venture an explanation for the pattern?
   
   **Hint 1:** Build a third table with volatility estimates for the 4 exchange rates (e.g., average or median “high minus low”, or standard deviation of the daily currency rates of return) and see whether the percentage spreads are correlated with volatility.
   
   **Hint 2:** Build a fourth table with volume estimates for the 4 exchange rates and see whether the percentage spreads are correlated with this measure of liquidity.
   
   **Note:** Volume estimates are not available daily from Bloomberg for OTC forex data. However, Bloomberg and other sources provide daily figures for forex futures volumes, while the BIS provides (every 3 years) estimates of OTC volumes by currency ad maturity.

<table>
<thead>
<tr>
<th>VOLATILITY</th>
<th>JPY/USD</th>
<th>USD/EUR</th>
<th>USD/GBP</th>
<th>CHF/USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>spot</td>
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<td>1-month</td>
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<td>6-month</td>
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</tbody>
</table>

c. Please plot the percentage bid-asked spreads, for each currency and each maturity, over time. Do you observe a commonality to those patterns in Fall 2008? At another time? What could be the reason(s)?
Question 2: Covered Interest Rate Parity (40 points)

Over the last six years, has covered interest rate parity held?

1. As a rough first pass, you could intuitively use the relevant LIBOR and midpoints of the daily Forex rate bid-ask quotes to check that, each day in your sample period and for each currency pair (for all three forward delivery dates), the forward premia/discounts were approximately equal to the relevant interest rate differentials:

\[
f_{t,T} = s_t \left( 1 + \frac{i}{360} \right) T \left( 1 + \frac{i^*}{360} \right) \quad \text{or} \quad \frac{f_{t,T} - s_t}{s_t} = \frac{(i - i^*) T}{1 + \frac{i^*}{360}}
\]

2. For the EUR/USD forward rates, please also proceed more formally. You should check whether the EUR/USD forward rates are in line with the spot rates, after adjusting for the relevant interest rate differentials. Do not forget to take into account bid-ask spreads for exchange rates (Bid vs. Asked) as well as interest rates (LIBOR on the ask side vs. LIBID or another deposit rate).

Hint: verify whether there is any day in your 6-year sample when either of the following inequalities do not hold:

\[
F_{t,T}^b \leq \frac{S_t^a (1+i_a T)}{(1+i_b^* T)} \quad \text{and} \quad F_{t,T}^a \geq \frac{S_t^b (1+i_b T)}{(1+i_a^* T)}
\]

Notes:

If you choose Bloomberg's LIBID as a proxy for unsecured interbank deposit rates, you’ll find out that LIBID figures are always 1/8th of 1% below the contemporaneous LIBOR quotes. The reason is that Bloomberg’s LIBID is not a market rate but is instead an indicative figure computed by Bloomberg by subtracting a fixed percentage (e.g., 0.125%) from the LIBOR quote reported by the British Bankers' Association (BBA). In other words, while LIBOR is market-based (notwithstanding the controversy about LIBOR during the crisis -- see, e.g., FT articles in Dec. 2007 and WSJ articles in May 2008), LIBID is not.

Generally, this need not be a major issue. Amid the crisis that started in August 2007 (and, even more, after the collapse of Lehman), however, one should worry that the actual spreads between bid and asked interest rates widened significantly beyond the fixed spreads assumed in the
Bloomberg dataset. Insofar as computations that rely on LIBOR and LIBID figures suggest arbitrage opportunities at some points during the financial crisis (especially after Lehman's collapse), the question arises as to whether there truly were arbitrage opportunities or whether, instead, transactions simply could not take place at the provided “quotes”.

A recent article by two economists from the Swiss National Bank (Mancini-Griffoli & Ranaldo, Limits to Arbitrage during the Crisis, e-copy available at: http://ssrn.com/abstract=1569504) provides a detailed analysis of these issues. In particular, it identifies two main ways to exploit deviations from CIRP. One arb strategy relies on secured interest rates; the other, on unsecured ones. Each approach has its own problems – in particular, data issues took the authors quite far.

For the case, no one is expected to go to the lengths Mancini-Griffoli & Ranaldo have gone. Here are some suggestions for a practical solution within the context of the case:

a. The starting point for a first possible workaround is the observation that, during the crisis, financial intermediaries hoarded cash or invested it in the safest possible assets. Intuitively, then, a bid interest rate like the interbank bid repo rate or a governmental treasury rate might provide a better measure than LIBID of the actual rate of return on short term bank investment (at least during the crisis period).

b. Because interbank repo bid rates are notoriously difficult to obtain, you may want to still use LIBOR on the ask side of your CIRP formulas but to replace the LIBID "rates" with a market-based substitute – for example, by using "safe" government rates (e.g., the 30-, 91- and 182-day T-bill rates in the US). Alternatively, you may want to stick to LIBID but increase the spread you compute from LIBOR during periods of crisis (in that case, please explain how you set the spread during the crisis period).

c. A natural question is when you may "safely" resort to Bloomberg's LIBID and when you need to use another interest rate quote.
   (i) One way to identify the periods of concern, might be to use the LIBOR-OIS (overnight IR swap) spread, which is a good measure of market stress.
   (ii) Another way might be to use the TED spread – when the latter is high, one may worry about the relevance of LIBID.
   (iii) This extra information requires additional data pulls from Bloomberg. A third, less data-intensive, approach might be to use your knowledge of the financial crisis to pick the periods when you should worry about LIBID relevance – for example, see http://en.wikipedia.org/wiki/Subprime_crisis_impact_timeline
Question 3: Yen carry trades (40 points)

a. Over the last 6 years, could you have made money from carry trades, using the yen as the funding currency (borrowing at LIBOR) and the US dollar as the target currency (depositing at USD LIBID or some other measure of the USD interbank deposit rate)?

**Hint:** Assume that you are continuously doing carry trades during the past 6 years, using 1-month or 3-month loans that you roll over. Describe the instruments you plan on using to implement your carry trades, your roll-over strategy, gains/losses, etc.

b. What would the risks have been? Please show your work.

**Hint:** For example, what would have happened to your bet in Fall 2008? More generally, what does the distribution of your carry-trade gains/losses look like – like a normal distribution, or something else? If the latter, what is your interpretation?