Exam FM/2 Study Manual - Spring 2007
Errata and Clarifications
February 28, 2007

Jan 30/07  **Module 1, Page 28, #8**

\[ \int_0^t \delta(u)\, du = \int_0^t \frac{4}{u+3} \, du = 4 \ln(u+3) \bigg|_0^t = 4 \ln \left( \frac{t+3}{3} \right) \]

\[ \varphi(t) = \left( e^{4 \ln(t+3)/3} \right) = \left( \frac{t+3}{3} \right)^4 \]

Jan 30/07  **Module 1, Page 38, #9**

First exponent should be 12, not 4.

Jan 31/07  **Module 2, Page 24**

First paragraph, last line: change 1000 to 10,000

Feb 28/07  **Module 2, Page 28**

End of 2nd paragraph, eliminate the word "rate" from the last line.

Feb 28/07  **Module 2, Page 31, Example 2.75**

The last sentence of the example should read:

How much will you have at the end of 5 years?

Feb 28/07  **Module 2, Page 35, #9 solution**

The last two lines are incorrect. 13.3542 should be 12.3542. The final answer should be 3622.60 (not 3621.85).

Feb 28/07  **Module 3, Page 10, Example 3.19**

This example uses the prospective method, not the retrospective method.
Feb 28/07  **Module 4, Page 6, Example 4.16**

The heading for the first column should be "Period" rather than "Year." Same for page 7, Example 4.20

Feb 28/07  **Module 4, Page 8, Example 4.22**

The amortization is for a discount, not premium. Same for Example 4.23

Feb 28/07  **Module 4, Page 16, #6.**

A question is not posed. Add:

Find the purchase price of the bond.

Feb 28/07  **Module 4, Page 26, #10**

The answer is B, not C.

Feb 28/07  **Module 5, Page 13**

Strike out the first sentence of the second paragraph which states that this material is not included.

Feb 28/07  **Module 6, Page 4, Exercise 6.3**

The reference should be to Table 6.1, not 1.1.

Feb 28/07  **Module 6, Page 8, #2**

The question should ask for the One year forward rate, not the Two year forward rate. The solution on the next page reflects this.

Feb 28/07  **Module 6, Section 6.8 Supplemental Exercises, Page 14, #6**

In the chart, the second column heading should read "Forward Rate" rather than "Spot Rate."
Feb 28/07  **Module 7, Page 13, Exercise 7.30**

The word "has" should be omitted.

Feb 28/07  **Module 7, Page 26, #2 solution**

Last line on the page should read:

\[ .9756(990.43) + .9565(1004.93) = 1927.48 \]

Feb 28/07  **Module 12, Pages 12-13**

Replacement pages are found at the end of this file. We have added some clarifying phrases.
Cash and Carry Arbitrage:
The cash and carry hedge assumed that the forward sale price was correct, or \( F_{0,T} = S_0 e^{(r-\delta)T} \).

Suppose you believe that the forward price offered is too high, or \( F_{0,T} > S_0 e^{(r-\delta)T} \).
Remember that the forward price depends on estimates of the correct \( \delta \) and \( r \), and could be wrong.

You can then arbitrage this error by the classic strategy of buying low and selling high: sell a forward at the higher forward price. Then create a synthetic purchase at the lower correct price.

Buy low and pay: \( S_0 e^{-\delta T} \).
Borrow: \( S_0 e^{(-\delta)T} \).
Sell high and receive: \( F_{0,T} \).
Repay loan: \( S_0 e^{(r-\delta)T} \).
Profit: \( F_{0,T} - S_0 e^{(r-\delta)T} \).

In the previous example, if the forward price was \( F_{0,T} = 1011 \) while the correct theoretical price is \( S_0 e^{(r-\delta)T} = 1010.05 \), the arbitrage would be to borrow to purchase a tailed position in the stock today. At time \( T \)

Repay loan: 1010.05
Sell high and receive: 1011
Profit: 0.95

This profit at time \( T \) had 0 cost at time 0. It is an arbitrage.

Reverse Cash and Carry Hedge:
Suppose that you have purchased a stock forward, agreeing to buy it at time \( T \) for \( F_{0,T} = S_0 e^{(r-\delta)T} \). To hedge this position you create a synthetic short forward agreeing to sell it for the same price at time \( T \). You are hedged, since at time \( T \) you net the sale price paid to you less the purchase price you pay:

\[
S_0 e^{(r-\delta)T} - S_0 e^{(r-\delta)T} = 0.
\]

The procedure is again common sense. To hedge a (long) forward purchase, offset it with a synthetic forward sale.

This too is simple in practice. Recall that the six month forward price when \( r = .04, \delta = .02 \) and \( S_0 = 1000 \) is \( F_{0,T} = S_0 e^{(r-\delta)T} = 1000e^{.01} = 1010.05 \).

Suppose that you have entered a forward contract to buy the stock in six months for 1010.05. To hedge this position you create a synthetic short forward for the same price.

Forward = Stock + zero coupon bond
Sell a tailed position in the stock today for \( S_0 e^{-\delta T} = 1000 e^{-0.01} = 990.05 \), and invest that 990.05 at the risk free rate \( r = 0.04 \). In six months you will have to deliver the stock that you have sold short, and be paid the amount \( 1000 e^{-0.01} e^{0.02} = 1010.05 \) from the zero coupon bond. Buy the stock under the forward contract that you are hedging using the amount of 1010.05 from the loan and deliver the stock to cover the short sale. The payoff is 0.

**Reverse Cash and Carry Arbitrage:**

The cash and carry hedge assumed that the forward sale price was correct, or \( F_{0,T} = S_0 e^{(r-\delta)T} \). And, suppose you believe that the forward price offered is too low, or \( F_{0,T} < S_0 e^{(r-\delta)T} \).

Then, you can once more arbitrage this error by the classic strategy of buying low and selling high. Buy a long forward at the lower forward price. Then create a synthetic sale at the higher correct price.

- Buy low and pay: \( F_{0,T} \)
- Sell high (synthetic) and receive: \( S_0 e^{(r-\delta)T} \)
- Profit: \( S_0 e^{(r-\delta)T} - F_{0,T} \).

Suppose that the forward price was \( F_{0,T} = 1009 \) while the correct theoretical price is \( S_0 e^{(r-\delta)T} = 1010.05 \). The arbitrage would be

- Buy low and pay: 1009
- Sell high and receive: 1010.05
- Profit: 1.05

This profit at time \( T \) had 0 cost at time 0. It is also an arbitrage.

**The Implied Repo Rate**

Recall that (12.11) stated: zero-coupon bond = Stock – forward

In words, if you buy a tailed position in a stock and sell the stock forward, you have the equivalent of a zero coupon bond at the risk free rate. If the forward is delivered at time \( T \), the precise results are:

- Time 0: Invest \( S_0 e^{-\delta T} \) to purchase the tailed position.
- Time \( T \): Sell the purchased stock and receive \( F_{0,T} = S_0 e^{(r-\delta)T} = e^{rT} S_0 e^{-\delta T} \) for it.

The continuously compounded return is \( r \), the risk free rate. In some cases, you may not know \( r \) and wish to estimate it. If \( F_{0,T} \) is theoretically correct, then

\[
\frac{F_{0,T}}{S_0 e^{-\delta T}} = e^{rT} \quad \text{and} \quad \ln \left( \frac{F_{0,T}}{S_0 e^{-\delta T}} \right) = rT \quad \text{so that} \quad \frac{1}{T} \ln \left( \frac{F_{0,T}}{S_0 e^{-\delta T}} \right) = r.
\]