Homework Assignment 6

1) Occasionally firms extend the life of warrants that would otherwise expire unexercised. Warrants are options a firm issues on its own stock. What is the cost of extending the life of the warrants? Who pays the cost?

2) Whirlpool has decided to issue convertible bonds. Each $1000 face value bond is convertible into 25 shares of stock. The bond makes one risk-free interest payment at maturity of $83 in one year. The risk-free interest rate is 8.3%. Whirlpool stock is currently selling for $40 per share and is not expected to pay any dividends in the next 18 months. The appropriate discount rate for Whirlpool equity is 15%. This rate is based on a β of 0.79 and a market price of risk of 8.5%. Assume that the market believes the stock price is equally likely to be 40, 42, 44, 46, 48, 50, or 52 next year.

   A) Is the market correctly valuing the stock given its expectations?

   B) What is the value of the convertible bond? Assume that the convertible bond has a β of 0.6.

   C) What is the β of the imbedded option?

   D) Being an industrious student, you have spent your spare weekends researching Whirlpool stock. You have discovered that the market has incorrectly estimated the mean stock price for next year. In reality, next year the stock price is equally likely to be 44, 46, 48, 50, 52, 54, or 56. With your private information, how would you value the stock and the convertible bond? Is one a better investment than the other? Explain.

   E) Take another example where you have researched Whirlpool (ignore your findings in D). You have discovered that the stock price will not be 40 or 52 next year. The market has over estimated the variance of the stock return. The stock price is equally likely to be 42, 44, 46, 48, or 50. What is the true value of the stock and the convertible bond? Use a β of 0.7 for the convertible. Which is a better investment?

3) Interest rate hedging at Procter & Gamble. On April 12, 1994, P&G announced it would take a one time charge of $157 million to close out two interest rate swaps it had purchased through Bankers Trust. P&G claimed it did not fully understand the swaps into which it had entered. "Derivatives like these are dangerous and we were badly burned," said CEO Edwin Artzt.[1] Some have argued that the swaps into which P&G entered were quite complicated and very difficult to understand. "Nobody knows for sure how P&G lost $153 million."[2] Since you are smarter, I would like you to analyze P&G's hedge.

[1] *Derivatives Strategy*, April 25, 1994, page 1.
[2] Ibid, page 3.

A) Procter and Gamble entered into a swap where they agreed to pay a spread above the commercial paper rate. The spread was calculated as:

$$\text{Spread} = \max[0, 17.0415 * r_{\text{5 year treasury}} - P_{\text{30 year treasury w/ coupon rate of 6.25\%}}] - 0.0075 \qquad (1)$$

The price of a 30 year treasury note can be written as a function of the rate on a 30 year treasury bond. The following formula calculates the price per dollar of face value, which is the price used in the spread formula above.

$$P_{30\,yr} = \sum_{t=1}^{60} \frac{\frac{0.0625}{2} * 1}{\left(1 + \frac{r_{30}}{2}\right)^{t}} + \frac{1}{\left(1 + \frac{r_{30}}{2}\right)^{60}} = \frac{0.0625 * 1}{r_{30}} \left[1 - \frac{1}{\left(1 + \frac{r_{30}}{2}\right)^{60}} \right] + \frac{1}{\left(1 + \frac{r_{30}}{2}\right)^{60}} \qquad (2)$$

The payments on P&G's swap depend on the 5 and 30 year government bond rates. Construct a table which reports the spread as a function of the 5 and 30 year interest rates.

P&G Spread	Thirty year rate			
Five year rate	5 %	6 %	7 %	8%
5 %				
6%				
7%				
8%				

B) Although this derivative is more complicated than a simple bet on the direction of interest rates, would you characterize this as a bet on rates rising or falling? How is this derivative different from a direct fixed for floating rate swap? A fixed for floating swap can also be used to bet on the direction of future interest rates.

C) What must P&G's risk exposure to interest rates look like to justify this hedge?

