Midterm Exam - Answer Key

1. 

(a) This might imply that large banks have a higher equity multiplier. Recall the relationship: \( \text{ROE} = \text{ROA} \times E.M. \)

(b) It is better to focus on \( NIM \) since this scales \( NII \) by assets. It shows the average return (interest income) on assets.

(c) It is probably best to focus on \( DGAP \) since this is related to net worth - this is what firm owners are most interested in.

2. The price of a pure discount bond with maturity of \( N \) and face value of \( F \) is given by:

\[
P_b = \frac{F}{(1 + i)^N}
\]

Taking logs we have \( \ln P_b = \ln F - N \ln (1 + i) \). Taking the derivative with respect to \( i \) yields:

\[
\frac{d \ln P_b}{di} = \frac{(dP_b/di)}{P_b} = -N \frac{1}{1 + i}
\]

Letting \( dP_b \approx \Delta P_b \) and \( di \approx \Delta i \) and rearranging we have:

\[
\frac{\Delta P_b}{P_b} = \% \Delta P_b = -N \frac{\Delta i}{1 + i}
\]

This is the duration formula where we see the elasticity is determined by the maturity.

3. (a) The \( DGAP = \left[ \frac{2}{18} \times 10 + \frac{15.5}{18} \times 2 \right] - \left[ \frac{8}{18} \times 0.3 + \frac{6}{18} \times 4.2 \right] = \left[ (0.11) (10) + (0.86) (2) \right] - \left[ (0.44) (0.3) + (0.33) (4.2) \right] = 1.1 + 1.7 - 0.13 - 1.4 = 1.3 > 0 \). The change in net worth is given by:

\[
\Delta NW = -\text{Assets} \times DGAP \frac{\Delta i}{1 + i} = -18,000 \text{ (1.3) } \frac{0.02}{1.09} = -$429.36
\]

(b) Take a position that will make money if interest rates rise (as shown above). If interest rates rise, then the price of bonds falls. So sell financial future - i.e. go short.

4. This statement is true. As was shown in class, the price that is paid at time \( T \) is:

\[
P_T = S_T + (F_T - F_T)
\]
That is, the price paid is equal to the spot price plus the change in the price of the futures contract. Add and subtract $S_t$ (the spot price when the futures contract is purchased or sold):

$$P_T = S_t + (S_T - F_T) - (S_t - F_t) = S_t + \Delta basis_{t,T}$$

Hence if the basis does not change, the price paid at time $T$ is the spot rate at time $t$. No price risk! But the basis may change so risk is not eliminated. Basis risk, however, is typically much more predictable since it is determined by storage costs and the current interest rate. (Recall the cash and carry arbitrage examples in class and the homework)

5. The expectations hypothesis implies that the current long maturity rate is the average of the current and expected future spot rates. So for a 3-year bond, this implies:

$$i_{3_t} = \frac{i_{1_t} + E_t(i_{1_{t+1}}) + E_t(i_{1_{t+2}})}{3}$$

The question gave $i_{3_t} = 0.12, i_{1_t} = 0.08, E_t(i_{1_{t+2}}) = 0.15$. Solving we get $E_t(i_{1_{t+1}}) = 0.13$. For the two-period bond we have

$$i_{2_t} = \frac{i_{1_t} + E_t(i_{1_{t+1}})}{2} = 0.105$$

6. Given the numbers, it makes sense for IBM to issue fixed rate debt and Wells Fargo to issue floating and then they engage in an interest rate swap. Suppose the floating rate that IBM pays is LIBOR denoted as $L$. Let the fixed rate paid by Wells Fargo by denoted $SR$. Then the all-in-costs for IBM must be less than the floating rate it can get in the market:

$$8 + L - SR \leq L + 0.50 \Rightarrow 7.5 \leq SR$$

For Wells Fargo, we have the analogous condition:

$$L + 0.65 - L + SR \leq 10 \Rightarrow SR \leq 9.35$$

So any $SR$ in the following interval is acceptable:

$$7.5 \leq SR \leq 9.35$$