1. A bond has face value of $100,000 and coupon rate of 10% paid out annually (its first coupon will be paid one year from now), its maturity date is 3 years from now and its yield to maturity is 5%. Using only duration (calculated at the current YTM of 5%), what is the percent change in the price of the bond if its yield to maturity jumps to 10%? Choose the closest alternative below.

A. -9%
B. -10%
C. -11%
D. -12%
E. -13%

Solution: E

We use the following formula for modified duration: $D = \frac{1}{1+y}\sum_{t=1}^{3} t * \frac{C}{P} * \left(\frac{1}{1+y}\right)^{t}$

Plugging in (C/P) = 10%, y = 5%, we find that the duration for this bond is 2.7525, which implies a price change of -D * Δy = -2.7525 * 0.05 = -13.107%.

2. You read the following on October 10, 2015:

Euro swings making investors wary of "carry trade"

Oct 10 (Reuters) - Selling the euro against just about anything has made money since the European Central Bank cut its deposit rate below zero. But now investor appetite for the trade is dwindling, because big swings in exchange rates are making it look far more risky.

Negative rates on cash parked at the European Central Bank, imposed in June, made it cheaper for return-hungry investors to borrow euros to buy higher-yielding but riskier currencies - so-called "carry trades".

The euro dropped sharply against the likes of the Australian and New Zealand dollars and emerging market currencies including the Turkish lira, the South African rand and the Brazilian real.

But carry trades depend crucially on exchange rates staying stable. In recent weeks, long-dormant currency volatility began to stir, and now investors are pulling in their horns.

Which of the following statements best describes the situation?

A. Spot-futures parity is independent of volatility so increased volatility in exchange rates does not change the futures price and is irrelevant to the carry trade.
B. In a carry trade, the future exchange rate is not hedged, so volatility of the future exchange rate does indeed create risk for the carry trade.
C. The euro's rise hurts the carry traders all the more because it has little to do with the gloomy euro zone's macroeconomic fundamentals.
D. With interest rates at or below zero in the eurozone, interest rates can only increase in the future, which increases the risk of a carry trade.

Solution: B

Regarding A, it is true that spot-futures parity is independent of volatility, but the whole point of a carry trade is to not use currency futures – otherwise there would be no profit by construction.
C: The carry trade has little to do with fundamentals. It's all about exploiting differences in interest rates across currencies.
D: That eurozone interest rates will go up in the future is quite plausible, but interest rates are fixed for the duration of a carry trade. All the risk comes in the form of the future exchange rate at which the currency in which you borrowed (euros here) will have to be bought back to repay the low-interest rate loan that funded the trade. A rise in eurozone interest rates will not hurt current carry traders. It may make future carry trades using the euro as funding currency less attractive.

3. Suppose inflation is currently 2%, the 30-year nominal zero-coupon government bond is trading with a YTM of 5%, and the YTM of a 30-year zero-coupon TIPS is 2%. Which of the following best describes market expectations for future inflation?

A. Inflation will remain constant over the next 30 years
B. Inflation will increase on average over the next 30 years
C. Inflation will decrease on average over the next 30 years if interest rates rise
D. Inflation will increase on average over the next 30 years if interest rates rise
E. Inflation will decrease on average over the next 30 years

Solution: B

According to the Fisher equation, market expectations for future average inflation are 5% - 2% = 3%, which is one percentage point higher than the current inflation rate of 2%. So inflation is expected to increase in the future.

4. Which of the following is part of Basel III?

A. Bank capital requirements and liquidity ratios
B. Countercyclical capital buffers implemented in times of high credit growth
C. Increased capital requirement for Systemically Important Financial Institutions (SIFIs)
D. Increased disclosure of derivatives and off-balance sheet exposure
E. All of the above

Solution: E

5. Which of the following are NOT sources of potential transaction costs for institutional investors with passive mandates?

A. Bid-ask spreads
B. Price impact
C. Noise trader risk
D. Commissions
E. Exchange fees
F. All of the above are sources of potential transaction costs

Solution: C

All of the other answer choices are either variable (A and B) or fixed (D and E) costs of trading. Noise trader risk relates to arbitrage strategies, the idea that markets may move against you before your trades converge.

6. Prior to the financial crisis, money market mutual funds (MMMF) were not permitted to hold more than 5% of their total assets in "second-tier" securities (securities with the second-highest rating by a credit rating agency). The remainder was required to be held in "first-tier" securities (securities with the highest rating by a credit rating agency).

After the bankruptcy of Lehman Brothers in September 2008, investors were shocked to learn that a major money market fund (the Reserve Primary Fund) had invested more than $785 million in Lehman's commercial paper. This prompted a run on the fund, which quickly spread to other money market funds, which later forced the US Treasury to implement temporary deposit insurance for money market mutual funds.

Which of the following best explains what happened to the Reserve Primary Fund?

A. Investors mistakenly thought that MMMFs had deposit insurance.
B. The Reserve Primary Fund violated the regulation that money market funds may only hold 5% of their total assets in second-tier securities.
C. The Reserve Primary Fund held too many securities that were not accurately rated by rating agencies.
D. The Reserve Primary Fund held too many long-term securities, which triggered a Diamond-Dybvig-type run on the MMMF.

Solution: C

When the Reserve Primary Fund was found to be holding $785 million of Lehman commercial paper, this is primarily a problem of credit-rating agencies rating Lehman paper too high. Had the credit-rating agencies rated Lehman appropriately, the Reserve Primary Fund would have held little to no commercial paper from Lehman, and investors would not have panicked about their investments in the Fund.

7. The annualized yield on 6-month German bonds is 2%, while the annualized yield on 6-month UK bonds is 4%. The spot price of one pound is 1.2 euros. What is the current 6-month forward price of one euro in pounds, assuming no arbitrage?

A. 0.825
B. 0.841
C. 1.188
D. 1.212
E. 1.425

Solution: A

Currently one euro = 0.8333 pounds. According to covered interest rate parity, the 6-month forward price of one euro = $0.8333 * \frac{(1+0.02)^{1/2}}{(1+0.04)^{1/2}} = 0.825$

8. Suppose that a country faces the following economic conditions:

IS curve: GDP = C + I + G + NX
LM curve: r = (2 + GDP – 100)/100
C = C_0 + (0.2)(GDP), I = 20 – 80r
Inflation = 0.01, C_0 = 30, G = 22, NX = 0

The central bank cannot lower nominal interest rates below zero, and thus, by the Fisher equation, the real interest rate cannot fall below r = –0.01. Calculate the level of GDP in this country given the ZLB policy of r ≥ –0.01.

A. 89
B. 91
C. 94
D. 97
E. 100

Solution: B

We are looking for the point where the IS curve intersects the ZLB at r = –0.01. So set r = –0.01 and plug that into the IS curve formula. We see the following:

$$\begin{aligned} GDP &= C + I + G + NX \\ GDP &= C_0 + 0.2(GDP) + 20 - 80r + G \\ 0.8GDP &= 30 + 20 - 80(-0.01) + 22 \\ GDP &= \frac{72.8}{0.8} \\ GDP &= 91 \end{aligned}$$

9. Now suppose that the central bank engineers a way to allow negative nominal interest rates, thus eliminating the ZLB policy restriction. Calculate GDP and r.

A. GDP = 91, r = –0.01
B. GDP = 91, r = –0.03
C. GDP = 91, r = –0.04
D. GDP = 94, r = –0.01
E. GDP = 94, r = –0.03
F. GDP = 94, r = –0.04

Solution: F

Plugging parameter values into the IS curve:

$$\begin{aligned} GDP &= C + I + G + NX \\ GDP &= C_0 + 0.2(GDP) + 20 - 80r + G \\ 0.8GDP &= 30 + 20 - 80r + 22 \\ 0.8GDP + 80r &= 72 \end{aligned}$$

Plugging parameter values into the (now unrestricted) LM curve:

$$\begin{aligned} r &= \frac{2 + GDP - 100}{100} \\ r &= 0.02 + 0.01(GDP) - 1 \\ 0.01GDP - r &= 0.98 \end{aligned}$$

Now you have a system of two equations in two unknowns

$$\begin{aligned} 0.8GDP + 80r &= 72 \\ 0.01GDP - r &= 0.98 \end{aligned}$$

You can solve by substitution, and you should get GDP = 94 and r = –0.04.

10. A novel pricing scheme called “maker-taker” pricing has been implemented recently by several stock exchanges in an effort to incentivize traders to provide liquidity to the market for a given security. In maker-taker pricing, an order that needs to be executed immediately “takes” liquidity from the market, and that order is charged $0.003 per share. Conversely, an order that does *not* need to be executed immediately “makes” liquidity for the market, and is given a rebate of $0.002 per share.

Which of the following most accurately the roles of limit orders and market orders in a maker-taker pricing scheme?

A. Limit orders are charged $0.003 per share, and market orders are rebated $0.002 per share. So when you consider making a trade, there is a $0.005 difference in favor of placing market orders over limit orders.
B. Limit orders are charged $0.003 per share, and market orders are rebated $0.002 per share. So when you consider making a trade, there is a $0.005 difference in favor of placing limit orders over market orders.
C. Limit orders are rebated $0.002 per share, and market orders are charged $0.003 per share. So when you consider making a trade, there is a $0.005 difference in favor of placing market orders over limit orders.
D. Limit orders are rebated $0.002 per share, and market orders are charged $0.003 per share. So when you consider making a trade, there is a $0.005 difference in favor of placing limit orders over market orders.

Solution: D

The key here is to understand that limit orders are orders where you set a price and wait for the market to hit that price, and market orders are orders that are executed immediately at the best bid or ask. You should see that limit orders provide liquidity, and market orders take liquidity. Thus, under maker-taker pricing, limit orders are rebated $0.002 per share, and market orders are charged $0.003 per share. This creates a $0.005 difference in favor of placing limit orders.

11. In their book *Exchange Rate Regimes in the Modern Era*, Klein & Shambaugh discuss the monetary policy trilemma facing any country — that a country can only control two of the following three things: free capital mobility, exchange rate management, and monetary autonomy. In their discussion, the authors outline the following hypothetical scenario:

"If capital markets are open and the exchange rate is fixed (and is expected to stay pegged at a constant rate), the interest rate on a representative domestic bond must equal the interest rate [plus or minus an appropriate risk premium] on a similar bond denominated in the currency of the country to which the exchange rate is pegged. If the interest rate on the domestic bond was lower…domestic investors would purchase foreign exchange in order to buy the higher-yielding foreign bond."

Which of the following best describes the trade-off that the domestic central bank faces in the above situation when the interest rate on the domestic bond is lower than that on the foreign bond?

A. The central bank can sell foreign exchange reserves to maintain the peg, but it will eventually run out of foreign exchange reserves.
B. The central bank can buy foreign exchange reserves to maintain the peg, but it may have to buy foreign exchange reserves indefinitely.
C. The central bank can maintain its level of foreign exchange reserves, but exchange rate pressure will increase the value of the domestic currency, breaking the peg.
D. The central bank can maintain its level of foreign exchange reserves, but bond market pressure will force interest rates to fall.

Solution: A

Because the interest rate on the domestic bond is lower than the interest rate on the equivalent foreign bond, investors will prefer the foreign bond. Since the country has open capital markets, domestic investors will want to purchase the foreign bond. To do this, they must convert their domestic currency into foreign currency, so they will demand foreign currency at the expense of domestic currency. This puts downward pressure on the currency peg — the market is trying to devalue the domestic currency. To avoid breaking the peg, the central bank must meet demand for foreign currency, so it must buy the domestic currency (which puts upward pressure on its value) and sell the foreign currency (which puts downward pressure on its value). But since the bank only has a finite amount of foreign currency reserves, it will eventually run out.

12. A bond paying interest annually has a face value of $1000, annual coupon rate of 5%, annualized yield to maturity of 10%, and maturity of 3 years. You (correctly) calculate that the bond price is P = 875.6574. If the yield to maturity decreases to 8%, what is the approximate dollar change in the price of this bond due to duration only? Duration is evaluated at the original yield to maturity. Choose the closest alternative below that is closest to the results you have computed.

A. 25
B. 30
C. 35
D. 40
E. 45

Solution: E

Let *D* be the *modified* duration, which is defined as follows.

$$D = \frac{1}{P}\left(\frac{1}{(1+y)}\sum_{t=1}^{3} t\frac{C_t}{(1+y)^t}\right)$$

Computation yields P = 2.59. Using the linear approximation $D = -\frac{1}{P}\frac{\Delta P}{\Delta y}$ and $\Delta y = -2\%$, we have the approximate change in price $\Delta P = -D \times \Delta y \times P \approx 45.359$.

13. A zero-coupon bond with maturity of 5 years has face value of $1000 and is trading at a price equal to $800. What is its annualized yield-to-maturity? Choose the closest alternative.

A. 2.5%
B. 3.5%
C. 4.5%
D. 5.5%
E. 6.5%

Solution: C

1000/(1+y)^5 = 800. Rearranging and solving gives y = 4.564%.

14. An XYZ bond has a face value of $1000 and an annual coupon payment of $50. XYZ matures in 10 years, and is currently trading at a price of $1000 (this year's coupon was just paid). What is the yield to maturity of the XYZ bond? Choose the closest answer.

A. 2%
B. 3%
C. 4%
D. 5%
E. 8%

Solution: D

XYZ is trading at par, so its YTM equals its coupon rate, 5%.

15. Given the following term structure (where ${}_xr_y$ is the per year market interest rate between the year x and year y):

${}_0r_1$	3.00%
${}_0r_2$	4.00%
${}_0r_3$	5.00%
${}_0r_4$	5.50%
${}_0r_{10}$	7.00%

What is the implied forward rate between year 2 and year 10 (${}_2r_{10}$), according to the expectations hypothesis? Choose the closest alternative below.

A. 7.75%
B. 8.25%
C. 6.75%
D. 7.25%
E. 10%

Solution: A

$(1+{}_2r_{10})^8 = (1+{}_0r_{10})^{10} / (1+{}_0r_2)^2$, so ${}_2r_{10} = 7.7634\%$

16. Two (non-callable) bonds, bond A and bond B, have the same price, the same yield, and the same duration, but bond A has lower convexity. Pick the best bond to buy for the indicated change in market interest rates:

A. If interest rates go up, A does better than B. If interest rates go down, B does better than A.
B. If interest rates go up, B does better than A. If interest rates go down, B does better than A.
C. If interest rates go up, B does better than A. If interest rates go down, A does better than B.
D. If interest rates go up, A does better than B. If interest rates go down, A does better than B.
E. Not enough information to know for sure.

Solution: B

If interest rates go up, B does better. If interest rates go down, B does better. In general, since convexity affects the price of the bond via the square of the change in yield, the bond with the higher convexity always does better. (Except for some callable bonds which could have negative convexity, but this was not covered in class.)

17. The return on equity (ROE) of Tencent can be expressed as a function of its return on assets ROA, leverage ratio D/E (where D is debt and E is equity), average interest rate i and average tax rate t as:

$$ROE = (1 - t) \cdot [ROA + D/E \cdot (ROA - i)]$$

Note that this equation reflects the fact that, under U.S. tax law, interest is not taxed at the corporate level (i.e. corporate taxes are assessed on shareholder profits after interest is paid).

(a) What is the expression when (D/E) = 0? Under what condition is ROE bigger when (D/E) > 0 than when (D/E) = 0? Interpret this condition.

(b) Suppose ROA = 0.12, D/E = 0.22, i = 0.08 and t = 0.25. What is the ROE of Tencent? Does Tencent's ROE benefit from its debt?

(c) Ninecent has less debt and a higher interest rate on its debt compared to Tencent, but higher ROE. Provide two reasons how this might be possible.

Solution:

(a) ROE = (1-t) ROA; ROE is just after-tax ROA. ROE is increasing with leverage when ROA > i: leverage boosts ROE when the cost of adding debt is lower than the return on assets (what you get without debt).
(b) ROE = (1-0.25)[0.12 + 0.22*(0.12-0.08)] = 0.0966 = 9.66%. Yes, since ROA>i.
(c) Lower tax payments and higher ROA

18. MKS Enterprises issues a 5-year bond today that will pay out $1000 at maturity and 4% semi-annual coupons. A bank wants to buy this bond and "strip" it for resale. This means that the bank is going to take all of the coupon payments and sell them as one security, and then it will take the par value paid at maturity and sell that as a separate security.

If the bank assumes a 10% discount rate and no-arbitrage pricing, calculate the price (today) it will pay for the bond, the price (today) it will receive for the coupon strips, and the price (today) it will receive for the stripped bond. Also assume no default risk.

A. Bank pays $776.25 for the bond, receives $155.33 for the coupon strips and $620.92 for the stripped bond.
B. Bank pays $931.58 for the bond, receives $310.66 for the coupon strips and $620.92 for the stripped bond.
C. Bank pays $938.86 for the bond, receives $155.33 for the coupon strips and $783.53 for the stripped bond.
D. Bank pays $1094.19 for the bond, receives $310.66 for the coupon strips and $783.53 for the stripped bond.
E. Bank pays $1263.04 for the bond, receives $310.66 for the coupon strips and $952.38 for the stripped bond.

Solution: A

$$P = \frac{Par}{(1+y)^T} + \sum_{t=1}^{T} \frac{C}{(1+y)^t}$$

$$P = \frac{1000}{(1.10)^5} + \frac{20}{(1.10)^{0.5}} + \frac{20}{(1.10)^1} + \frac{20}{(1.10)^{1.5}} + \cdots + \frac{20}{(1.10)^5}$$

$$P = 620.92 + 155.33$$

$$P = 776.25$$