

UE 111  
FINANCIAL MODELING AND APPLICATIONS  
TD #3

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This problem uses the dataset contained in the "DJIA" Excel workbook. This dataset reports the monthly closing values of the Dow Jones Industrial Average (DJIA) index over the period March 2006 – January 2016.

### Questions

Questions 1 and 2 must be answered without using VBA programming

1. Consider a buy-and-hold strategy (henceforth BH strategy) in which you invest 10,000 dollars in the DJIA index on March 2006. What is the value of your investment in January 2016? Compute the average monthly discrete return and the average monthly continuous return of your investment.
  2. Plot a graph of the evolution of the DJIA value over the sample period. From this graph, can you infer that an active strategy could yield a higher return than the passive BH strategy? Why?
  3. Assume that you have the ability to predict without error, at the beginning of month  $m$ , the value of the DJIA at the beginning of month  $(m + 1)$ . You use this ability to implement the following active strategy:
    - At the beginning of month  $m$ , if you anticipate that the DJIA will increase over the month, depending on whether you are initially invested in cash or in the DJIA index, you respectively:
      - Invest all your cash in the DJIA index, assuming that 1 DJIA point = \$1 (rebalancing);
      - Maintain your investment in the DJIA index (no rebalancing).
    - If you anticipate that the DJIA will decrease over the month, depending on whether you are initially invested in cash or in the DJIA index, you respectively:
      - Keep being invested in cash (no rebalancing). It is assumed that the continuous annual risk-free return on cash is equal to 3%;
      - You liquidate your position in the DJIA at a price equal to the DJIA value at the beginning of month  $m$ , assuming that 1 DJIA points = \$1 (rebalancing).
- (a) Let assume that you start implementing this strategy on March 1, 2006. Write a VBA program that computes the value of your portfolio at the beginning of January 1, 2016.

- (b) Apart from the fact that being able to predict systematically the increases and decreases in the DJIA index value at a one month horizon is unrealistic, what are the other elements that make the terminal value of this strategy unattainable?
4. We assume now that rebalancing your portfolio (from 100% cash to 100% DJIA or from 100% DJIA to 100% cash) is costly and that you bear transaction costs equal to 1% of the traded amount. Write a VBA program that computes the terminal value of the strategy on January 1, 2016. What is the amount lost in transaction costs? What would be the value of your profits/losses if transaction costs are set to 3%? Under which market condition is the active strategy costlier?
  5. We still assume that you are able predict with a 100% success rate next month's value of the DJIA, but this time it is assumed that rebalancing takes place only if the gain from rebalancing exceeds the loss due to transaction costs. Write a VBA program that allows to compute the terminal value of the portfolio if transaction costs are set to 1%. What is the amount that is saved with this strategy compared with the "naive" active strategy? Same question if the costs are set to 3%? Briefly comments the various results.
  6. We now consider a more realistic framework in which your success rate regarding you prediction is not equal to 100%. More precisely in  $x\%$  of the cases, you make the wrong decision, i.e. you rebalance your portfolio when you should not and you do not rebalance when you should do so.
    - (a) What changes have to be made to your program to account for this prediction error? Is it possible to compute the the terminal value of your strategy with a single price trajectory? Why?
    - (b) Compute the distribution of your profits (and losses) by running 1,000 simulations assuming that your error rate is equal to 30%. Draw a frequency diagram of the obtained distribution and comment your results.
    - (c) What conclusions can be drawn from this exercise?