

## Chapter 4: Market efficiency - part 1

### Exercises - solutions

1. Goldman's decision is an effort to 'time' the market, which assumes the ability to predict when valuations will go up again. In efficient markets prices cannot be predicted, the possibility that valuations will go up again is already included in today's price.
2. That the NPV is zero. On efficient markets securities are priced such that they earn their expected return, which makes their NPV zero.
3. Investors will sell and short sell the stock when prices are predictably high and buy when they are low. This will drive the prices down at the top of the cycle and up at the bottom of the cycle, and they will keep on buying and selling until the cycle has disappeared.
4. No, even if many investors do not follow the information on a stock and even less trade, the price can still reflect available information. Market efficiency requires that trades take place and at prices that reflect all available information, the number of investors involved is irrelevant.
5. (a) Keim and Stambaugh investigate the 'weekend effect', which claims that stock returns tend to be low or negative during weekends (e.g. from close Friday to close Monday). Using the entire period over which the New York Stock Exchange was open five days a week (before 1953 it was also open on Saturdays), they indeed find the weekend effect. The statistically significant difference between Monday returns and returns on Fridays (the same is true for Wednesdays and Thursdays) are a predictable pattern that contradicts market efficiency in its weak form. Notice that significantly positive returns on some days of the week do not, by themselves, contradict market efficiency. Stocks are expected to earn a positive return, albeit a small one, on a daily basis. It is the pattern low on Monday, high on Wednesday-Friday that contradicts market efficiency.  
In practice, the weekend effect is probably not exploitable. In most cases, the difference is likely to be smaller than the transaction costs. Moreover, the instruments may not be available (i.e. you may not be able to short the index). But investors can use the weekend effect by selling on Fridays near close if they want to sell (and not buying on Fridays) and buying on Mondays near close if they want buy (and not selling on Mondays).
- (b) In the last sub-period, Keim and Stambaugh's findings confirm what several other paper also have found: that the weekend effect has disappeared. Apparently, traders have noticed the weekend pattern and traded it away. If the difference between Mondays' and Thursdays' negative returns and Wednesdays' positive returns is statistically significant, then this can be interpreted as a contradiction of weak form market efficiency.
6. (a) The plots can visualize autocorrelation in the daily returns. Positive autocorrelation would give a clustering of the observations in the upper right and lower left quadrants of the graphs, showing that positive returns tend to be followed by positive ones and negative returns by negative ones. Negative autocorrelation would

give a clustering of the observations in the lower right and upper left quadrants of the graphs, showing that positive returns tend to be followed by negative ones and negative returns by positive ones. The figure in the question shows neither pattern, the observations are scattered over all quadrants. Hence, the graphs show no autocorrelation in daily returns and do not reveal market inefficiency.

- (b) The plots show that the single stock AF has a much larger volatility than the index: the index returns are much more clustered around the graph's origin (coordinates 0,0).
  - (c) The autocorrelation coefficients are all low, but the coefficient of Unilever is statistically significant. Significant autocorrelation rejects the hypothesis that the market is efficient. However, it is doubtful whether we can use such a low coefficient for a successful trading strategy. The square of the correlation coefficient measures the proportion of the variance of today's return that is explained by yesterday's return. For Unilever's coefficient this is less than 2%:  $-.138^2 = .019$ . Also, it is highly unlikely that Unilever will have the same autocorrelation in the next period.
  - (d) As under (c), the coefficients are low, but two of them are significantly different from zero (those for  $r_{t-2}$  and  $r_{t-3}$  of Royal Dutch Shell (RDSA)). These two contradict the efficient market hypothesis but it is, again, doubtful whether this result persists in other periods and whether it is large enough to be exploitable. The proportion of variance in today's return that is explained by the regression (measured by the  $R^2$  statistic) is lower than 5%. Note that the significant autocorrelation in UNA does not appear in the regression.
7. No, over short time intervals (e.g. days) the expected return is so small that it can be ignored in autocorrelation calculations. 20% return per year over 250 trading days means less than 0.1% per day, very small compared to daily price changes. The fair game model does not require returns (price changes) to have zero expectation, but the *excess returns*, or deviations from the expected returns. Similarly, the EMH does not require stock prices to be martingales but the *properly discounted* stock prices. The stock prices themselves are expected to increase with required rate of return on the stock.