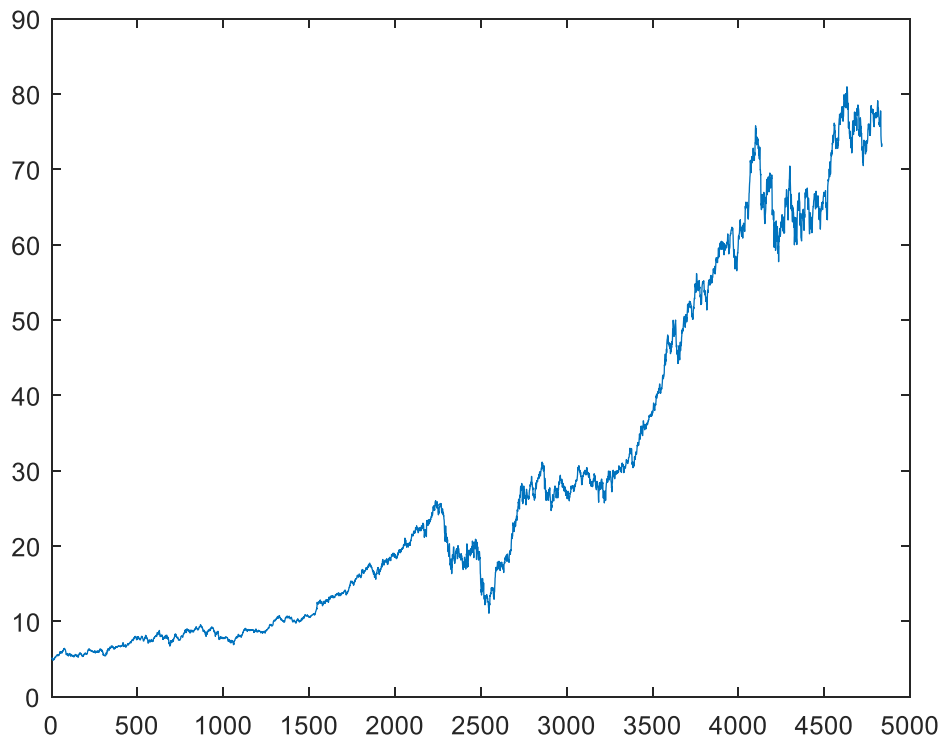


## Solutions: An Introductory Tutorial in Matlab

**Matlab** is a very popular and powerful tool for statistical, econometric and mathematical modelling, simulation and analysis. It is used by many financial institutions and other businesses and is close to the next most popular statistical software tool, behind SAS, in the business world. We will learn many other Matlab commands and functions throughout the course. This exercise was meant as a simple introduction to the environment of Matlab and to give you a reference for some common Matlab functions. **You might like to add your own commands to this document as needed throughout semester.**

### Exercises:

- (i) *Plot the CBA prices over time. Discuss the properties of CBA prices over the past decade or so. Are they predictable? Stable?*



Prices rose to nearly ten times their 1996 level (of about \$10) reaching a maximum of \$80.96 (observation 4632) but has dropped back in recent months and is currently around \$73. The effect of global financial crisis (GFC) is seen clearly with two sharp drops in 2007 and 2008, (the first is around observation 2250). Predictable? Stable?? Prices are not predictable. They move in the fashion of a random walk, though with changing variance. They can drop sharply or rise quickly and are rarely stable looking.

- (ii) Find the sample mean, median, standard deviation, skewness and kurtosis for the CBA percentage return data. Discuss the general properties of this data.

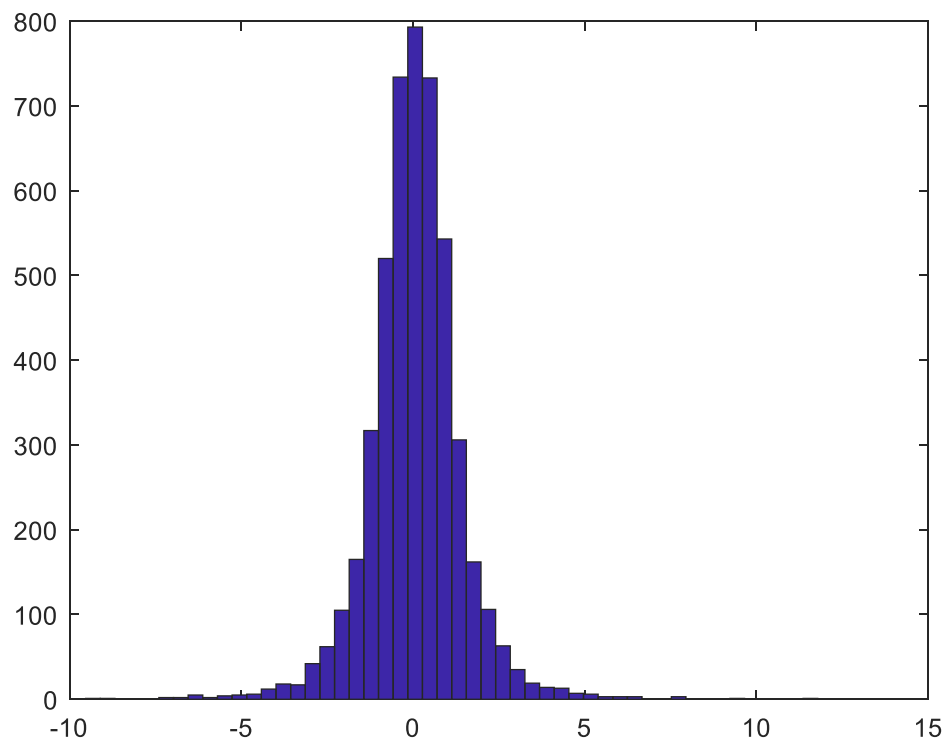
```
ret=diff(log(prices));
CBAr=100*ret;
[mean(CBAr) median(CBAr) std(CBAr) skewness(CBAr) kurtosis(CBAr)]

ans =    0.0556    0.0438    1.3495    0.0309    8.7755
```

The mean daily log return is 0.0556%, while the median is 0.0438%. Standard deviation is 1.35%. Skewness is slightly positive (-0.03) and kurtosis is way above 3 at 8.76. The data seem to be negatively skewed with highly positive excess kurtosis. The distribution seems to have fatter tails and to be more peaked than a normal distribution. See below.

- (iii) Plot a histogram of the percentage returns. Use 'hist' and type 'help hist' for assistance. Discuss the distribution of percentage returns for CBA.

```
hist(CBAr,50)
```



This is a histogram with 50 boxes or bins. Apart, from a few outlying returns, the distribution seems close to symmetric. Clearly the distribution is heavy-tailed and centred close to 0.

- (iv) Find the following percentiles of this data: 0.5%, 1%, 10%, 25%, 50%, 75%, 90%, 99%, 99.5%. Further describe the distribution of log returns.

```
[prctile(CBAr,0.5) prctile(CBAr,1) prctile(CBAr,10) prctile(CBAr,25)
prctile(CBAr,75) prctile(CBAr,90) prctile(CBAr,99) prctile(CBAr,99.5)]
```

ans = -4.6279    -3.8077    -1.3795    -0.6283    0.7583    1.4825    3.8470  
4.6751

The 25<sup>th</sup> percentile for the CBA log returns is -0.63%, and it is closer to zero than the 75<sup>th</sup> percentile, which is 0.76%. Also, the 10<sup>th</sup> percentile is -1.38%. It is closer to zero than the 90<sup>th</sup> percentile, which is 1.48%. Thus the negative percentiles at the equivalent percentile level seem less extreme than the positive equivalent percentile. This is further evidence of the positive skewness.

- (v) *What return might an investor expect to suffer on only 0.1% of days when investing in CBA stock? What does your estimate depend on?*

‘Suffer’ means on the negative side ie a loss:

```
prctile(CBAr,0.1)
```

ans =

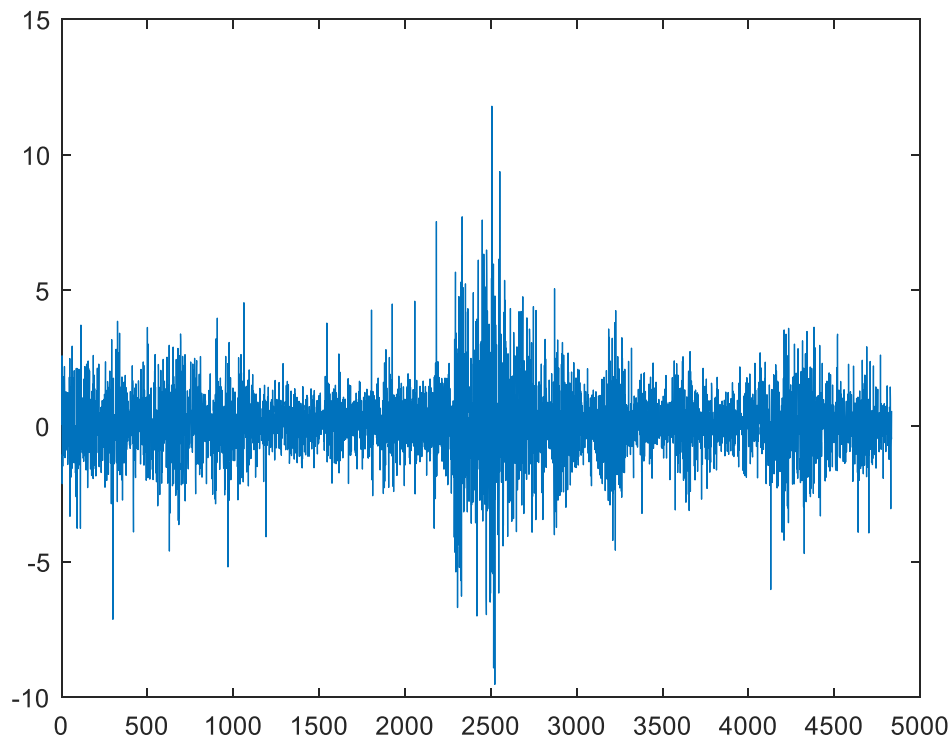
-6.8710

Only 0.1% of CBA returns are less than -6.871%.

It depends on the distribution of CBA being constant over time: i.e. strict stationarity!

- (vi) *Plot the CBA log returns over time. Discuss this plot and the time properties of CBA returns. What aspects seem to change with time? Which seem to remain fairly constant or static over time?*

```
plot(CBAr)
```



The mean return seems to stay fairly constant over time, and fairly close to 0. Extreme returns seem to occur infrequently in no real pattern, except during the GFC period in 2008 when many extreme returns occur close together (some positive and some negative). Does the volatility or variance level change with time?? (Discussed in class)