

APPENDIX VII

Historical Volatility

- 1.1 Historical volatility is a mathematical method of reducing to a single figure the dispersion of share price returns expressed as an annualised number.
- 1.2 For example, a 20 day volatility calculation measures the standard deviation in price returns over that period and is expressed on an annualised basis utilising the number of trading days per annum (250 days for present purposes). This is calculated by multiplying the standard deviation over the 20 day period by the square root of the annual number of trading days (250 days).
- 1.3 There are a number of mathematical formulas one could use to calculate historical volatility. The most widely used is the following:

Historical Volatility Formula:

$$S = \sqrt{\frac{1}{(n-1)} \sum_{y=1}^n \left(\ln \frac{y_i}{y_{i-1}} - m \right)^2}$$

$$m = \frac{1}{n} \sum_{y=1}^n \left(\ln \frac{y_i}{y_{i-1}} \right)$$

where

Variable		Description
S	=	standard deviation, i.e. volatility
m	=	mean of a sample of measurements
n	=	number of time periods being considered
y_i	=	price of share at time <i>i</i>
ln	=	Natural log of function

- 1.4 The above volatility is per time period between price measurements. To obtain volatility on an annualised basis, this number should be multiplied by the square root of the number of trading periods in a year.

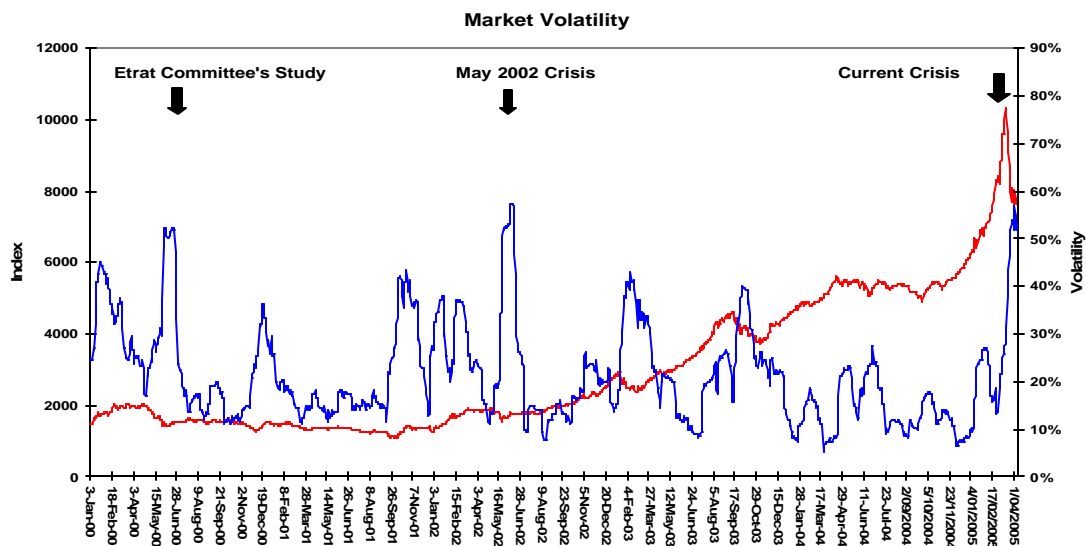
$$S_a = S \sqrt{n}$$

where **S_a** is the annual volatility and **n** is the number of trading periods in a year. **n** is usually set between 245 and 255 depending on the actual number of trading days in a year. As a rule of thumb, for KSE markets, allowing for weekends, and public holidays

the number of days is set at 250. These formulas are widely used by traders in the market to calculate historical volatility. There are other formulas, some of which use slightly different measures of price change, however this formula is the most widely used.

- 1.5 Historical volatility can be calculated on a daily basis or an intra-day basis. The dispersion of prices over different periods of time is used to calculate daily and intra-day volatility.
- 1.6 The historical daily volatility of KSE 100's Share Price Index for the period 3rd January 2000 to 1st April 2005 is depicted in the following graph.

KSE 100 Share Price Index and Volatility



- 1.7 The left hand scale is KSE 100's price and the right hand scale the historical volatility.
- 1.8 As depicted above KSE 100's 20 day/250 trading day historical volatility ranged from 7% to over 50%, between 3rd January 2000 and 1st April 2005. As can be seen from the above Graph, volatility increased in March 2005 as the KSE 100 increased.