Exercise Session for Financial Data Analysis  
Summer term 2010  
Problem Set 3  

We consider weekly observations of the MSCI World stock market index from January 1990 to February 2010 (1049 observations).\(^1\) Returns are calculated as

\[
r_t = 100 \times \log \left( \frac{I_t}{I_{t-1}} \right),
\]

where \(I_t\) is the index level at time \(t\). Returns are calculated from Wednesday to Wednesday in order to avoid issues such as possible abnormal Monday or Friday returns.

**Problem 1** Several properties of the index and the index returns are summarized in Table 1 and Figures 1 and 2. Explain.

<table>
<thead>
<tr>
<th>Table 1: Basic statistics of MSCI returns.</th>
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<tbody>
<tr>
<td>Mean</td>
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<tr>
<td>0.066</td>
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</table>

“Skewness” denotes the moment-based coefficient of skewness, \(\gamma = \frac{m_3}{m_2^{3/2}}\), and “Kurtosis” the moment-based coefficient of kurtosis, \(\kappa = \frac{m_4}{m_2^2}\), where \(m_i = T^{-1} \sum_t (r_t - \bar{r})^i\), \(i = 2, 3, 4,\) and \(\bar{r} = T^{-1} \sum_t r_t\). JB is the Jarque–Bera test for normality, based on the result that, under normality, \(JB = T\frac{\gamma^2}{6} + T(\kappa - 3)\frac{2}{24} \sim \chi^2(2)\), with \(p\)-value given in parentheses.

\(^1\)For more information on the index, see, e.g., [http://en.wikipedia.org/wiki/MSCI_World](http://en.wikipedia.org/wiki/MSCI_World).
Sample autocorrelations of index level

Sample autocorrelations of log of index level

Figure 1: MSCI index level.
Figure 2: MSCI index returns (1).