CHAPTER- 7

A Study of the Relation between Stock Market Indices and Commodity Prices

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A Study of the Relation between Stock Market Indices and Commodity Prices

7.1 Introduction

The stock markets are only one component of the market structure of the economy. As pointed out in the introduction to this work, there is another branch of the markets that deals with commodities. The two markets have their own unique characteristics. Both attract a lot of popular attention from the investing community. Naturally a question may arise with regard to the possible inter-relationship among the two kinds of markets and whether one can impact the behaviour of the other.

This chapter intends to complete the circle of analysis that was initiated in Chapter 5. After examining the relationships between primary and sectoral indices on the leading Indian exchanges in Chapter 5, followed by a comparison between Indian and international indices in Chapter 6, the present chapter is intended to complete the picture by drawing up a comparison across markets, i.e., a comparison between the Indian stock markets (as manifested through the Sensex) and the international commodity markets (as exemplified through the international prices of two leading and widely-followed commodities, viz.-, gold and petroleum). After the wide canvases drawn up in the previous analyses, the scope of the present study has been purposely kept limited, partly due to the fact that this work does not have commodities as its focus, and partly because of time constraints.

The choice of gold and petroleum from amongst the commodities is based on the fact that each has its own significance in the mind of the Indian consumer. India as a country has one the largest markets for gold in the world. It is common to find households in India spending a percentage of their savings on gold which is then kept either at home or in bank lockers. Thus gold can be treated here as an alternative form of investment. In other words gold diverts investment that could have found its way to the stock market. From this perspective it may be worthwhile to examine the relationship between stock markets and gold prices.
On the other hand, the importance of oil as a commodity can hardly be over emphasised. Oil prices drive economies around the world. They also have a direct impact on the prices of oil scrips and consequently on the broader stock market. This would suggest that oil should be a natural choice as a commodity to be studied in conjunction with the stock market.

### 7.2 The Analytical Framework: Data and Methodology

As in case of the previous two analyses, the present analysis will also follow the three way paradigm, viz. - unit root tests (employing the ADF test), followed by cointegration analysis employing the Johansen procedure and rounds up with the Granger Causality test for determining the causal relationship among the series involved. The data and methodology constituting the study has been discussed earlier in Section 3 of Chapter 3.3 (Data and Methodology).

### 7.3 Unit Root and Cointegration Analysis.

#### 7.3.1 Unit Root Test for the Sensex and International Commodity Prices

The results of the unit root tests are summarised in the following table:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Data Series</th>
<th>Value of Test Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sensex</td>
<td>-2.13322</td>
<td>0.5263</td>
</tr>
<tr>
<td>2.</td>
<td>Oil</td>
<td>-1.903353</td>
<td>0.6524</td>
</tr>
<tr>
<td>3.</td>
<td>Gold</td>
<td>-2.393164</td>
<td>0.3830</td>
</tr>
</tbody>
</table>

In each the value of the ADF test statistic falls well within the tabulated value of the test statistic at the 1%, 5% and 10% levels of significance. In other words, we are unable to reject the null hypothesis, thus implying that each of the above data series has a unit root, i.e., the chosen data series for Sensex as well as the series for international prices of oil and gold are all stationary. This
allows us to proceed for the next step, viz., cointegration analysis by the Johansen procedure.

7.3.2 Cointegration Analysis for the Sensex and International Commodity Prices

In the second stage of our analysis we proceed with the cointegration analysis through the Johansen procedure. The results of the test suggest that there may be at least one cointegrating equation at the 5% level of significance.

Table 7.2: Results of Trace Test and Maximum Eigen Value Test

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None*</td>
<td>0.047409</td>
<td>127.1011</td>
<td>42.91525</td>
<td>0</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.004159</td>
<td>15.43958</td>
<td>25.87211</td>
<td>0.5382</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.002545</td>
<td>5.858213</td>
<td>12.51798</td>
<td>0.4785</td>
</tr>
</tbody>
</table>

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

<table>
<thead>
<tr>
<th>Hypothesized No. of CE(s)</th>
<th>Eigenvalue</th>
<th>Max-Eigen Statistic</th>
<th>0.05 Critical Value</th>
<th>Prob.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>None*</td>
<td>0.047409</td>
<td>111.6615</td>
<td>25.82321</td>
<td>0</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.004159</td>
<td>9.581364</td>
<td>19.38704</td>
<td>0.6635</td>
</tr>
<tr>
<td>At most 2</td>
<td>0.002545</td>
<td>5.858213</td>
<td>12.51798</td>
<td>0.4785</td>
</tr>
</tbody>
</table>

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
The cointegrating equation is specified in the table that follows:

**Table 7.3: Cointegrating Equation for comparison between Sensex and commodities series**

\[
\begin{bmatrix}
    d(\text{Gold Dollars})(t) \\
    d(\text{Oil Dollars})(t) \\
    d(\text{SENSEX})(t)
\end{bmatrix}
= \begin{bmatrix}
    -0.005 \\
    -0.031 \\
    -0.051
\end{bmatrix}
+ \begin{bmatrix}
    1.000 & 8.482 & -0.009 \\
    0.004 & -0.065 & 0.001 \\
    -0.638 & -0.050 & 0.071
\end{bmatrix}
\begin{bmatrix}
    d(\text{Gold Dollars})(t-1) \\
    d(\text{Oil Dollars})(t-1) \\
    d(\text{SENSEX})(t-1)
\end{bmatrix}
+ \begin{bmatrix}
    -0.006 & -0.030 & -0.000 \\
    0.014 & -0.058 & -0.002 \\
    1.294 & -5.022 & 0.001
\end{bmatrix}
\begin{bmatrix}
    d(\text{Gold Dollars})(t-2) \\
    d(\text{Oil Dollars})(t-2) \\
    d(\text{SENSEX})(t-2)
\end{bmatrix}
+ \begin{bmatrix}
    0.922 \\
    0.000 \\
    8.092
\end{bmatrix}
\]

Which entities may enjoy such a relationship can become clear only after we undertake the Granger Causality Test for the three data series. This leads us to the third stage of our analysis.
7.3.3 Granger Causality Test for the Sensex and International Commodity Prices

The Granger Causality tests show that all three series Granger-cause one another, i.e., there is a cause-and-effect relationship among Sensex and oil, Sensex and gold, as well as gold and oil. At the same time commodities as a whole (in this case the combination of gold and oil) can jointly Granger-cause the Sensex. The results of the Granger Causality tests are summarised in the following tables:

Table 7.4: Results of Granger Causality Tests

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>$H_0$</th>
<th>Result of Test</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sensex does not Granger-cause gold and oil.</td>
<td>REJECTED</td>
<td>0.0001</td>
</tr>
<tr>
<td>2.</td>
<td>Oil does not Granger-cause gold and Sensex.</td>
<td>REJECTED</td>
<td>0.0000</td>
</tr>
<tr>
<td>3.</td>
<td>Gold does not Granger-cause oil and Sensex.</td>
<td>REJECTED</td>
<td>0.1914</td>
</tr>
<tr>
<td>4.</td>
<td>Gold and oil do not Granger-cause Sensex.</td>
<td>REJECTED</td>
<td>0.002</td>
</tr>
</tbody>
</table>

It is obviously not difficult to understand the results of these tests. Clearly the effect of international gold and oil prices on the values of the Sensex is more obvious than the converse. However, the latter proposition can become more acceptable if one considers that in an environment of greater integration among the global stock indices, the Sensex too can have an effect on gold and oil prices. As India has the second largest growth market among the developing nations (after China) it is both a fact as well as a reality that the rapidly growing economy will consume substantial quantities of oil, which in turn can impact international prices of the commodity. Again, it is a well-known fact that India has always had one of the largest markets for the yellow metal. Naturally it is to be expected that the significant amount of transactions in gold here will influence global gold prices.
Lastly increasing integration among different markets along with almost instantaneous access to information across the world implies that commodity markets as a whole will affect the investment patterns in the Indian stock markets, and hence the index values in the latter. The opposite also holds true, since changes in investment patterns in the stock markets will obviously influence the extent of exposure taken in the commodity markets. For example, a downward spiral in the stock markets may cause investors to reduce investment levels in securities. The investment so withheld can naturally find its way to the commodity markets, which are increasingly emerging as a promising avenue for investment.

**7.4 Indian Stock Indices vs Commodity Prices: A Comparison.**

The preceding analysis shows that there is obviously some kind relationship amongst the Sensex and the commodities chosen. This is confirmed by both cointegration analysis as well as the causality tests. On the whole it can be said that the financial and commodity markets being the two sides of the same coin, it is to be expected that a to-and-fro causal relationship will exist among the Sensex and the international prices of gold and oil. The obvious fallout of this is that events in one can be used to foretell occurrences in the other.

The scope of this study is rather limited for the reasons that have been mentioned before. There is always scope to increase the basket of commodities chosen and to see whether the same conclusions hold in the long run.