TSA – A Computer Program for Technical Analysis of Stocks

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Abstract - Technical analysis is based on the widely accepted premise that security prices are determined by the supply and the demand for securities. With adequate tools technical analysis is recording historical financial data on charts, i.e. bar charts and line charts, studying these charts in an effort to find meaningful patterns, and using these patterns to predict future prices.

To analyze the pros and cons of technical analysis in this article an educational computer program called TSA is presented, which calculates on the basis of daily high, low and close prices of stocks or other securities bar charts and line charts of stocks.

Taking into account different moving averages (50, 100 and 200 days) and actual daily stock prices of 30 stocks in the DJIA the program is graphing the trades and simulates the results of such trades. It calculates the number of profitable and unprofitable trades, the average trading profit or loss, the maximum trading profit or loss and at the end the net profit if it exists.

The goal of such an approach for students is to simulate different investment strategies without the risk of loosing real money and therefore being better prepared for "real life" investments in the mature financial markets and in the more volatile emerging financial markets.

II. TECHNICAL ANALYSIS

Technical analysis is based on the widely accepted premise that security prices are determined by the supply of and the demand for securities. While fundamental analysis tries to estimate the intrinsic value of securities, technical analysis studies the effects of supply and demand - that is, the price movements themselves. [1] With adequate tools technical analysis is recording historical financial data on charts, studying these charts in an effort to find meaningful patterns, and using these patterns to predict future prices. Some charting techniques are used to predict the movements of a single security; some are used to predict the movements of a market index and others to predict both the action of individual securities and the market action.

The basic assumptions of technical analysis are [4] :

a. Market value is determined solely by the interaction of supply and demand.  
b. Supply and demand are governed by numerous factors, both rational and irrational.  
c. In disregard of minor fluctuations in the market, stock prices tend to move in trends which persist for an appreciable length of time.  
d. Changes in trend are caused by the shifts in supply and demand.  
e. Shifts in supply and demand, no matter why they occur, can be detected sooner or later in charts of market action.  
f. Some chart patterns tend to repeat themselves.

Given these assumptions technical analysis can be used for at least three purposes [7]:

• Price forecasting. Technical analysis can project price movements either in tandem with fundamental approach or solely on the basis of charted movements.  
• Market timing. Chart analysis is much better suited than the fundamental approach for determining exactly when to buy and sell.  
• Leading indicator. If market action discounts all influences on it, then price movement may be considered as a leading indicator and may be used in two ways. First, the chartist may – without regard for why prices are moving in one direction or the other – buy or sell. Second, an annual price movement can be taken as a signal that some influence or another on the market has not been accounted for in the
fundamentalist’s analysis or previous and that further study is required.

A. Bar charts

Technical analysis uses three basic types of charts: bar charts, point-and-figure charts and line charts. Bar charts have vertical bars representing each day’s price movement. Fig. 1. shows a typical bar chart. This chart depicts price changes and the volume of stocks traded on the vertical axis and the time on the horizontal axis. The price change is indicated by a vertical bar showing the high price, low price, and closing price for uniform time intervals. These time intervals can be daily, weekly or monthly. The number of stocks traded, or volume, is shown at the bottom of the chart. Some bar chartist contend that price, volume, and time are essential ingredients for the proper interpretation of the patterns that develop. Other chartists depend primarily on price changes.

B. Point and figure charts

Point and figure charts differ from bar charts in three aspects. First, only significant price changes are recorded. Thus, a stock is required to fluctuate a certain number of points (1, 2, or 3) before the change is recorded. Second, there is no time dimension, such as daily or weekly recordings. However some point-and-figure chartists do record the month in which price changes occur. Finally, no volume is recorded. Thus, point and figure charts reflect only price change and direction of that change.

Construction of a point and figure chart requires several basic steps [12]:
• Every time the price of a stock increases by, say, one point (1 US$) mark an x in the appropriate box.
• Every time the price of a stock declines by one point mark an 0 in the appropriate box.
• Every time the direction of price change is reversed, start a new column.

Fig. 2. shows a typical point and figure chart.

C. Line charts and moving averages

A line chart is used to denote the trend of a single financial asset. An example could be the closing price of a stock, bond or a currency. A moving average is an average of closing prices over a certain number of days.[5] For example a 200-day moving average include the past 200 days’ prices. It is «moving» because, as the latest day’s prices are included in the average, the oldest day's prices are left out.

Moving averages can be applied on market averages, like the Dow Jones Industrial Average or the Financial Times Stock Exchange 100 index in London. (Fig. 3.)

III. THE PROGRAM TSA AND ITS STRUCTURE

Based on the theoretical framework and concepts elaborated above the program TSA illustrates on the basis of daily high-low-close prices of stocks or other securities bar charts and line charts of stocks. It calculates moving averages and carries out a trading strategy following the principles of technical analysis. It provides also an ex-post “what if” analysis of the implemented strategy and shows the financial outcome of such a trading system (net profit or loss).
To do so the program is divided in four parts (menus) the Root menu, the Files menu, the Chart Analysis menu and the Quit menu. Help is always available by typing F1, and date and time are also displayed. Microsoft compatible mouse support is also built in the program. [10] [11]

In the Root menu general functions of the program are explained as well as basic movements through the program by using up and down arrow keys or the integrated mouse support. It is pointed out that the computer program TSA or Technical Stock Analysis is a software for chart analysis of stocks based on high-low-close stock prices. (Fig. 4.)

The second menu or the File menu is used for two purposes: first, to retrieve stock prices in data files and second to exit to DOS or Windows operating system. After selecting the choice for retrieving files, a vertical menu is displayed containing all data files in the current directory of the PC. By selecting one file, i.e. a series of daily high-low-close stock prices of a stock included in the Dow Jones Industrial Average (other securities, currencies etc. could be used as well) the chosen name of the stock is displayed in the main menu. (Fig. 5.)

The most important part of the program is the Chart Analysis menu where two different types of charts of stocks are displayed. The first one illustrates a bar chart based on daily high-low-close prices of stocks and the second one a line chart where actual close stock prices are presented together with selected moving averages (50, 100 or 200 days). (Fig. 6.)

After deciding which moving average to choose the program switches in graphic mode and the two graphs are displayed one after the other. It is important to stress that in the second graph the program is carrying out a complete trading strategy based on the principles of technical analysis. When daily stock prices break out above the moving average a buy signal is showed and vice versa, when the daily price falls below the moving average a sell signal is presented. (Fig. 7. and Fig. 8.)
After that, a complete "what if" analysis is done by taking into account every trading transaction when stocks are bought or sold according to the trading strategy mentioned above. That means that for every transaction the price at which a stock is bought and sold is presented, as well as the profit and the position after each transaction.

At the end, a so called summary statistic is elaborated where the number of profitable and unprofitable trades, the average trading profit or loss, the maximum trading profit or loss and the remaining net profit are calculated.[8] (Fig. 9. and Fig. 10.)

### Summary Statistic

<table>
<thead>
<tr>
<th>Buy</th>
<th>Sell</th>
<th>Profit</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>33.60</td>
<td>36.30</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>37.63</td>
<td>36.50</td>
<td>-1.13</td>
<td>1.37</td>
</tr>
<tr>
<td>36.63</td>
<td>36.38</td>
<td>-0.25</td>
<td>1.12</td>
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<tr>
<td>36.88</td>
<td>39.75</td>
<td>2.87</td>
<td>3.99</td>
</tr>
<tr>
<td>39.08</td>
<td>38.13</td>
<td>-1.75</td>
<td>2.24</td>
</tr>
</tbody>
</table>

Press RETURN . . .

Fig. 9. Transactions report screen

<table>
<thead>
<tr>
<th>Number of profitable trades: 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of unprofitable trades: 3</td>
</tr>
<tr>
<td>Average trading profit: 2.69</td>
</tr>
<tr>
<td>Average trading loss: -1.04</td>
</tr>
<tr>
<td>Maximum trading profit: 2.87</td>
</tr>
<tr>
<td>Maximum trading loss: -1.75</td>
</tr>
<tr>
<td>Net Profit: 2.24</td>
</tr>
</tbody>
</table>

Press RETURN . . .

Fig. 10. Summary statistic screen

### IV. PROGRAM DISTRIBUTION AND INSTALLATION

TSA is an educational computer program so its delivery and installation are very easy. The program consists of seven application files (tsa.exe, t01.exe, t02.exe, t03.exe, egavga.bgi, error.msg, 4x6.fon), 30 data files (*.dat, which include high-low-close prices of 30 stocks in the Dow Jones Industrial Average) and a file named dowjon.txt where the ticker symbols of the 30 DJIA stocks are explained.

To install the program TSA it is necessary to copy all the files to a directory on the hard disk of a PC (for example C:\TSA) and to start the program by typing (TSA) (Enter). Help is always available by pressing (F1) and pull down menus can be activated by highlighting the menu item or by using Microsoft compatible mouse.

### V. CONCLUSION

TSA is an educational computer program which calculates on the basis of daily high-low-close prices of stocks bar charts and line charts. Taking into consideration different moving averages (50, 100 and 200 days) and daily prices of 30 stocks in the DJIA the program is graphing the trades and simulates the results of such trading strategy. It calculates the number of profitable and unprofitable trades, the average trading profit or loss, the maximum trading profit or loss and at the end the net profit. This program is very useful for students because it simulates different investment strategies without the risk of loosing real money and therefore the students are better prepared for "real life" investments in the very volatile financial markets today.

TSA was carefully programmed in Turbo Pascal using its Turbo Graphix Toolbox and other libraries, so it is running on PCs with Operation Systems ranging from MS DOS to Windows Vista.

### REFERENCES