International Finance

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Real Exchange rates

Real exchange rates

An equivalent way of viewing the real exchange rate is that it represents the relative price levels in the domestic and foreign countries. Mathematically, we can represent the foreign price level in terms of the domestic currency as:

$$\text{Foreign price level in domestic currency} = S_{d/f} \times P_f$$

where $S_{d/f}$ is the spot exchange rate (quoted in terms of the number of units of domestic currency per one unit of foreign currency) and P_f is foreign price level quoted in terms of the foreign currency. We can define the domestic price level, in terms of the domestic currency, as P_d. Hence, the ratio between the foreign and domestic price levels is:

$$\text{Real exchange rate}_{d/f} = (S_{d/f} \times P_f)/P_d = S_{d/f} \times (P_f/P_d)$$

Real exchange rates

For example, for a British consumer wanting to buy goods made in the Eurozone, the real exchange rate (defined in GBP/EUR terms; note that the domestic currency for the United Kingdom is the price currency, not the base currency) will be an increasing function of the nominal spot exchange rate (GBP/EUR) and the Eurozone price level and a decreasing function of the UK price level. This is written as:

$$\text{Real exchange rate}_{\frac{GBP}{EUR}} = S_{\frac{GBP}{EUR}} \times \left(\frac{CPI_{EUR}}{CPI_{UK}} \right)$$

Real exchange rates

Let's examine the effect of movements in the domestic and foreign price levels, and the nominal spot exchange rate, on the real purchasing power of an individual in the United Kingdom wanting to purchase Eurozone goods. Assume that the nominal spot exchange rate (GBP/EUR) increases by 10 percent, the Eurozone price level by 5 percent, and the UK price level by 2 percent. The change in the real exchange rate is then:

$$\left(1+\frac{\Delta S_{\frac{d}{f}}}{S_{\frac{d}{f}}}\right)\times\frac{\left(1+\frac{\Delta P_f}{P_f}\right)}{\left(1+\frac{\Delta P_d}{P_d}\right)}-1=(1+10\%)\times\frac{1+5\%}{1+2\%}-1\approx 10\%+5\%-2\%\approx 13\%$$

Real exchange rates

The real exchange rate for a currency can be constructed for the domestic currency relative to a single foreign currency or relative to a basket of foreign currencies. In either case, these real exchange rate indexes depend on the assumptions made by the analyst creating them. Several investment banks and central banks create proprietary measures of real exchange rates. It is important to note that real exchange rates are *not* quoted or traded in global FX markets; they are only indexes created by analysts to understand the international competitiveness of an economy and the real purchasing power of a currency.

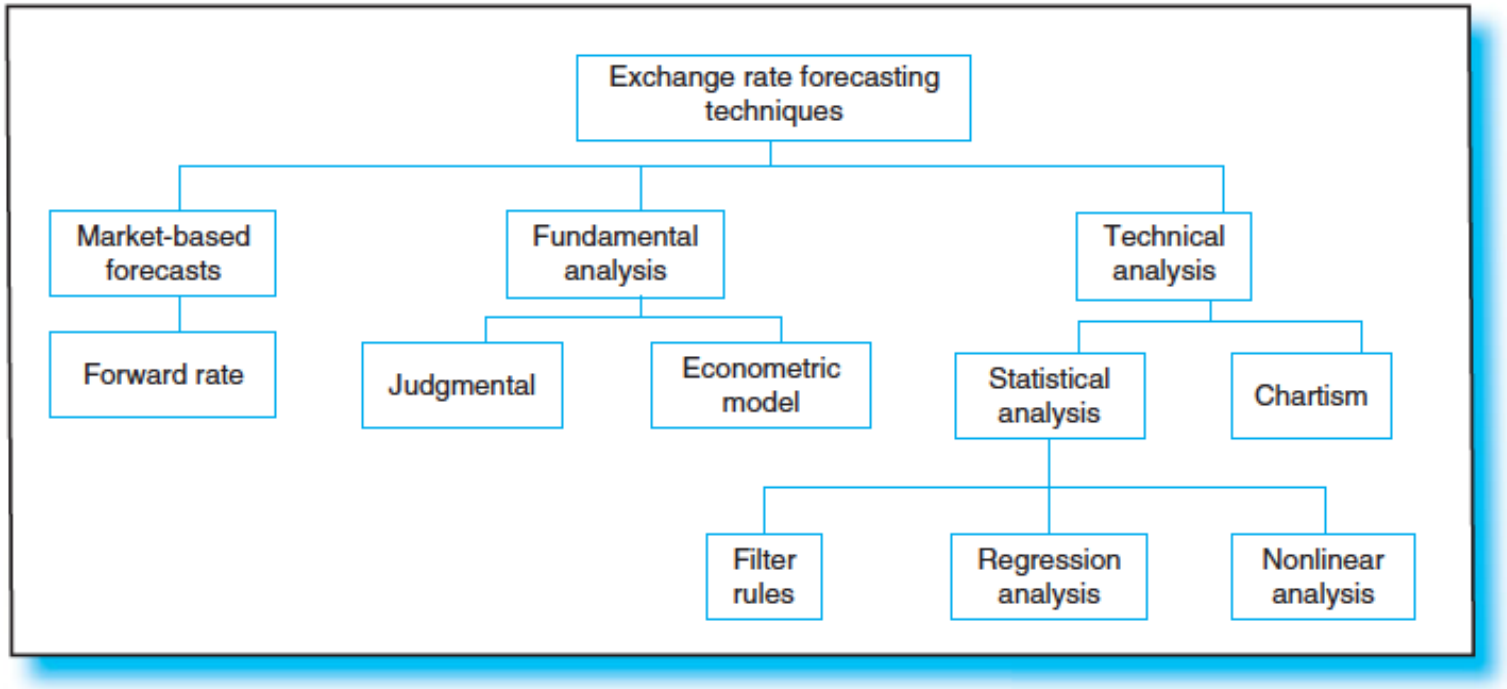
Forecasting exchange rates (Based on Rossi, 2013)

Which predictors to use? Which forecast horizon to predict? Which model to estimate? Which data frequency? Which sample?

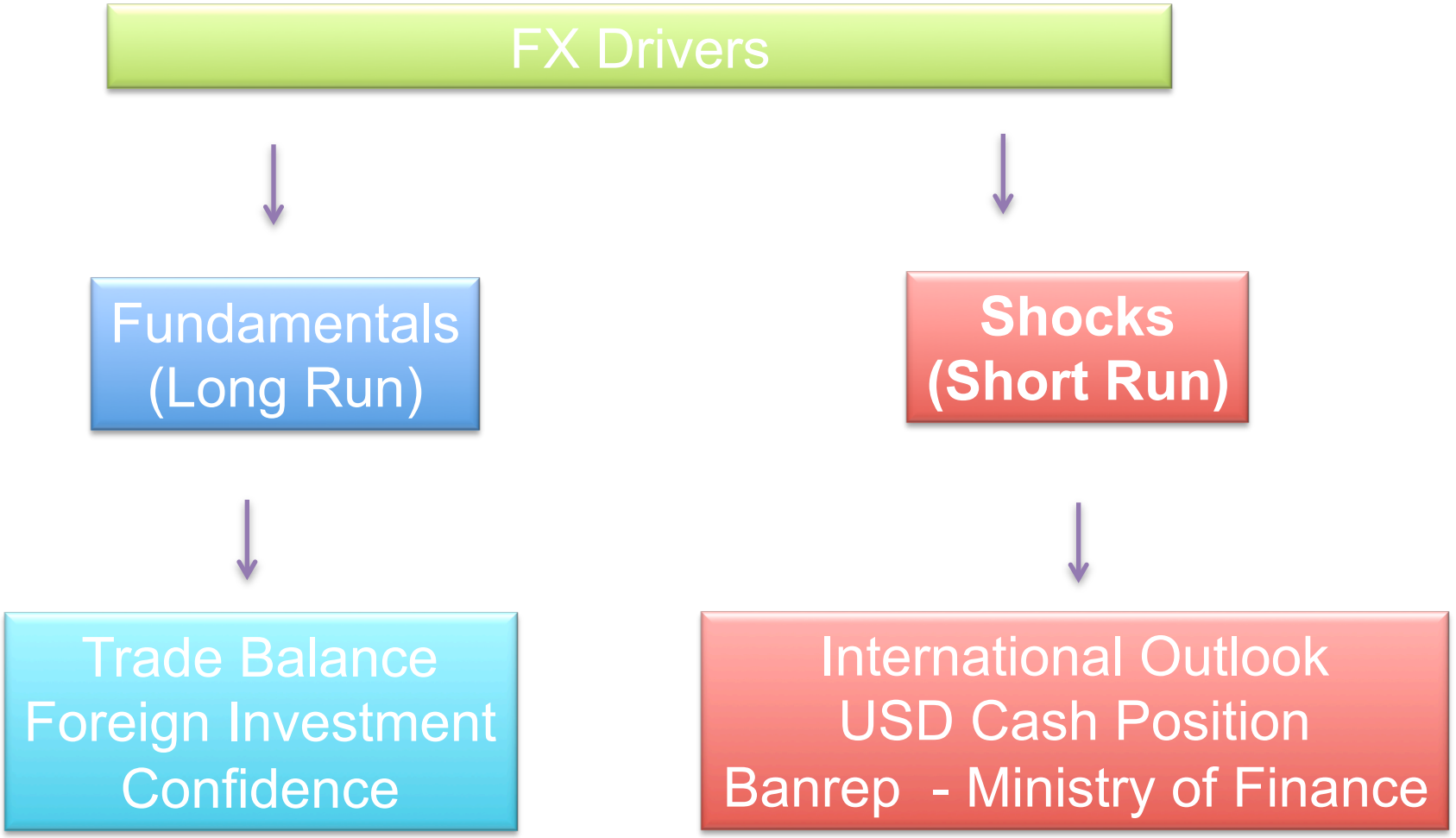
Forecasting exchange rates

- Since Meese and Rogoff (1983a,b, 1988), it has been well known that exchange rates are very difficult to predict using economic models; in particular, a simple, a-theoretical model such as the random walk is frequently found to generate better exchange rate forecasts than economic models.
- The latter finding is known as "the Meese and Rogoff puzzle".

Forecasting exchange rates



What variables you should look?


FX Drivers
Fundamentals (Long Run)
Shocks (Short Run)
Trade Balance
Foreign Investment
Confidence
International Outlook
USD Cash Position
Banrep - Ministry of Finance

The relationship between the exchange rate and its fundamental can be described by several models. For expositional purposes, let the model be linear and such that it does not include a constant term:

$$E_t\left(s_{t+h} - s_t\right) = \beta f_t, \quad t = 1, 2, ..., T,$$

Let the benchmark model be the random walk without drift:

$$E_t\left(s_{t+h} - s_t\right) = 0.$$

The forecasting ability of the model is measured by a loss function; for example, a common choice is the Root Mean Squared Forecast Error (RMSFE),

$$RMSFE_f \equiv \frac{1}{P}\sum_{t=R}^{T}\left(\varepsilon^f_{t+h|t}\right)^2$$

Exchange rate forecasts

- Themodel forecasts better than the random walk if

$$RMSFE_f < RMSFE_{rw} \equiv \frac{1}{P}\sum_{t=R}^{T}\left(\varepsilon_{t+h|t}^{rw}\right)^2$$

(a) Interest Rate Differentials

Uncovered interest rate parity (UIRP) dates back to Fisher (1896) – see Dimand (1999). Fisher (1896) provided a general analysis of how interest rates can be related to expected changes in the relative value of units of account or commodities: one of the examples he considered concerned international currencies, and has become known as UIRP. UIRP states that, in a world of perfect foresight[11] with a nominal bilateral exchange rate S_t, investors can buy $1/S_t$ units of foreign bonds using one unit of the home currency, where S_t denotes the price of foreign currency in terms of home currency. Let the foreign bond pay one unit plus the foreign interest rate between time t and $t+h$, i^*_{t+h}. At the end of the period, the foreign return can be converted back in home currency and equals $S_{t+h}\left[\left(1+i^*_{t+h}\right)/S_t\right]$ in expectation. By arbitrage and in the absence of transaction costs, this return must be in expectation equal to the return of the home bond, $1+i_{t+h}$. That is, $\left(1+i^*_{t+h}\right)E_t\left(S_{t+h}/S_t\right) = 1+i_{t+h}$, where $E_t(.)$ denotes the expectation at time t. Finally, by taking logarithms and ignoring Jensen's inequality, the previous UIRP equation can be rewritten as:

$$E_t\left(s_{t+h}-s_t\right) = \alpha + \beta\left(i_{t+h}-i^*_{t+h}\right), \tag{1}$$

(b) Price and Inflation Differentials

According to Purchasing Power Parity (PPP), the real price of comparable commodity baskets in two countries should be the same. That is, the price level in the home country, converted to the currency of the foreign country by the nominal exchange rate, should equal the price level of the foreign country. Thus, a unit of currency in the "home" country will have the same purchasing power in the "foreign" country. The theory, due to Cassel (1918), was developed during the debate on the appropriate value of nominal exchange rates among major industrialized countries after the hyper-inflations in World War I. Let the logarithm of the commodity price (CP) index in the home and foreign countries be denoted by p_t and p_t^*, respectively. Then, PPP implies that:

$$s_t = \alpha + \beta \left(p_t - p_t^* \right) + \varepsilon_t. \tag{2}$$

(c) Money and Output Differentials

According to the monetary model of exchange rate determination, bilateral nominal exchange rate fluctuations should reflect movements in countries' relative money, output, interest rates and prices. The monetary model was first introduced by Frenkel (1976) and Mussa (1976), and builds on a simple small open economy model where real output is exogenous. Real money demand is viewed as a function of income and the interest rate; by using UIRP and PPP to substitute relative interest rates and prices as function of exchange rates, one obtains a relationship between exchange rates, money and output differentials. More in detail, let m_t be the logarithm of nominal money, y_t be the logarithm of real output, and the horizon, h, equals 1. Then, real demand for money is modeled as:

$$m_t - p_t = -\eta i_{t+1} + \phi y_t.$$

$$s_t = \eta \left(i_{t+1} - i^*_{t+1}\right) - \phi \left(y_t - y^*_t\right) + \left(m_t - m^*_t\right)$$

$$s_t = \eta \left(i_{t+1} - i^*_{t+1}\right) - \phi \left(y_t - y^*_t\right) + \left(m_t - m^*_t\right) + \zeta_2 \left(p_t - p^*_t\right)$$

(d) Productivity Differentials

More general monetary models that include additional predictors have been considered by several authors. For example, Cheung, Chinn and Pascual (2005) consider a model where PPP does not hold even in the long run; instead, relative prices $(p_t - p_t^*)$ are expressed as a function of productivity differentials z_t following Balassa (1964) and Samuelson (1964):

$$s_t = \eta \left(i_{t+1} - i_{t+1}^*\right) - \phi \left(y_t - y_t^*\right) + \zeta_1 \left(m_t - m_t^*\right) + \zeta_2 z_t + \varepsilon_t. \tag{5}$$

(e) Portfolio Balance

Traditional portfolio balance models (Frankel, 1982; Hooper and Morton, 1982) include a measure of stock balances:

$$s_t = \beta_0 + \beta_1 \left(i_t - i_t^* - E_t \left(s_{t+1} - s_t \right) \right) + b_t - b_t^*, \tag{6}$$

Summary of Empirical Findings

Overall, the empirical evidence based on the traditional predictors is not favorable to the economic models. While the out-of-sample forecasting ability of the economic predictors occasionally outperforms that of a random walk in some studies for some countries/time periods, it definitely does not systematically do so. More importantly, with a few exceptions, their predictive ability is not significantly better than that of a random walk at short horizons. The main exception is the work by Clark and West (2006) regarding the out-of-sample predictive ability of UIRP; the next sections will investigate the reasons why their finding is different from the rest of the literature. At longer horizons, there is more evidence of predictive ability in favor of the monetary model, although the finding is contentious. At the same time, some predictors (i.e. interest rate differentials) show significant in-sample fit, although with coefficient signs that are inconsistent with economic theory.

New approaches

- Taylor rule fundamentals
- External imbalances
- Commodity prices

Technical Analysis vs. Fundamental Analysis

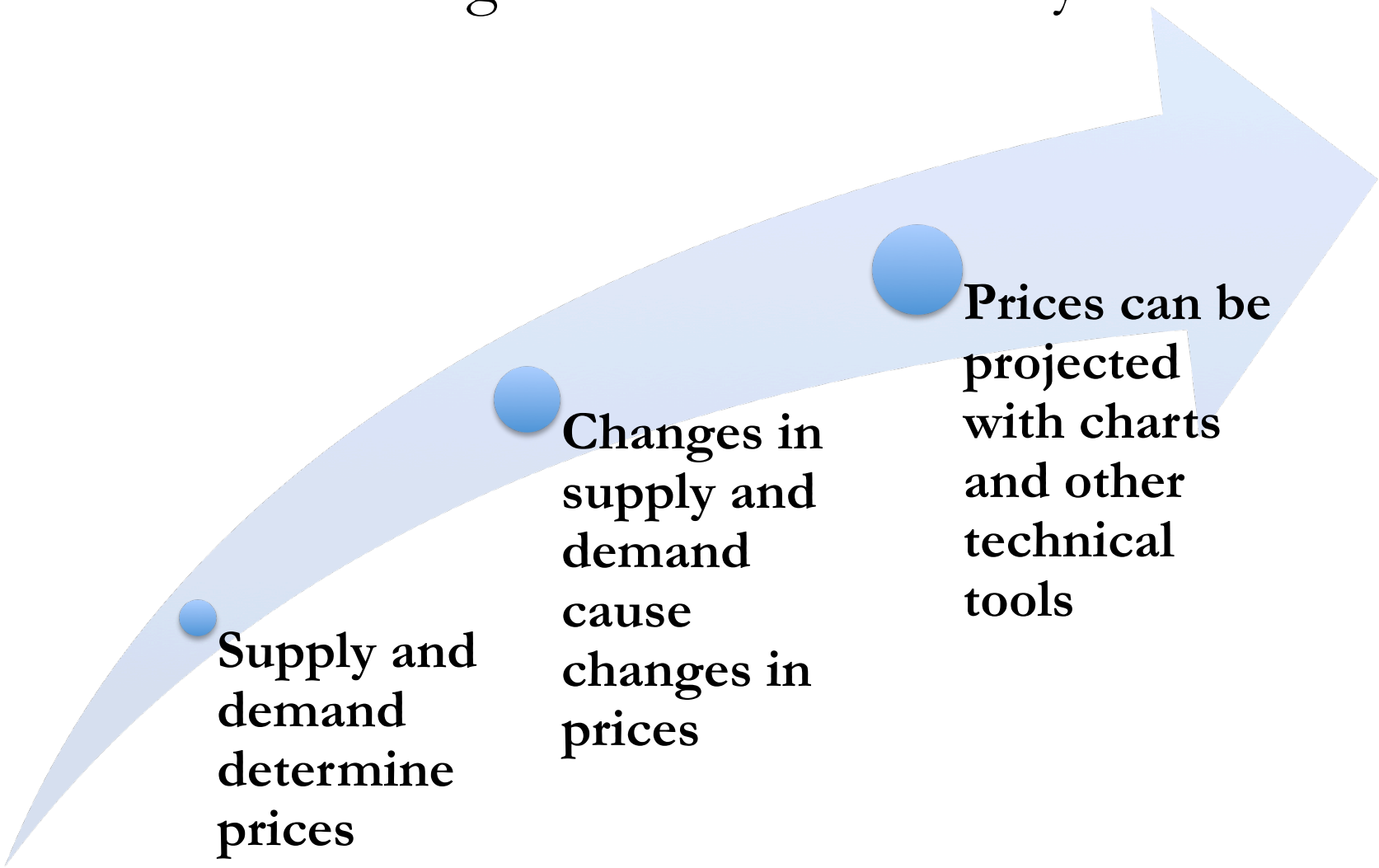
- **Fundamental analysts** look for changes in asset values (risk and return) that lead to changes in supply and demand and believe asset values adjust quickly to new information about value

- **Technical analysts** look directly for signals and indicators of changes in supply and demand and believe asset prices move in trends that can persist for long periods

Technical Analysis

- Technical analysis is the study of collective market sentiment, as expressed in buying and selling of assets.
- It is based on the idea that prices are determined by the interaction of supply and demand. The market price equates supply and demand at any instant.
- Only participants who actually trade affect prices, and better-informed participants tend to trade in greater volume.
- Thus, price and volume reflect the collective behavior of buyer and sellers.

The Logic of Technical Analysis



Assumptions of Technical Analysis

- Asset values determined by supply and demand
- Supply and demand are driven by both rational and irrational behavior
- Asset prices move in trends that persist for long periods
- While causes of changes in supply and demand are difficult to determine, the changes themselves can be observed in market price behavior

Advantages of Technical Analysis

- Quick and easy (sometimes)
- Does not involve messing with data and adjusting for accounting changes and differences
- Incorporates psychological as well as economic (rational as well as irrational) reasons behind price changes

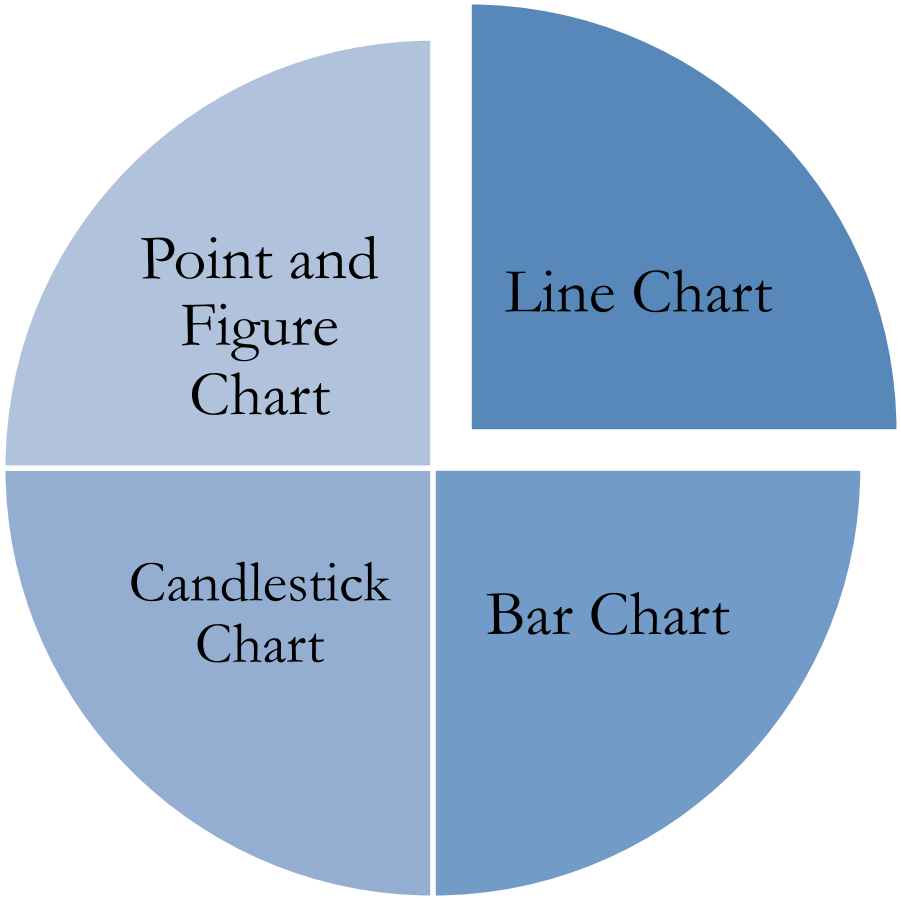
Challenges to Technical Analysis

- The weak form EMH suggests that stock prices reflect all available trading information
- Statistical tests find no evidence of price trends or profitable trading rules
- If statistical trading rules worked, price changes would become self-fulfilling prophecies; its value would be neutralized
- Interpreting technical rules is subjective, and decision variables change over time

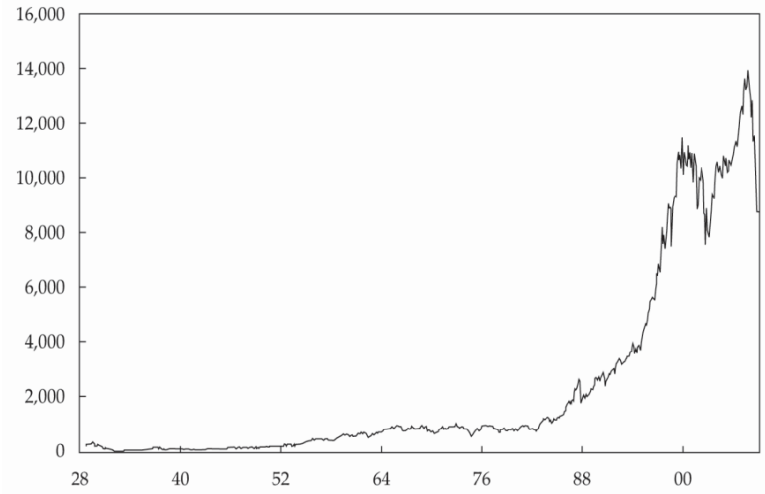
Assumptions of Technical Analysis

- Human behavior is often erratic and driven by emotion.
- Market trends and patterns reflect irrational human behavior.
- Trends and patterns repeat themselves and are thus predictable.

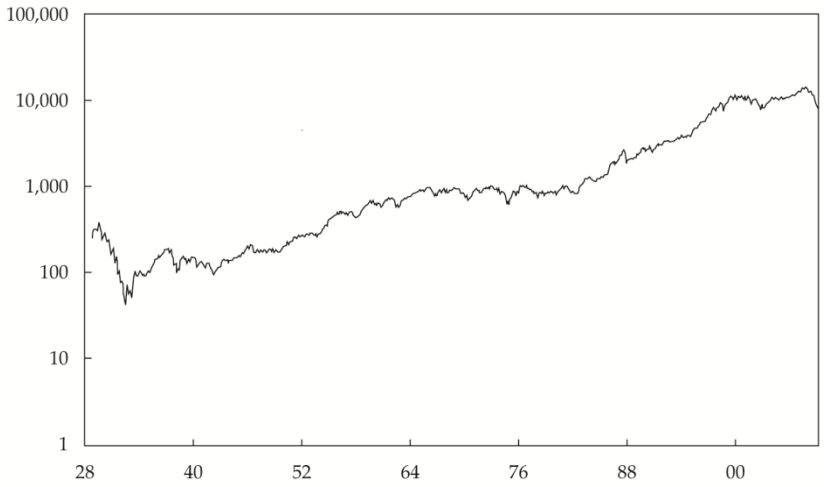
Charts


Point and Figure Chart
Line Chart
Candlestick Chart
Bar Chart

Line Charts and Scale

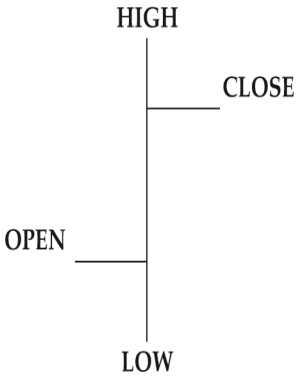


Dow Jones Industrial Average on a Linear Scale, 1928–2010 (in U.S. dollars)

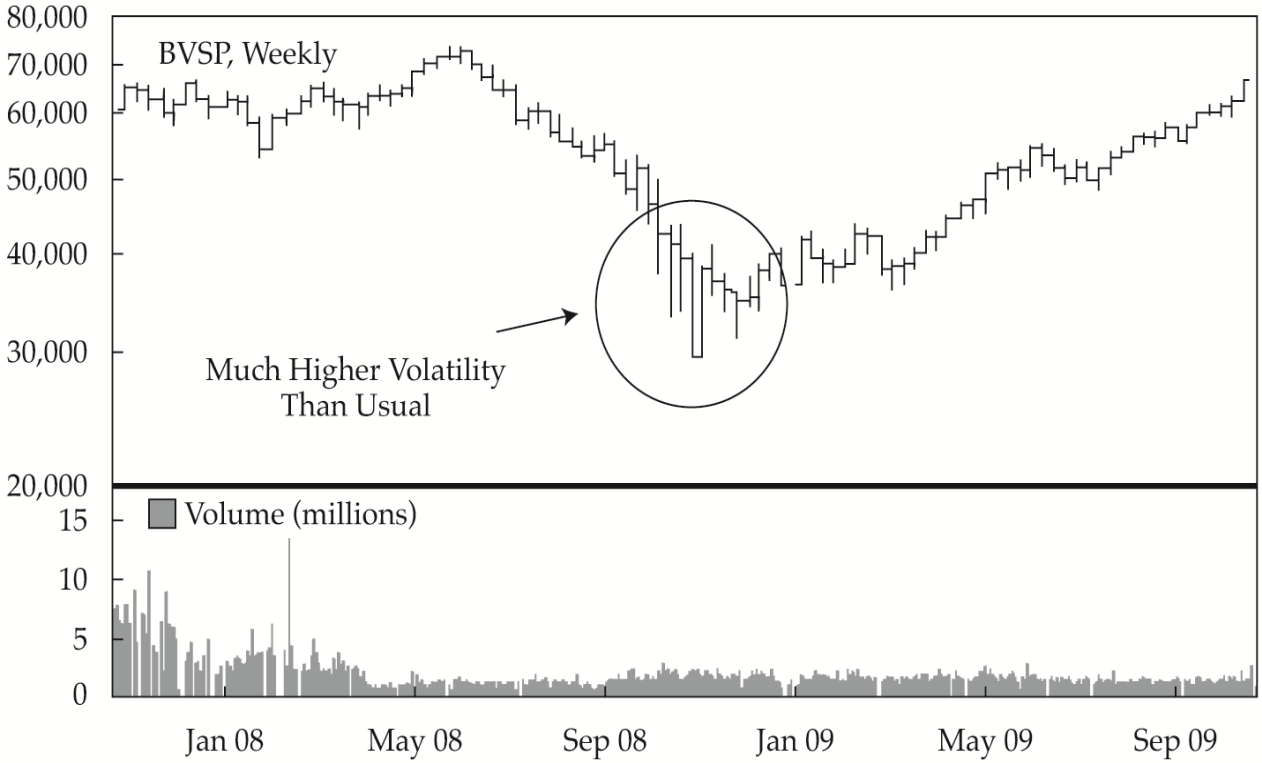


Dow Jones Industrial Average on a Logarithmic Scale, 1928–2010 (in U.S. dollars)

Bar Charts

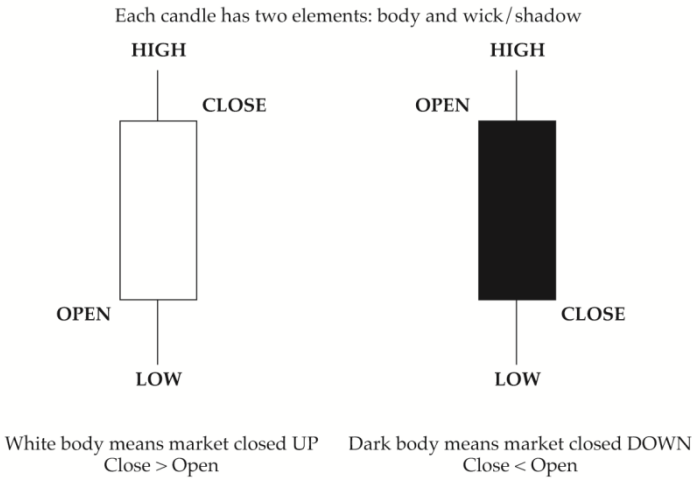


Bar Chart Notation

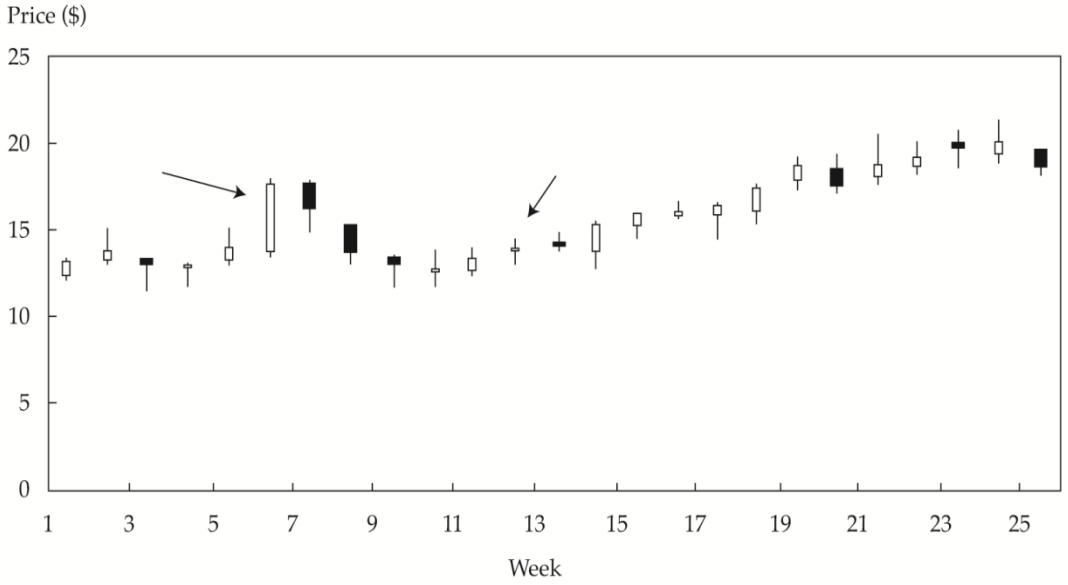


Bar Chart: Bovespa Index, November 2007–November 2009 (price in Brazilian reals)

Candlestick Charts

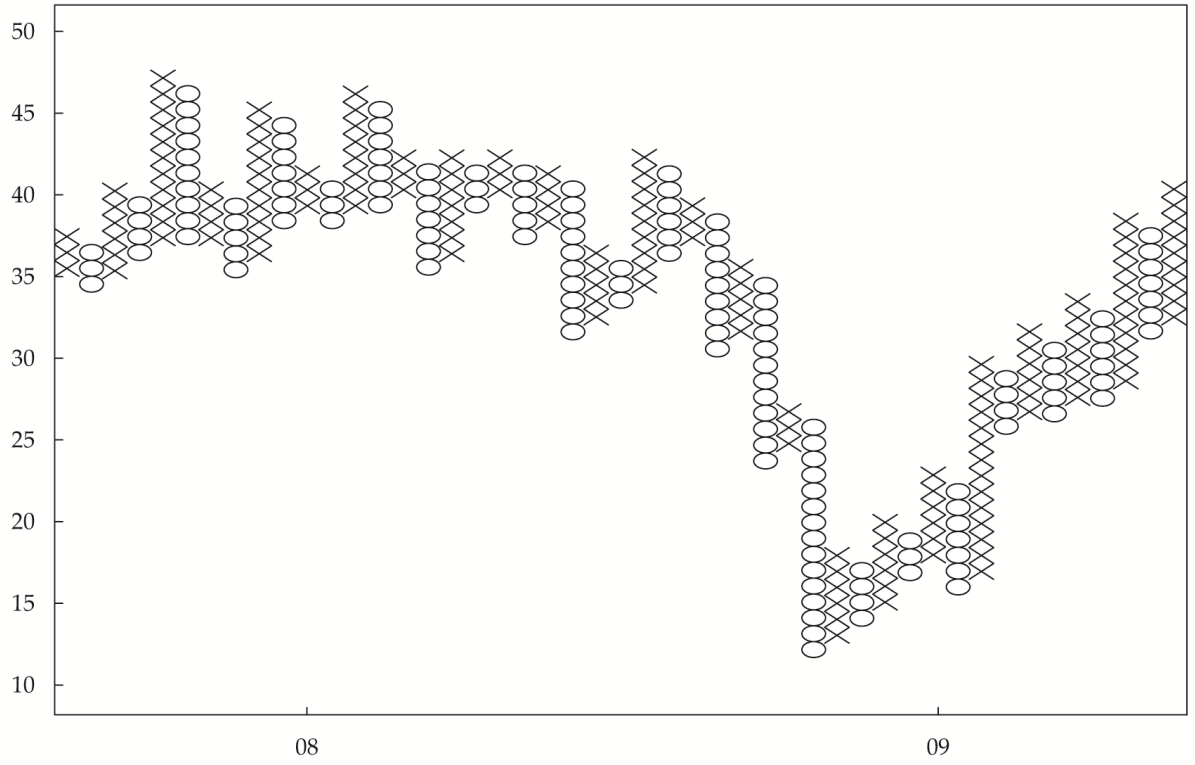


Construction of a Candlestick Chart



Candlestick Chart: Companhia Vale do Rio Doce, 1 January– 15 June 2009 (prices in U.S. dollars)

Point and Figure Charts



Point and Figure Chart: Wharf Holdings Daily Price Chart, 2007–2009 (Hong Kong dollars)

Note: The box size is HK$1, and the reversal size is three.

Point and Figure Charts

In a point and figure chart, X represents an increase in price and O represents a decline in price. In constructing a chart, the technician draws an X in a column of boxes every time the security price closes up by the amount of the box size. To construct a point and figure chart, the analyst must determine **both the box size** and **the reversal size.** Box size refers to the change in price represented by the height of each box (boxes are generally square, but the width has no meaning). In the figure, the box size is HK$1. The reversal size is used to determine when to create a new column. The reversal size is three, meaning a reversal in price of three or more boxes.

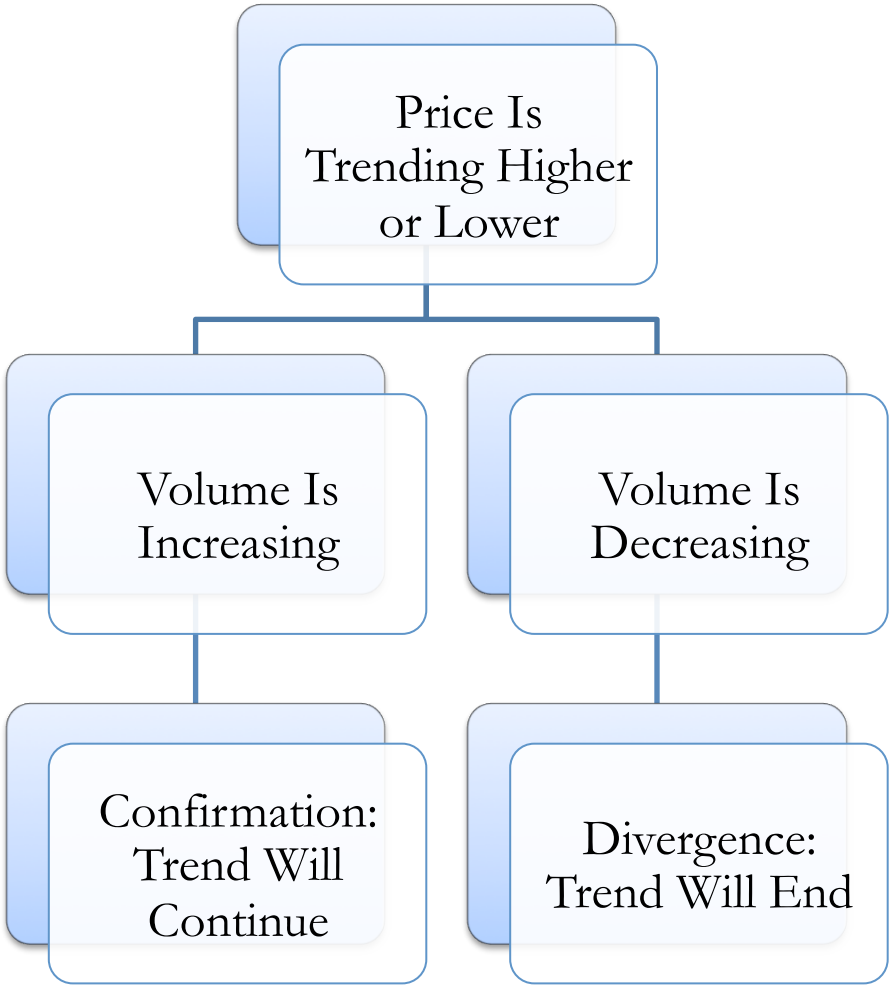
If the price increases by twice the box size, the technician draws two X's to fill in two boxes, one on top of the other. The technician fills in more boxes for larger price moves. The resulting column starts at the opening price level and extends to the closing price level. As long as the security keeps closing at higher prices, the technician keeps filling in boxes with X's, which makes the column higher and higher. If the price does not increase by at least the box size, no indication is made on the chart. Thus, in some cases, the chart is not updated for long periods, but no indication of this passage of time is made on the chart.

The reversal size determines when to create a new column. A reversal results in the technician shifting to the next column over and beginning a column of O's. The first box to be filled in is to the right and below the highest X in the prior column. The technician then fills in an O to bring the column down to the price level at the close. As long as the downtrend continues, without a reversal in price, the technician continues adding O's to the column below the prior O's. A reversal in the downtrend by at least the amount of the reversal size prompts the technician to move to the next column and begin drawing a series of X's again.

Point and figure charts are particularly useful for making trading decisions because they clearly illustrate price levels that may signal the end of a decline or advance. They also clearly show price levels at which a security may frequently trade. In using the point size and reversal size to make trading decisions, for uptrends, or columns of X's, the practitioner would maintain long positions. The reversal size could be considered the amount of loss that would prompt the closing of a long position and the establishment of a new short position. The larger the reversal size, the fewer columns in the chart and the longer uptrends and downtrends will run.

Analysis of a point and figure chart is relatively straightforward as long as the technician understands its construction and limitations. The chart is relatively simple, and repeated high and low prices are evident. Congestion areas, where a security trades up and down in a narrow range, are evidenced by a series of short columns of X's and O's spanning roughly the same price range. Major, sustained price moves are represented by long columns of X's (when prices are moving up) or O's (when prices are moving down).

Price and Volume

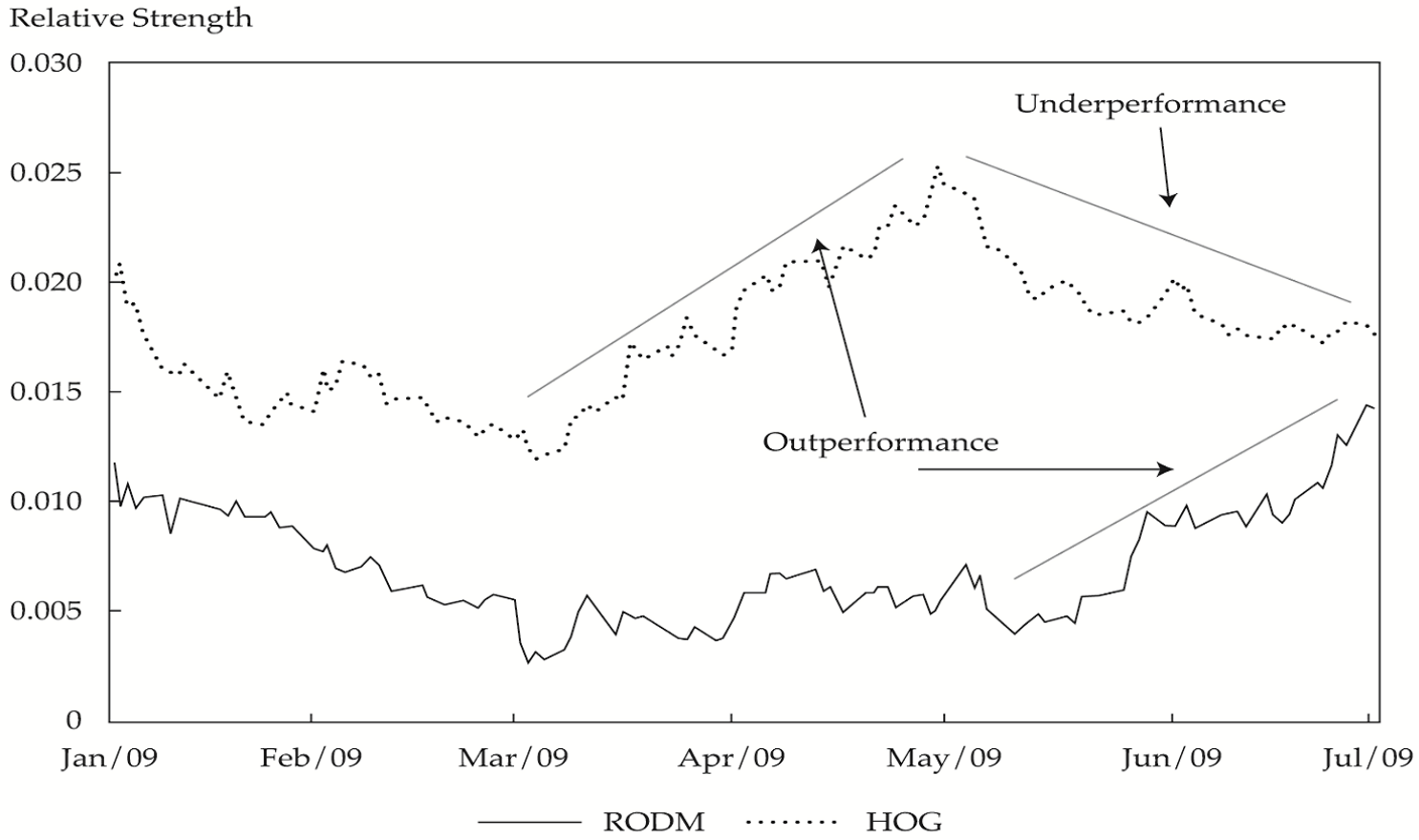


Relative Strength Analysis

- Relative strength analysis is widely used to compare the performance of a particular asset, such as a common stock, with that of some benchmark—such as, in the case of common stocks, the FTSE 100, the Nikkei 225, or the S&P 500 Index—or the performance of another security.

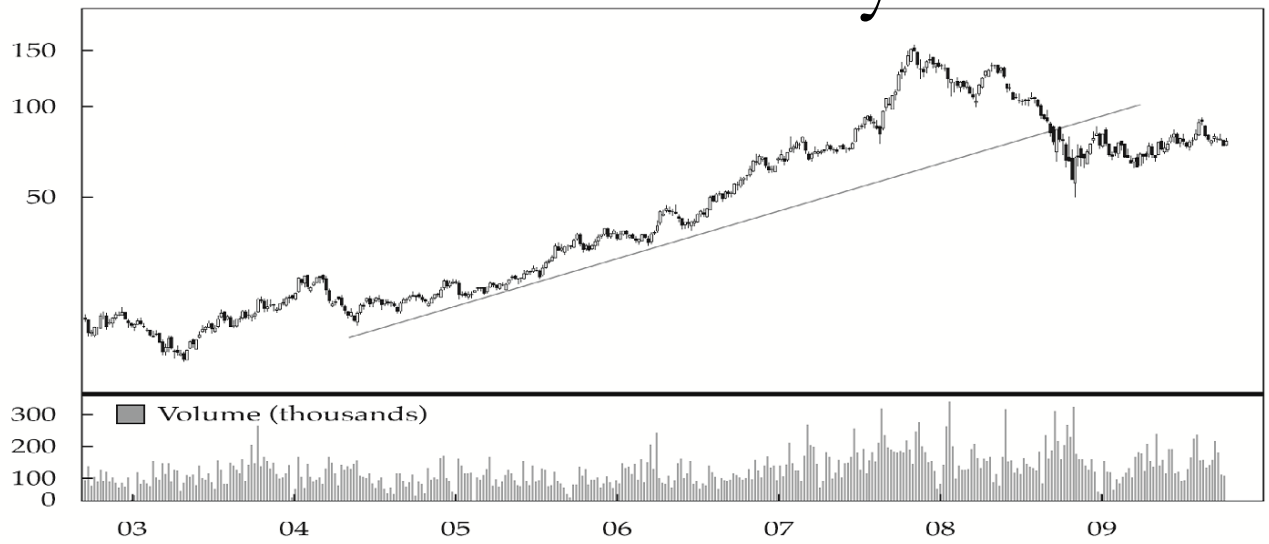
- The intent is to show out- or underperformance of the individual issue relative to some other index or asset. Typically, the analyst prepares a line chart of the ratio of two prices, with the asset under analysis as the numerator and with the benchmark or other security as the denominator. A rising line shows the asset is performing better than the index or other stock; a declining line shows the opposite. A flat line shows neutral performance.

Relative Strength Analysis

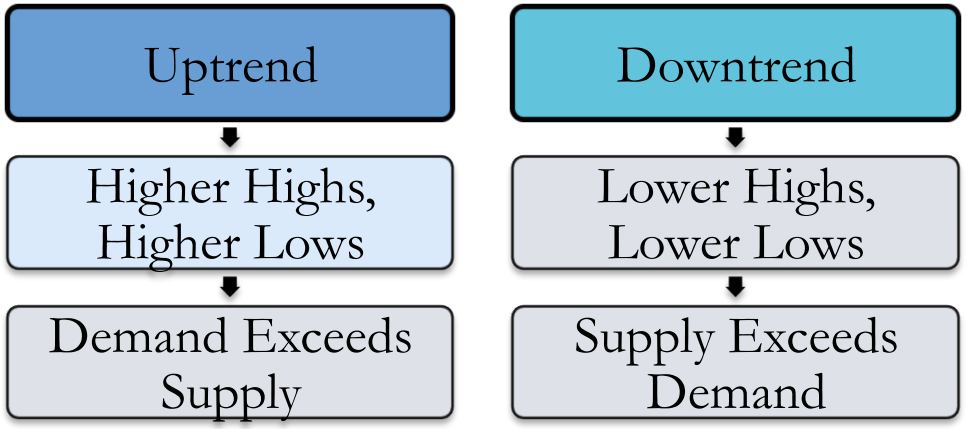


Relative Strength Analysis: HOG vs. the S&P 500 and RODM vs. the S&P 500, January–June 2009

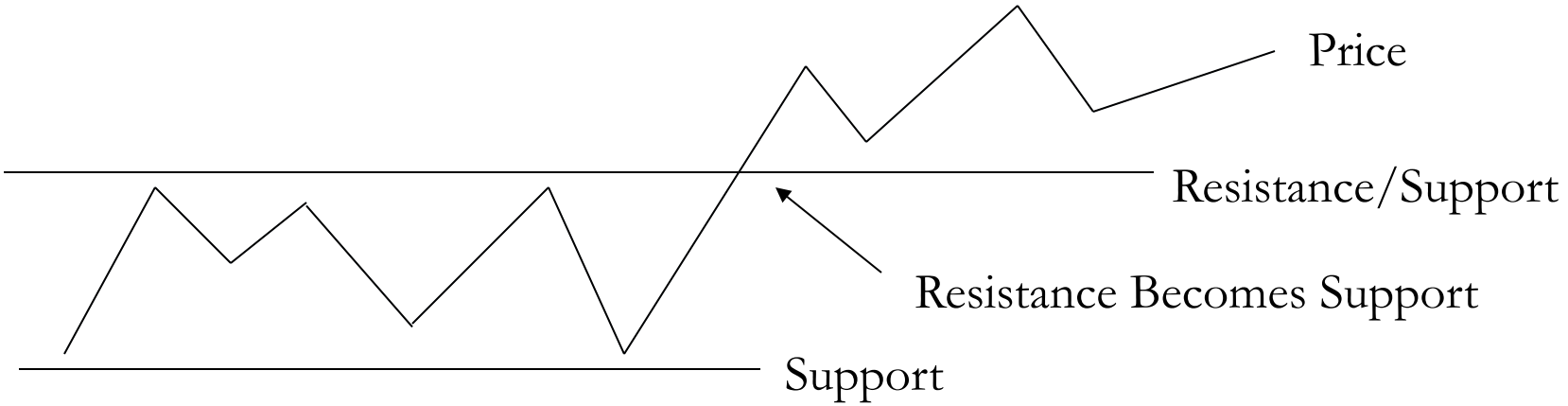
Trend Analysis



Trend Analysis: China Mobile Weekly Price Chart, 2002–2010 (prices in Hong Kong dollars)

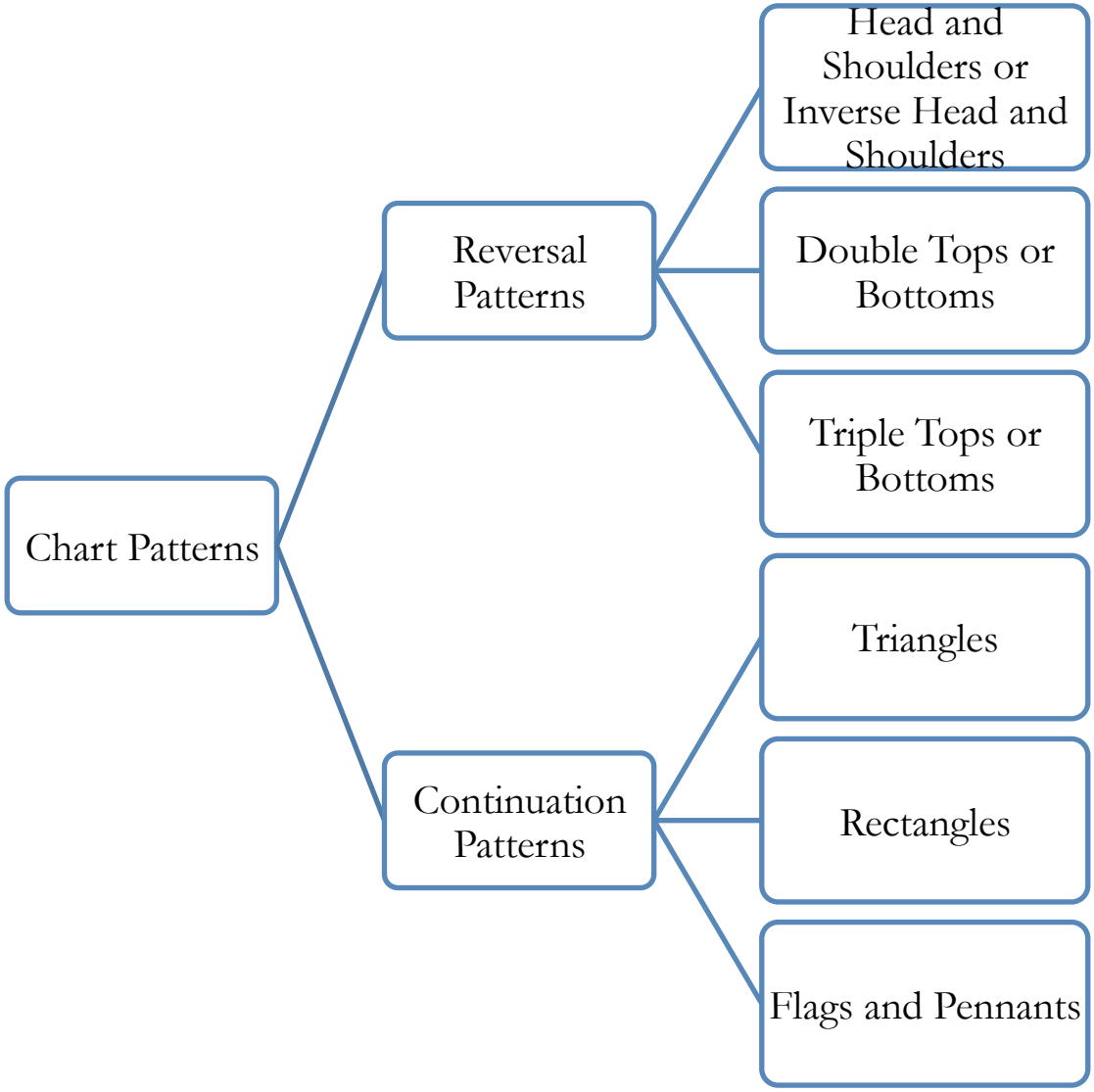


Support and Resistance

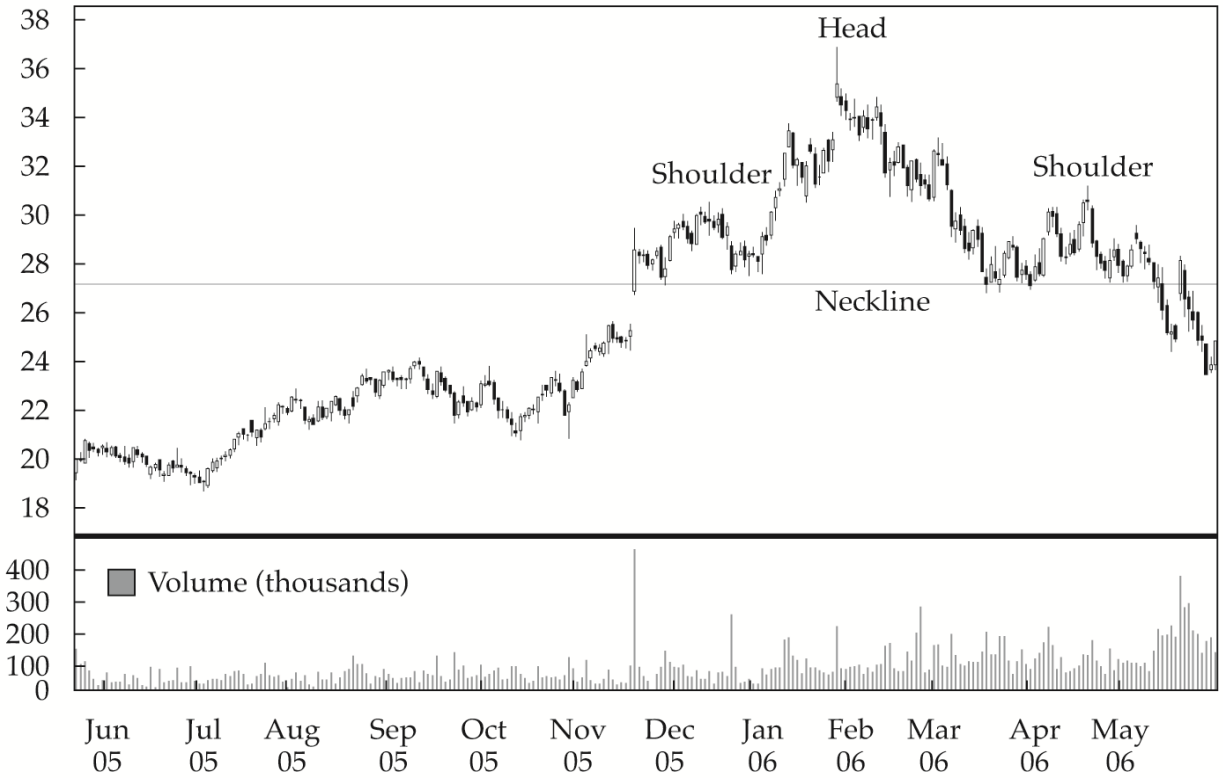


Support	• A low price range in which buying activity is sufficient to stop a decline in price
Resistance	• A high price range in which selling activity is sufficient to stop a rise in price
Change in Polarity	• Once a resistance (support) level is breached, it becomes a support (resistance) level

Chart Patterns



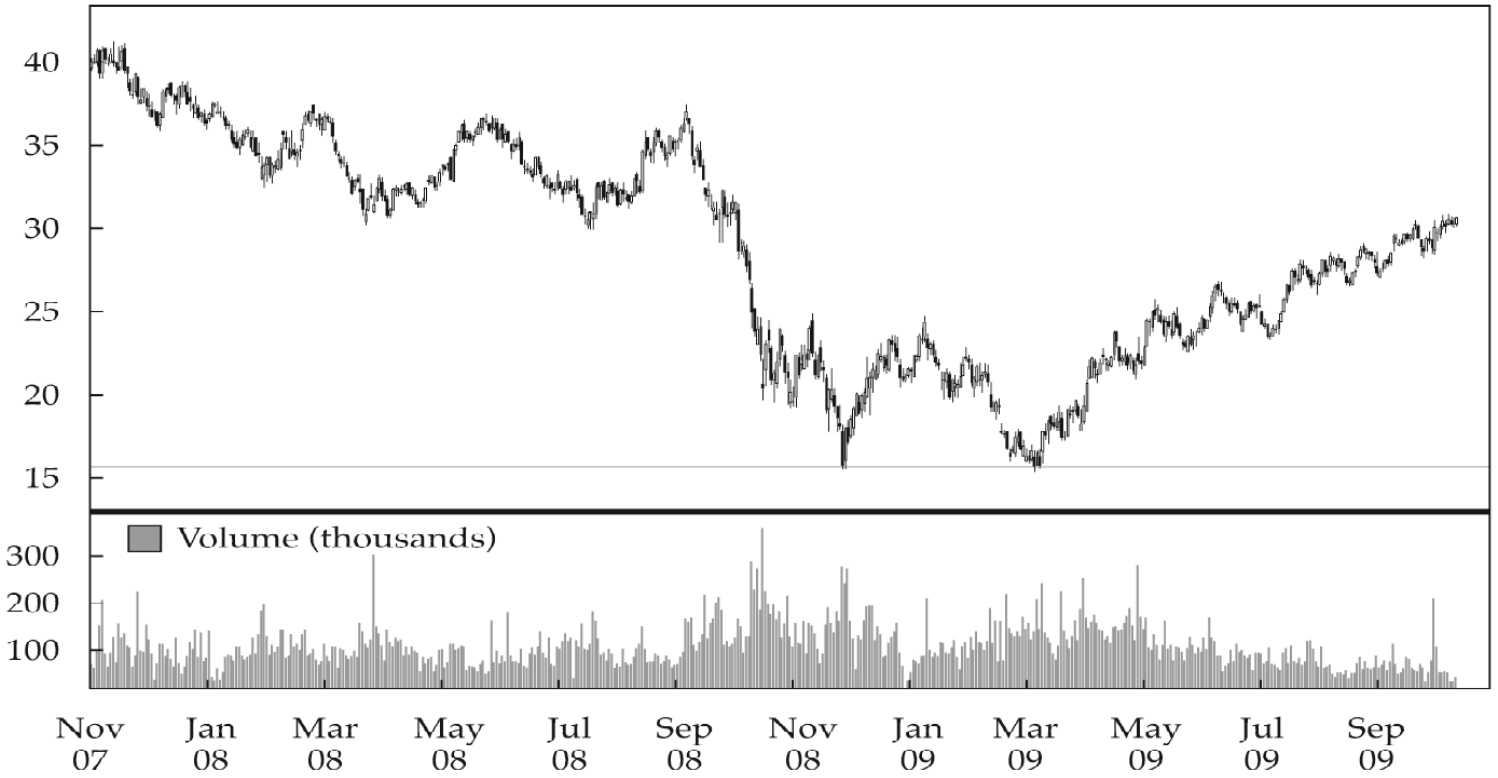
Head and Shoulders



Head and Shoulders Pattern: Marvell Technology Daily Price Chart, June 2005–June 2006 (price in U.S. dollars ÷ 100)

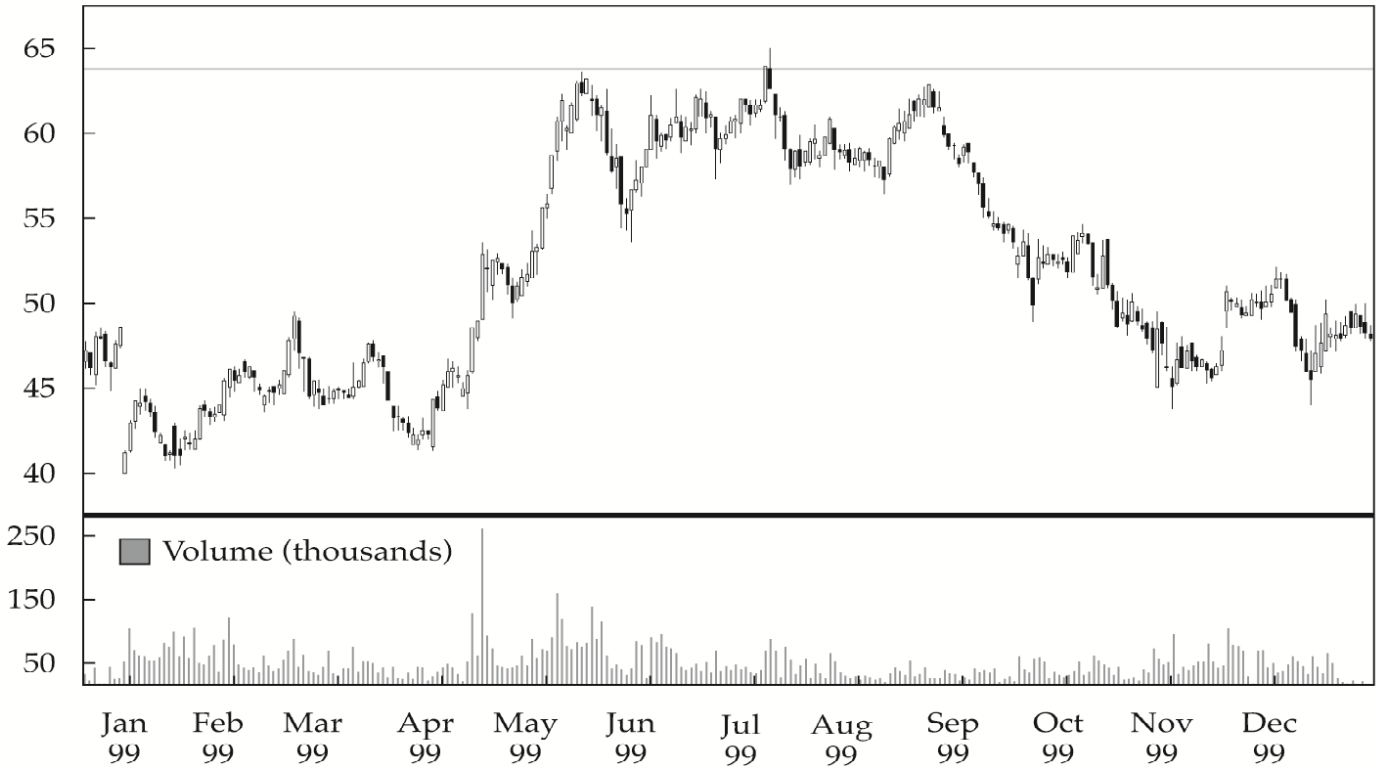
(Head and Shoulders) Price target = Neckline – (Head − Neckline)
(Inverse Head and Shoulders) Price target = Neckline + (Head – Neckline)

Double Tops and Bottoms



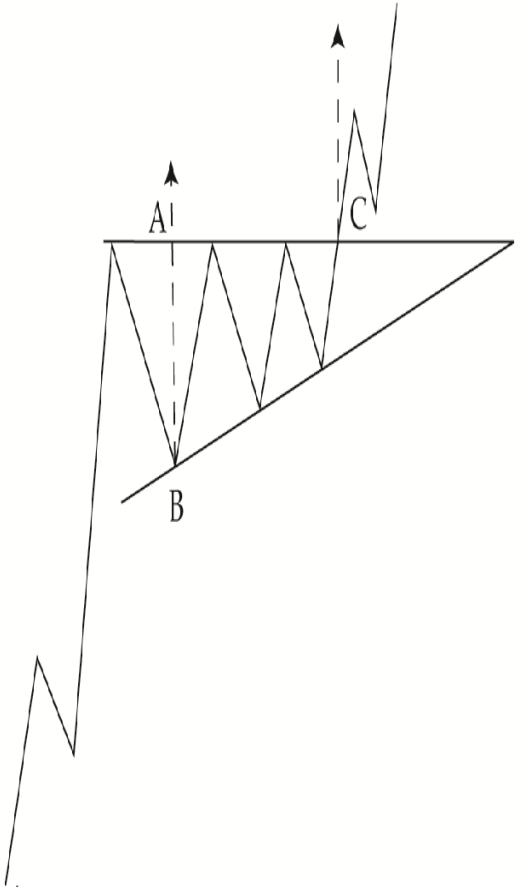
Double-Bottom Pattern: Time Warner Daily Price Chart, November 2007–October 2009 (price in U.S. dollars)

Triple Tops and Bottoms

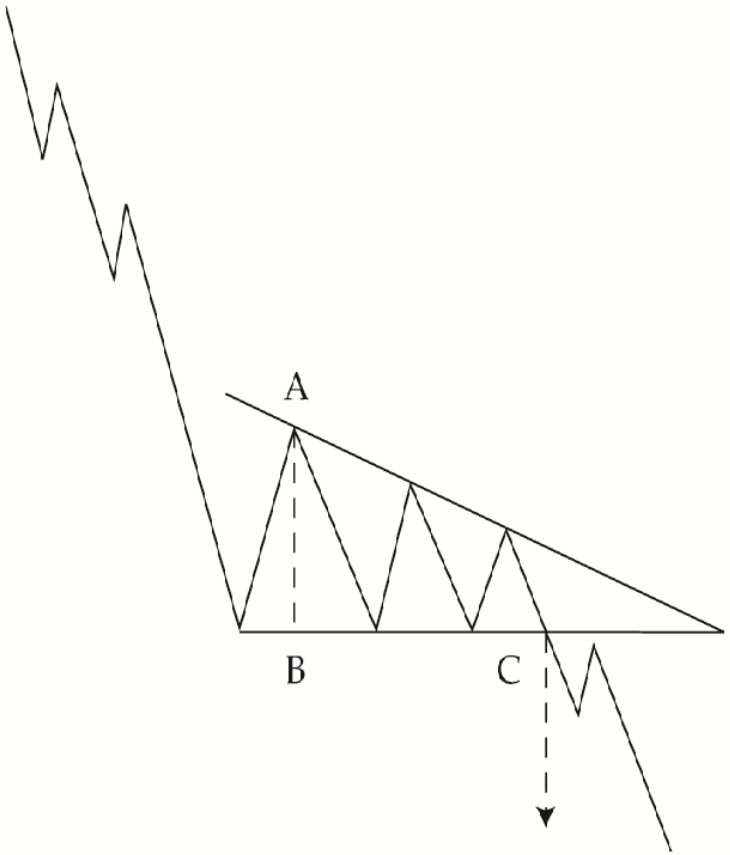


Triple-Top Pattern: Rockwell Automation Daily Price Chart, 1999 (price in U.S. dollars)

Triangles



Ascending Triangle Pattern

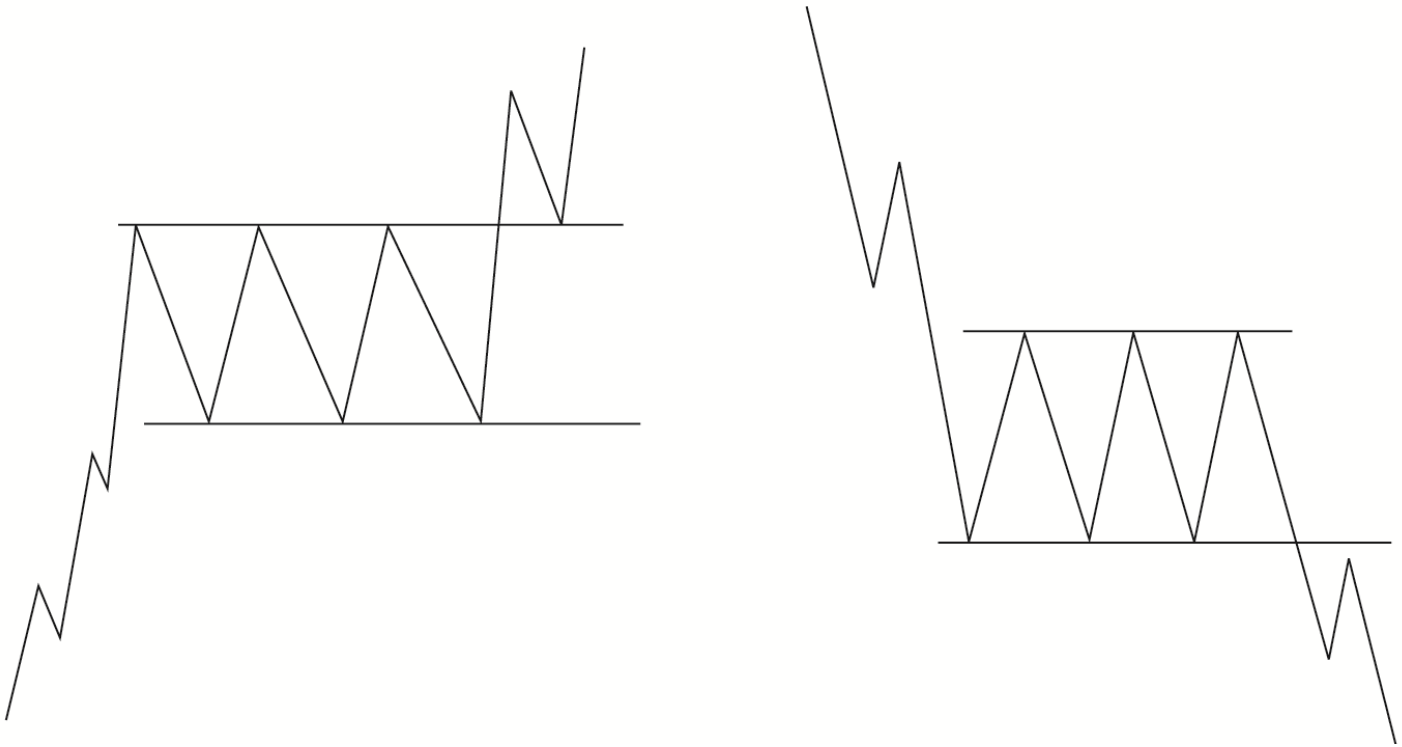


Descending Triangle Pattern

Rectangles

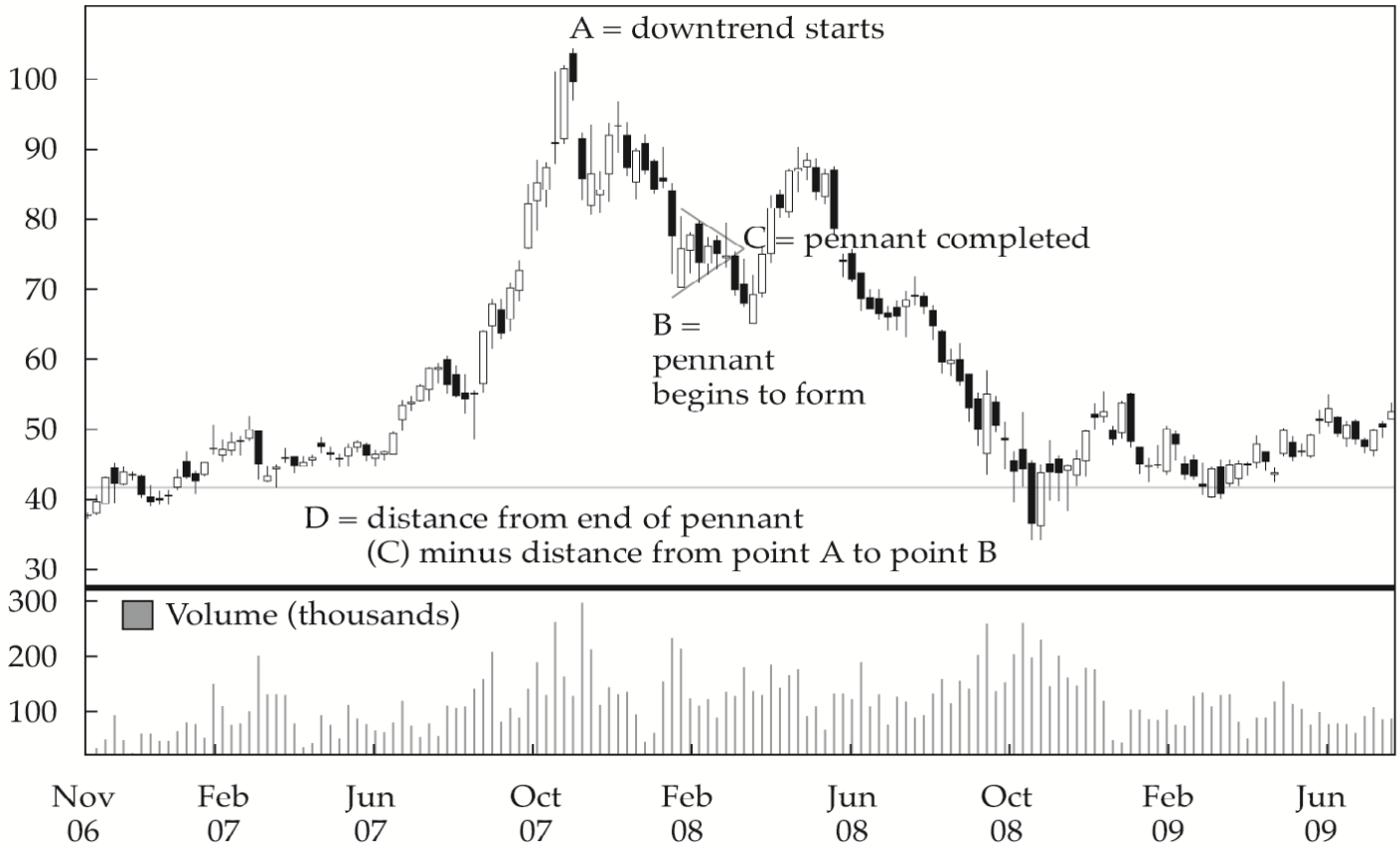
Bullish Rectangle

Bearish Rectangle



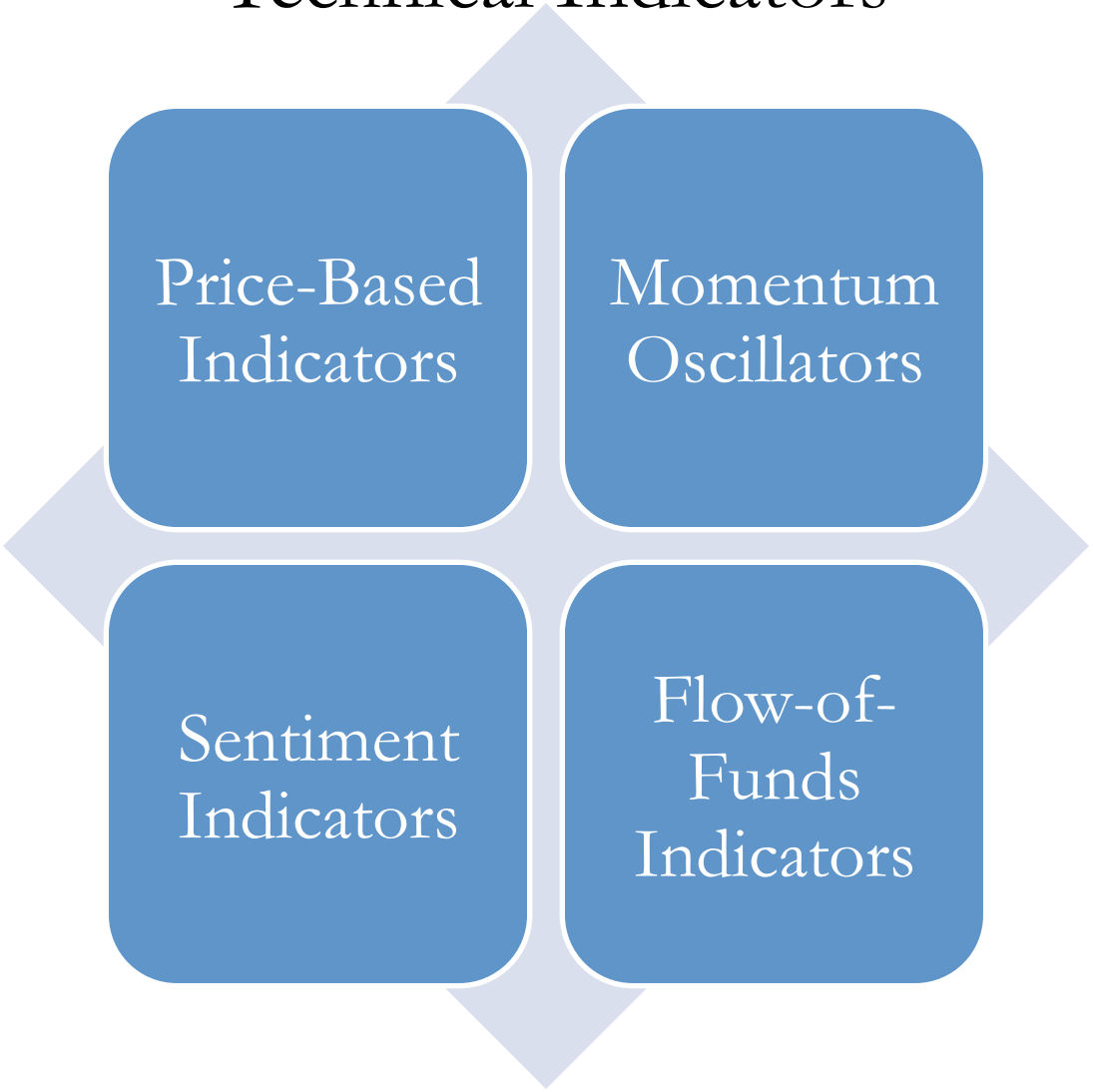
Rectangle Patterns

Flags and Pennants

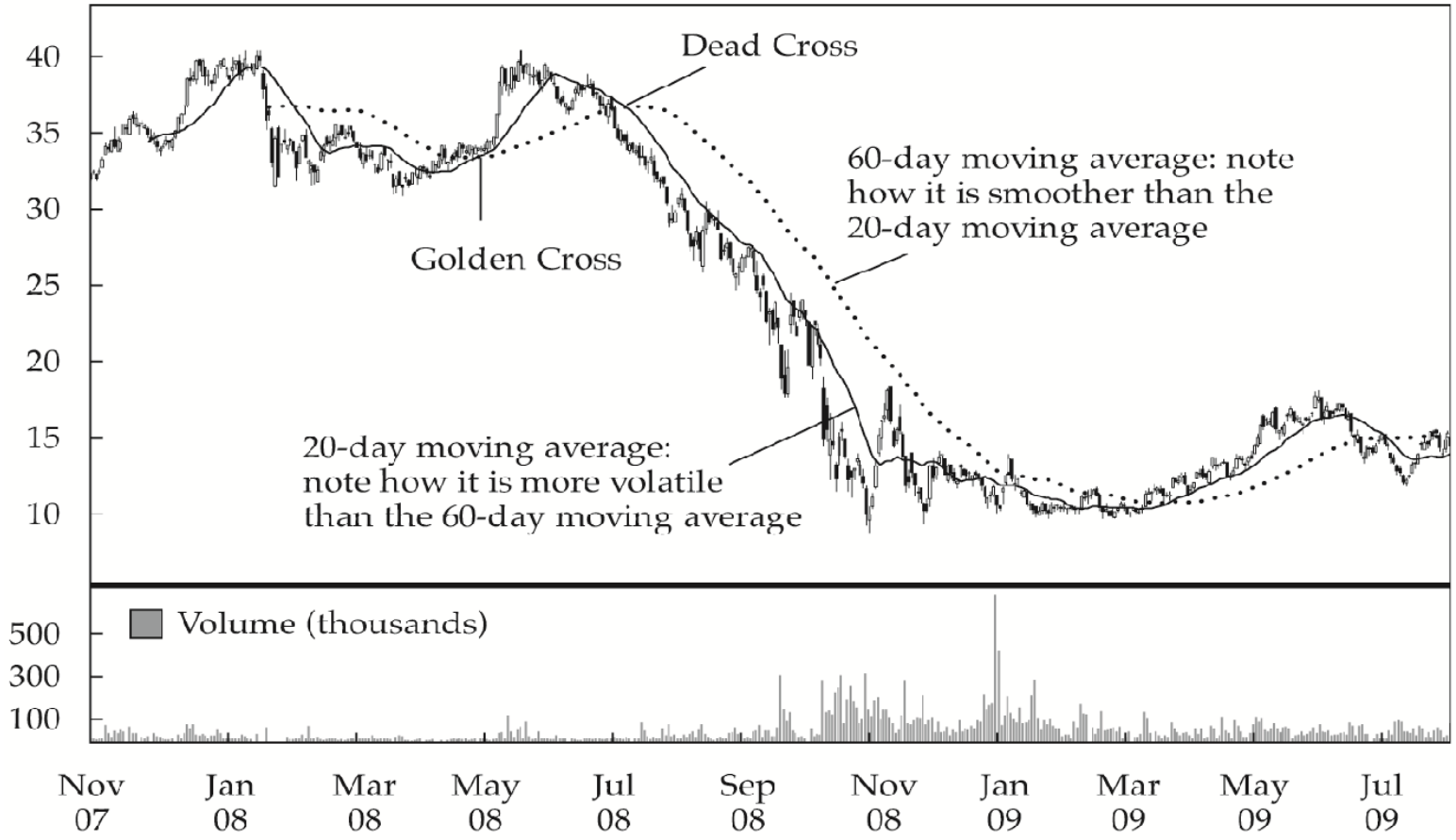


Pennant Formation: China Mobile ADR,
November 2006–July 2009 (price in U.S. dollars)

Technical Indicators

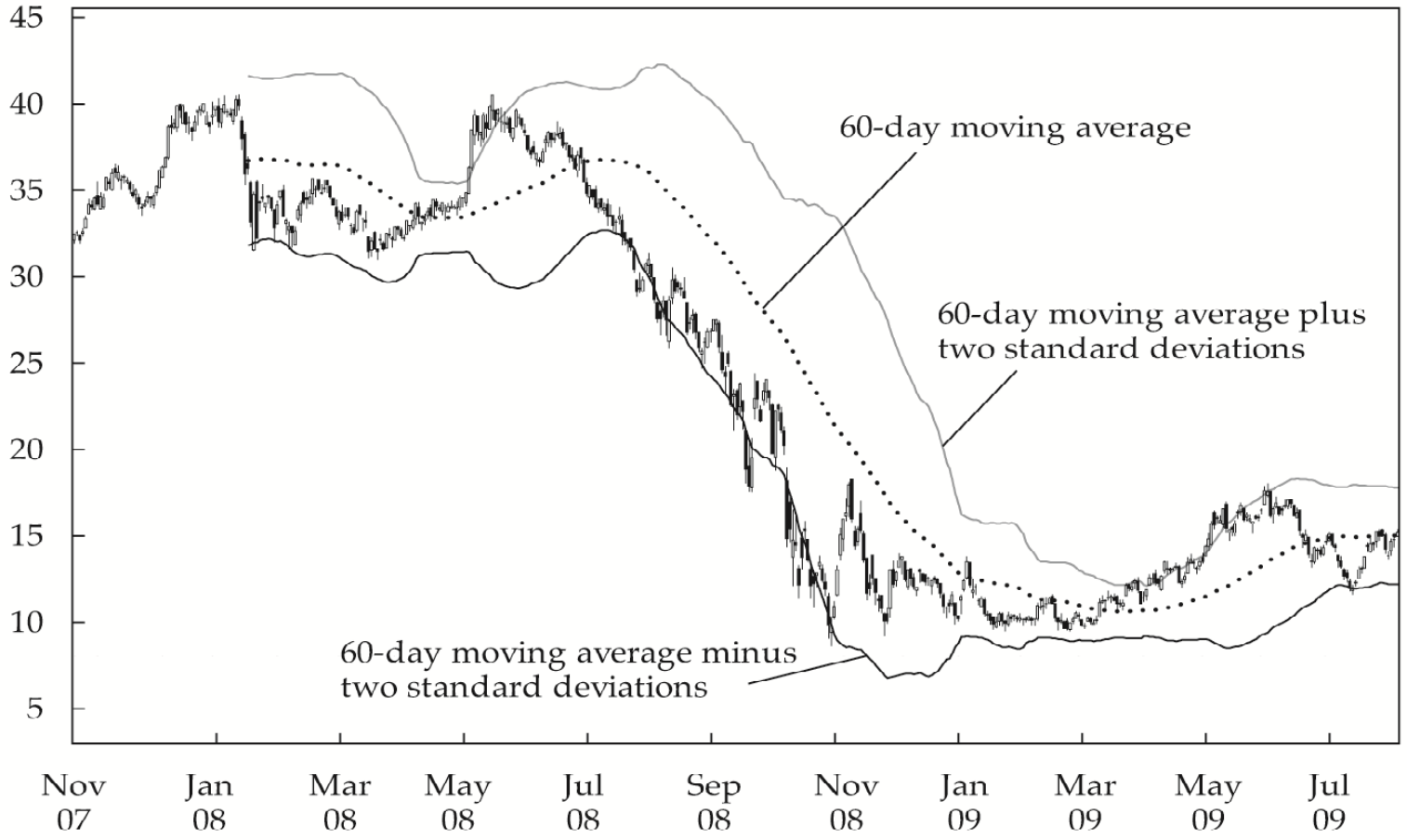


Price-Based Indicator: Moving Average



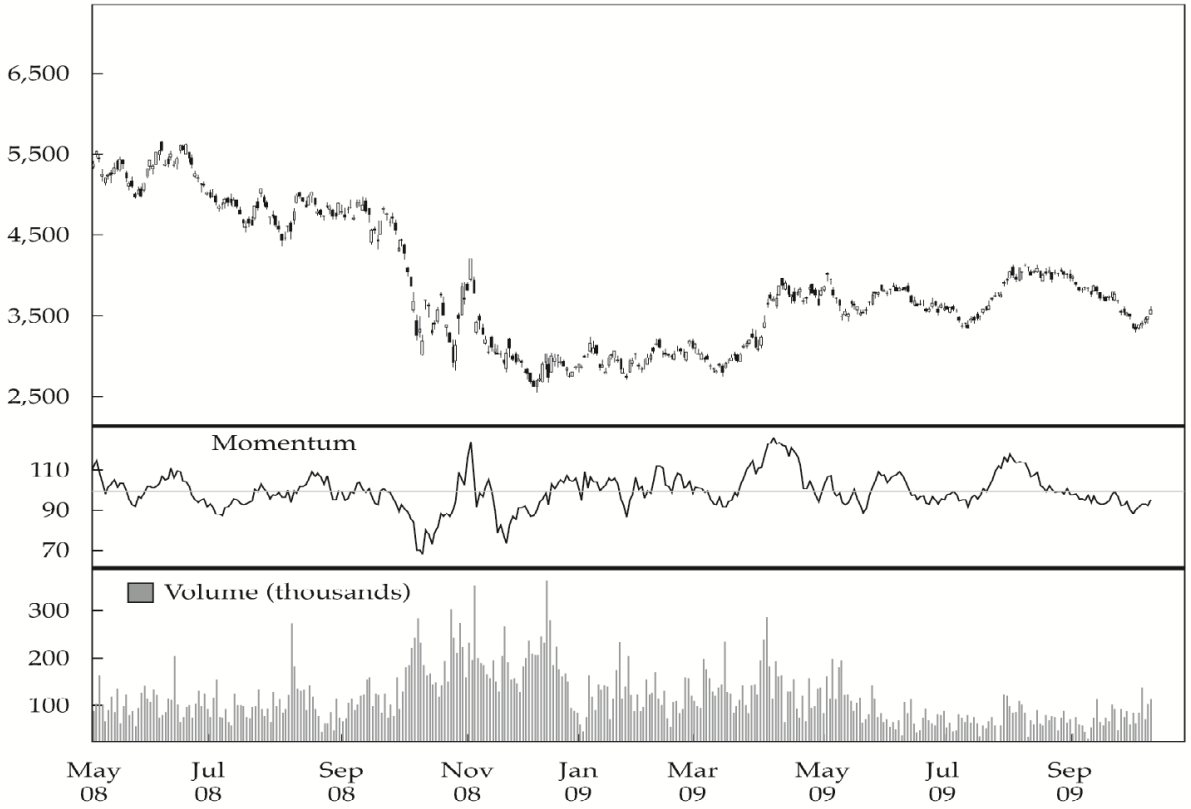
Daily Price Chart with 20-Day and 60-Day Moving Averages: Gazprom EDR, November 2007–August 2009 (price in euros)

Price-Based Indicator: Bollinger Band



Bollinger Band Using 60-Day Moving Average and 2 Standard Deviations: Gazprom EDR Daily Price Chart, November 2007–August 2009 (price in euros)

Momentum Oscillator: Rate of Change Oscillator ($M = V \div Vx \times 100$)



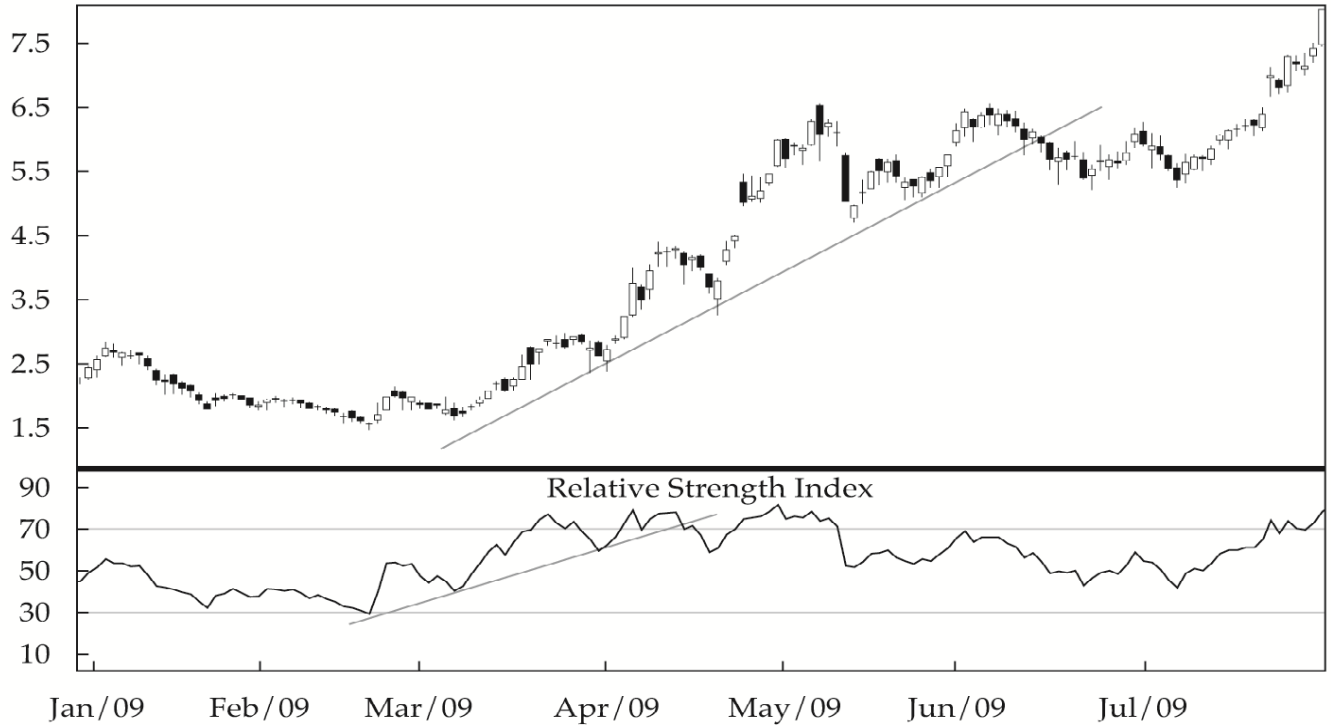
Note that for this stock, the ROC oscillator tends to maintain a range between ¥85 and ¥115. So, episodes when the oscillator moves outside this range are of particular interest to the technician.

Momentum Oscillator with 100 as Midpoint: Toyota Motor, May 2008–October 2009 (price in Japanese yen)

Momentum Oscillator: Relative Strength Index

$$RSI = 100 - \frac{100}{1 + RS}$$

$$RS = \frac{\sum(\text{Up changes for the period under consideration})}{\sum\left(\left|\text{Down changes for the period under construction}\right|\right)}$$



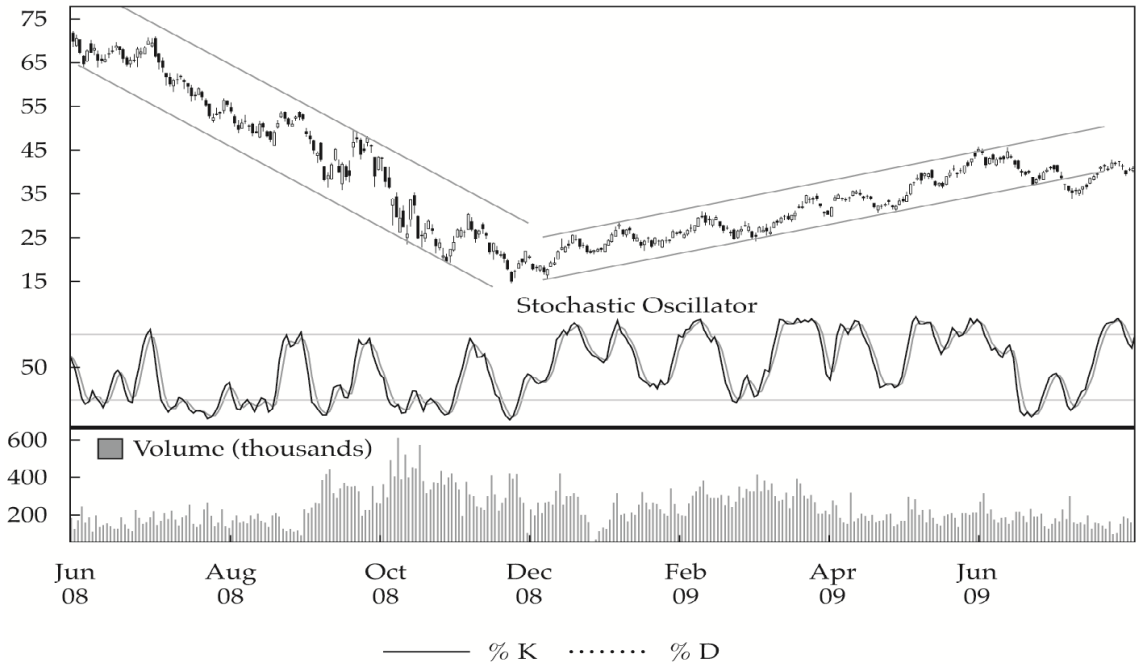
The index construction forces the RSI to lie within 0 and 100. A value above 70 represents an overbought situation. Values below 30 suggest the asset is oversold.

Candlestick Chart with RSI: Ford, January–August 2009 (price in U.S. dollars)

Momentum Oscillator: Stochastic Oscillator

$$\%K = 100\left(\frac{C - L14}{H14 - L14}\right)$$

%D = Average of the last three %K values calculated daily



The stochastic oscillator is based on the observation that in uptrends, prices tend to close at or near the high end of their recent range and in downtrends, they tend to close near the low end.

Weekly Price Chart and Stochastic Oscillator: Petroleo Brasileiro ADR, June 2008–July 2009 (price in U.S. dollars)

Momentum Oscillator: MACD Oscillator

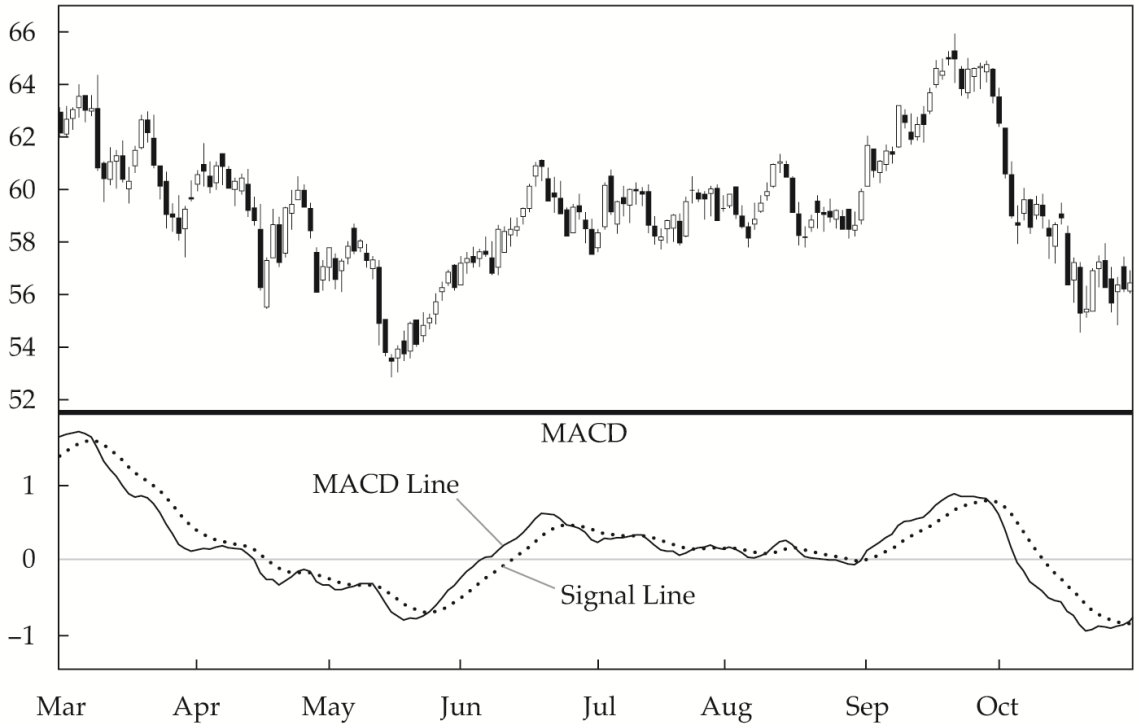
The moving-average convergence/divergence oscillator is commonly referred to as MACD, which is pronounced Mack Dee. The MACD is the difference between a short-term and a long-term moving average of the security's price. The MACD is constructed by calculating two lines, the MACD line and the signal line:

- *MACD line: difference between two exponentially smoothed moving averages, generally 12 and 26 days*
- *Signal line: exponentially smoothed average of MACD line, generally 9 days*

The indicator oscillates around zero and has no upper or lower limit. Rather than using a set overbought–oversold range for MACD, the analyst compares the current level with the historical performance of the oscillator for a particular security to determine when a security is out of its normal sentiment range.

MACD is used in technical analysis in three ways. The first is to note crossovers of the MACD line and the signal line, as discussed for moving averages and the stochastic oscillator. Crossovers of the two lines may indicate a change in trend. The second is to look for times when the MACD is outside its normal range for a given security. The third is to use trend lines on the MACD itself. When the MACD is trending in the same direction as price, this pattern is convergence, and when the two are trending in opposite directions, the pattern is divergence.

Momentum Oscillator: MACD Oscillator



Note the convergence in the bottoming of both the oscillator and price in May, which provided confirmation of a change in trend. This change was further confirmed by the MACD line crossing above the signal line. A bearish signal was given in September with the change in trend of both price and the oscillator and the crossover of the signal line by the MACD line. The fact that the MACD oscillator was moving up to a level that was unusually high for this stock would have been an early warning signal in September.

MACD and Daily Price Chart: Exxon Mobil, March–November 2005 (price in U.S. dollars)

Sentiment Indicator: Opinion Polls

- Opinion — Investors Intelligence Advisors' Sentiment Report
- Opinion — Market Vane Bullish Consensus
- Opinion — Consensus Bullish Sentiment Index
- Opinion — Daily Sentiment Index
- Opinion — AAII Investor Sentiment Survey

Sentiment Indicator: Calculated Statistical Indices

Put/Call Ratio

- Normally below 1.0
- Considered a contrary indicator

CBOE Volatility Index

- Based on options on stocks in the S&P 500
- Used with trend, pattern, or oscillator tools

Margin Debt

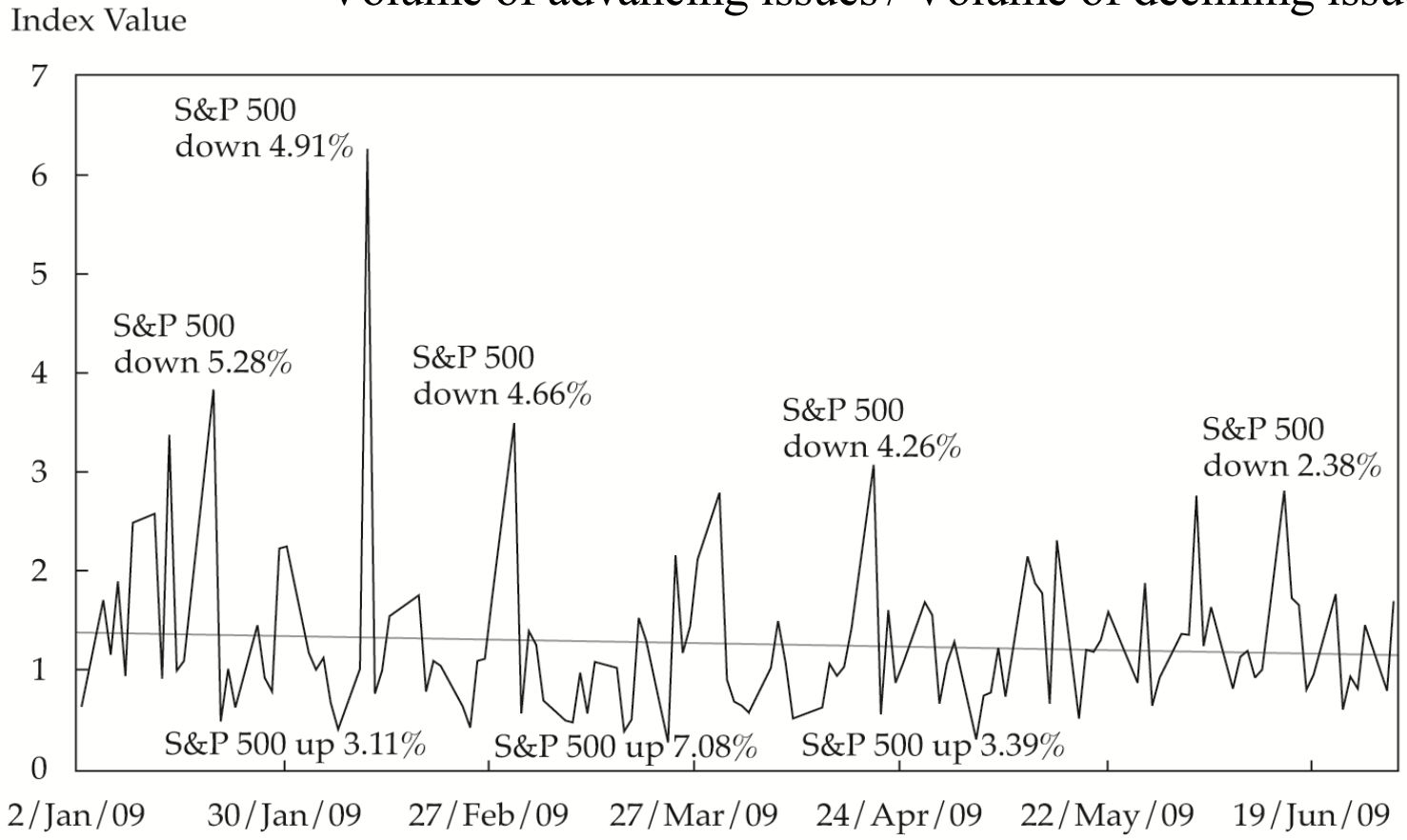
- Rising margin debt believed to be a signal of aggressive buying
- Considered a contrary indicator

Short Interest Ratio

- Short interest ÷ Average daily trading volume
- Considered a contrary indicator

Flow-of-Funds Indicator: Arms Index (TRIN)

$$\text{Arms Index} = \frac{\text{Number of advancing issues / Number of declining issues}}{\text{Volume of advancing issues / Volume of declining issues}}$$



Arms Index for the S&P 500, January–July 2009

Other Flow-of-Funds Indicators

Margin Loans	• Ability to buy stock on margin may increase demand • Declining margin balances may result in forced selling
Mutual Fund Cash Positions	• Considered a contrary indicator: High cash balances represent buying power • Some analysts take into account the level of interest rates
New Equity Issuance and Secondary Offerings	• Considered a contrary indicator: High issuance and offerings are considered signs of a market top

Cycles

Kondratieff Wave (K-wave)

- Western economies have a 54-year cycle
- Originally tied to economic cycles and commodity prices

18-Year Cycle

- 3 × 18 years = 54 years
- Most often mentioned in connection with real estate prices

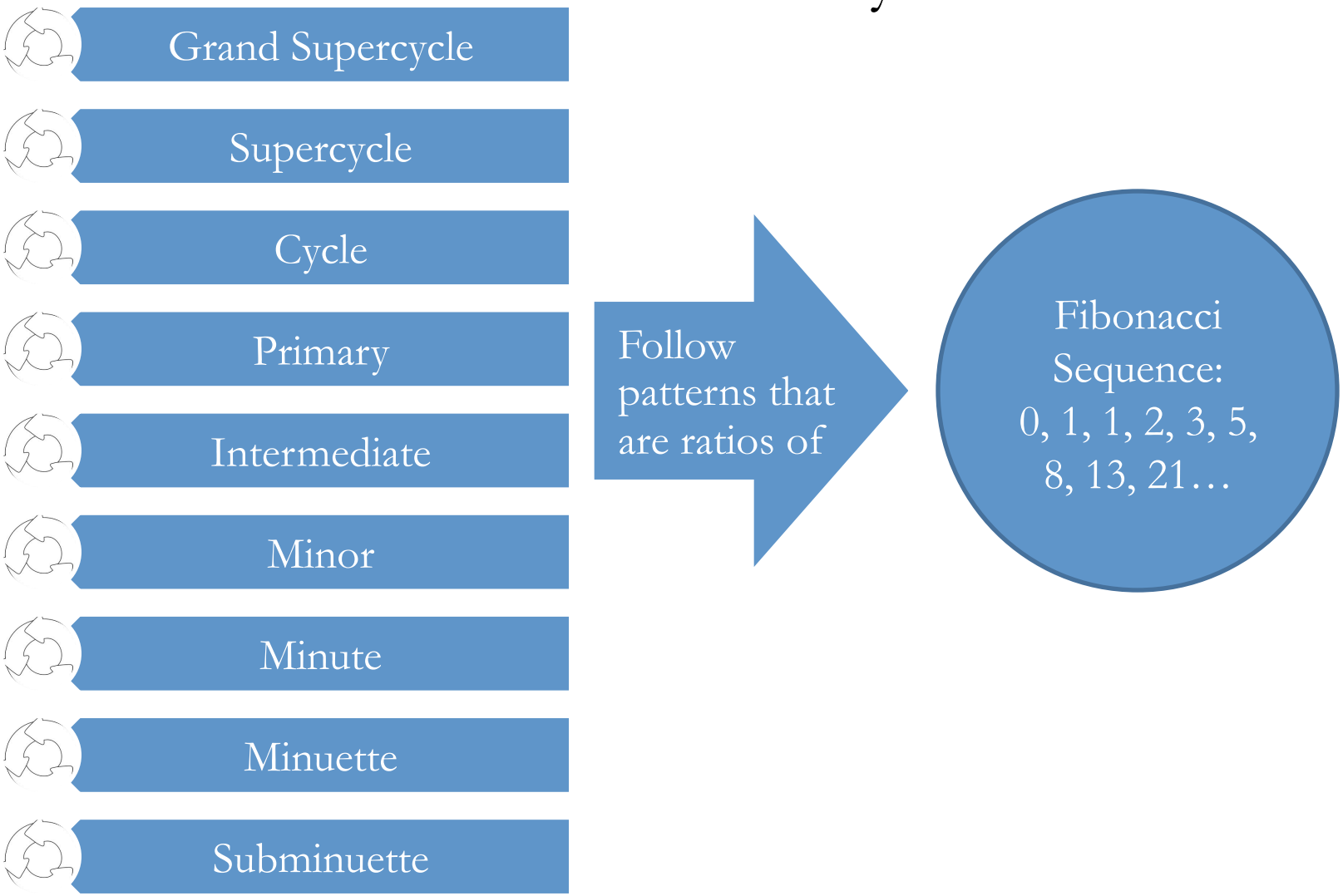
Decennial Pattern

- Pattern of market returns broken down based on the last digit of a year
- Years ending in 5 have the best returns

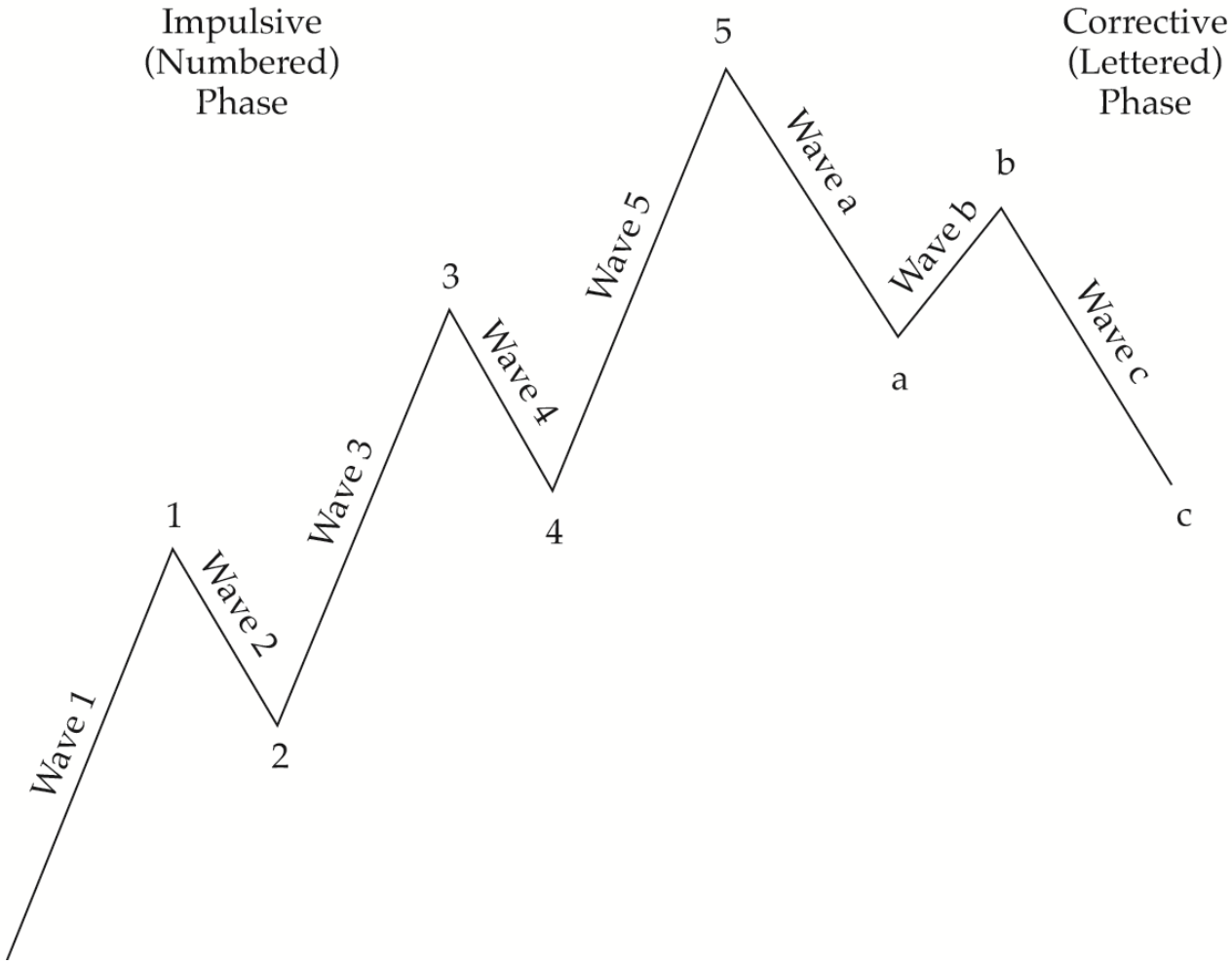
Presidential Cycle

- Returns broken down by year of U.S. President's term in office
- Third year (year prior to next election) has best historical performance

Elliott Wave Theory



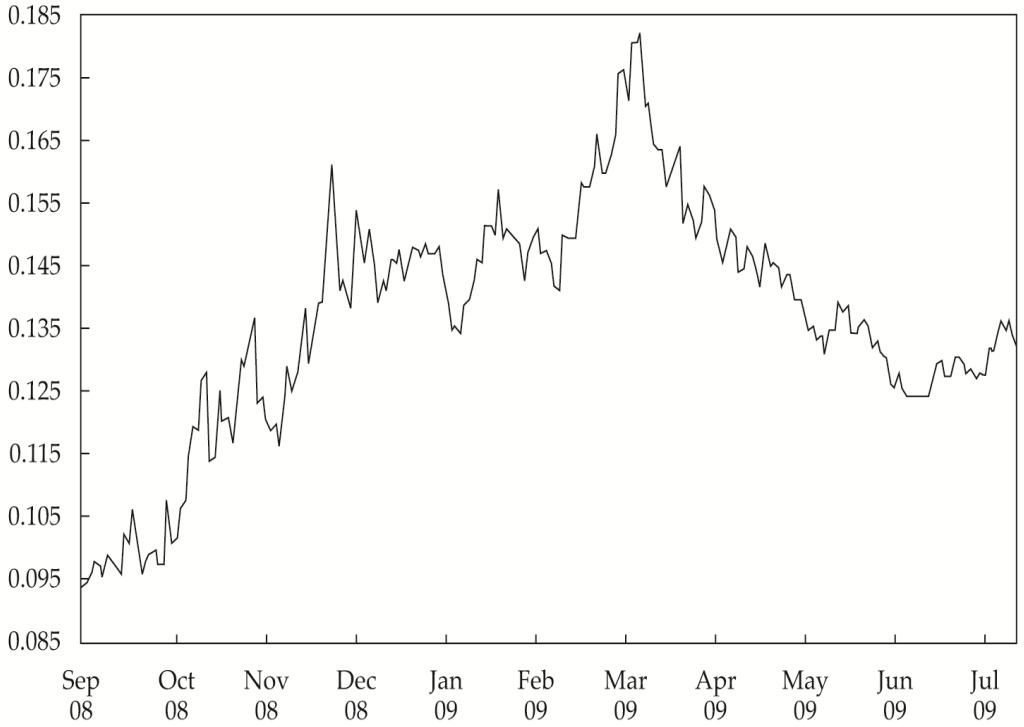
Impulse Waves and Corrective Waves



Intermarket Analysis

Inflection points in one market

May be a warning sign of a change in trend in another market



Relative Strength of 10-Year T-Bonds vs. S&P 500, September 2008–July 2009

Summary

- Principles, applications, and assumptions of technical analysis
- Construction and interpretation of charts
- Trend, support, and resistance lines, and change in polarity
- Common technical analysis patterns, indicators, and cycles
- Elliott Wave Theory
- Intermarket analysis