

CHAPTER 7

SMOKE AND MIRRORS? CHARTING AND TECHNICAL ANALYSIS

Charts have been around as long as there have been markets. Some investors have always believed that charts of past prices provide signals of the future, and have pored over charts looking for patterns that predict price movements. Notwithstanding the disdain with which they are viewed by other investors and many academics, easy access to data combined with an increase in computing capabilities – charting and graphing programs abound – has meant that more investors look at charts now than ever before. In addition, data on trading volume and from derivatives markets have provided chartists with new indicators of the future.

In this chapter, we will look at the basis of charting by examining the underlying premise in charting and technical analysis, which is a belief that there are systematic and often irrational patterns in investor behavior and that technical indicators and charts provide advance warning of shifts in investor behavior. While we will not attempt to describe every charting pattern and technical indicator – there are hundreds – we will categorize them based upon the view of human behavior that underlies each. In the process, we will see if there are lessons in charts that even non-believers can take away with them and cautionary notes for true believers about potential inconsistencies.

Random Walks and Price Patterns

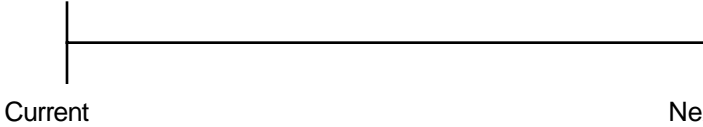
In many ways, the antithesis of charting is the notion that prices follow a random walk. In a random walk, the stock price reflects the information in past prices, and knowing what happened yesterday is of no consequence to what will happen today. Since the random walk comes in for a fair degree of abuse, some justified and some not, from technical analysts, we will begin by looking at what the random walk is and its implications.

The Basis for Random Walks

To understand the argument for prices following a random walk, we have to begin with the presumption that investors at any point in time estimate the value of an asset based upon expectations of the future, and that these expectations are both unbiased and rational, given the information that investors have at that point in time. Under these conditions, the price of the asset changes only as new information comes out about it. If the market price at any point in time is an unbiased estimate of value, the next piece of information that comes

out about the asset should be just as likely to contain good news as bad.¹ It therefore follows that the next price change is just as likely to be positive as it likely to be negative. The implication of course is that each price change will be independent of the previous one, and that knowing an asset's price history will not help form better predictions of future price changes. Figure 7.1 summarizes the assumptions.

Figure 7.1: Information and Price Changes in a Rational Market

Information	All information about the firm is publicly available and traded on.	New information comes out about the firm.
		
Market Expectations	Investors form unbiased expectations about the future	Since expectations are unbiased, there is a 50% chance of good or bad news.
Price Assessment	Stock price is an unbiased estimate of the value of the stock.	The price changes in accordance with the information. If it contains good (bad) news, relative to expectations, the stock price will increase (decrease).
Implications for Investors	No approach or model will allow us to identify under or over valued assets.	Reflecting the 50/50 chance of the news being good or bad, there is an equal probability of a price increase and a price decrease.

While the random walk is not magic, there are two prerequisites for it to hold. The first is that investors are rational and form unbiased expectations of the future, based upon all of the information that is available to them at the time. If expectations are set too low or set too high consistently – in other words, investors are too optimistic or pessimistic - information will no longer have an equal chance of being good or bad news, and prices will not follow a random walk. The second is that price changes are caused by new information. If investors can cause prices to change by just trading, even in the absence of information, you can have price changes in the same direction rather than a random walk.

The Basis for Price Patterns

Chartists are not alone in believing that there is information in past prices that can be useful in forecasting future price changes. There are some fundamentalists who use

¹ If the probability of good news is greater than the probability of bad news, the price should increase before the news comes out. Technically, it is the expected value of the next information release is zero.

technical and charting indicators, albeit as secondary factors, in picking stocks. They disagree with the fundamental assumptions made by random walkers and argue that

1. Investors are not always rational in the way they set expectations. These irrationalities may lead to expectations being set too low for some assets at some times and too high for other assets at other times. Thus, the next piece of information is more likely to contain good news for the first asset and bad news for the second.
2. Price changes themselves may provide information to markets. Thus, the fact that a stock has gone up strongly the last four days may be viewed as good news by investors, making it more likely that the price will go up today than down.

The debate about whether price changes are random or not has raged for the last 50 years, ever since researchers were able to access price data on stocks. We have to admit that the initial tests were almost all conducted by those who believed that prices follow a random walk, and not surprisingly, they found no price patterns. In the last two decades, there has been an explosion in both the amount of data available and in the points of view of researchers. One of the biggest surprises (at least to those who believed the prevailing dogma of efficient and rational markets) has been the uncovering of numerous price patterns, though it is not clear whether these are evidence of irrational markets and whether they offer potential for profits.

Empirical Evidence

As the studies of the time series properties of prices have proliferated, the evidence can be classified into two classes - studies that focus on short-term (intraday, daily and weekly price movements) price behavior and research that examines long-term (monthly, annual and five-year returns) price movements. Since the findings are contradictory, we will present them separately. We will also present evidence on seasonal patterns in stock prices that seem to persist not only over many periods but also across most markets.

a. Short Term Price Patterns

The notion that today's price change conveys information about tomorrow's price change is deep rooted in most investors' psyches. In its more sophisticated formats, the notion that there are patterns in price movements over short periods of time forms the basis for much of charting. All too often, these patterns are backed up anecdotal evidence, with the successful experiences on one or a few stocks extrapolated to form rules about all stocks and assets. Even in a market that follows a perfect random walk, you will see price patterns on some stocks that seem to defy probability. The entire market may go up ten days in a row, or down, for no other reason than pure chance. Given that this is often true, how do we

test to see if there are significant price patterns? We will consider two ways in which researchers have examined this question in this section.

a. Serial correlation

If today is a big up day for a stock, what does this tell us about tomorrow? There are three different points of view. The first is that the momentum from today will carry into tomorrow, and that tomorrow is more likely to be an up day than a down day. The second is that there will be the proverbial profit taking as investors cash in their profits and that the resulting correction will make it more likely that tomorrow will be a down day. The third is that each day we begin anew, with new information and new worries, and that what happened today has no implications for what will happen tomorrow.

Statistically, the serial correlation measures the relationship between price changes in consecutive time periods, whether hourly, daily or weekly, and is a measure of how much the price change in any period depends upon the price change over the previous time period. A serial correlation of zero would therefore imply that price changes in consecutive time periods are uncorrelated with each other, and can thus be viewed as a rejection of the hypothesis that investors can learn about future price changes from past ones. A serial correlation that is positive, and statistically significant, could be viewed as evidence of price momentum in markets, and would suggest that returns in a period are more likely to be positive (negative) if the prior period's returns were positive (negative). A serial correlation which is negative, and statistically significant, could be evidence of price reversals, and would be consistent with a market where positive returns are more likely to follow negative returns and vice versa.

From the viewpoint of investment strategy, serial correlations can sometimes be exploited to earn excess returns. A positive serial correlation would be exploited by a strategy of buying after periods with positive returns and selling after periods with negative returns. A negative serial correlation would suggest a strategy of buying after periods with negative returns and selling after periods with positive returns. Since these strategies generate transactions costs, the correlations have to be large enough to allow investors to generate profits to cover these costs. It is therefore entirely possible that there be serial correlation in returns, without any opportunity to earn excess returns for most investors.

The earliest studies² of serial correlation all looked at large U.S. stocks and concluded that the serial correlation in stock prices was small. One of the first by Fama in

² Alexander (1964), Cootner (1962) and Fama (1965) all estimated serial correlation in stock prices. Given the difficulty of obtaining data, they worked with small samples over short periods.

1965, for instance, found that 8 of the 30 stocks listed in the Dow had negative serial correlations and that most of the serial correlations were less than 0.05. Other studies confirm these findings – of very low correlation, positive or negative - not only for smaller stocks in the United States, but also for other markets. For instance, Jennergren and Korsvold (1974) report low serial correlations for the Swedish equity market and Cootner (1961) concludes that serial correlations are low in commodity markets as well. While there may be statistical significance associated with some of these correlations, it is unlikely that there is enough correlation in short-period returns to generate excess returns, after you adjust for transactions costs.

The serial correlation in short period returns is affected by market liquidity and the presence of a bid-ask spread. Not all stocks in an index are liquid, and, in some cases, stocks may not trade during a period. When the stock trades in a subsequent period, the resulting price changes can create positive serial correlation. To see why, assume that the market is up strongly on day 1, but that three stocks in the index do not trade on that day. On day 2, if these stocks are traded, they are likely to go up to reflect the increase in the market the previous day. The net result is that you should expect to see positive serial correlation in daily or hourly returns in illiquid market indices. The bid-ask spread creates a bias in the opposite direction, if transactions prices are used to compute returns, since prices have a equal chance of ending up at the bid or the ask price. The bounce that this induces in prices will result in negative serial correlations in returns.³ For very short return intervals, this bias induced in serial correlations might dominate and create the mistaken view that price changes in consecutive time periods are negatively correlated.

There are some recent studies that find evidence of serial correlation in returns over short time periods, but the correlation is different for high volume and low volume stocks. With high volume stocks, stock prices are more likely to reverse themselves over short periods, i.e., have negative serial correlation. With low volume stocks, stock prices are more likely to continue to move in the same direction – i.e., have positive serial correlation.⁴ None of these studies suggest that you can make money of these correlations.

³ Roll (1984) provides a simple measure of this relationship,

$$\text{Bid-Ask Spread} = -\sqrt{2} (\text{Serial Covariance in returns})$$

where the serial covariance in returns measures the covariance between return changes in consecutive time periods.

⁴ See “Volume and Autocovariances in Short-Horizon Individual Security Returns”, Conrad, Hameed and Niden, in *Journal of Finance*, 1994.

b. Runs Tests

Once in a while a stock has an extended run where stock prices go up several days in a row or down several days in a row. While this, by itself, is completely compatible with a random walk, you can examine a stock’s history to see if these runs happen more frequently or less frequently than they should. A runs test is based upon a count of the number of runs, i.e., sequences of price increases or decreases, in price changes over time. Thus, the following time series of price changes, where U is an increase and D is a decrease would result in the following runs -

UUU DD U DDD UU DD U D UU DD U DD UUU DD UU D UU D

There were 18 runs in this price series of 33 periods. The actual number of runs in the price series is compared against the number that can be expected⁵ in a series of this length, assuming that price changes are random. If the actual number of runs is greater than the expected number, there is evidence of negative correlation in price changes. If it is lower, there is evidence of positive correlation. A study of price changes in the Dow 30 stocks, assuming daily, four-day, nine-day and sixteen day return intervals provided the following results -

	DIFFERENCING INTERVAL			
	Daily	Four-day	Nine-day	Sixteen-day
Actual runs	735.1	175.7	74.6	41.6
Expected runs	759.8	175.8	75.3	41.7

The actual number of runs in four-day returns (175.8) is almost exactly what you would expect in a random process. There is slight evidence of positive correlation in daily returns but no evidence of deviations from normality for longer return intervals.

Again, while the evidence is dated, it serves to illustrate the point that long strings of positive and negative changes are, by themselves, insufficient evidence that markets are not random, since such behavior is consistent with price changes following a random walk. It is the recurrence of these strings that can be viewed as evidence against randomness in price behavior.

b. Long Term Price Patterns

While most of the earlier studies of price behavior focused on shorter return intervals, more attention has been paid to price movements over longer periods (six months

⁵ There are statistical tables that summarize the expected number of runs, assuming randomness, in a series of any length.

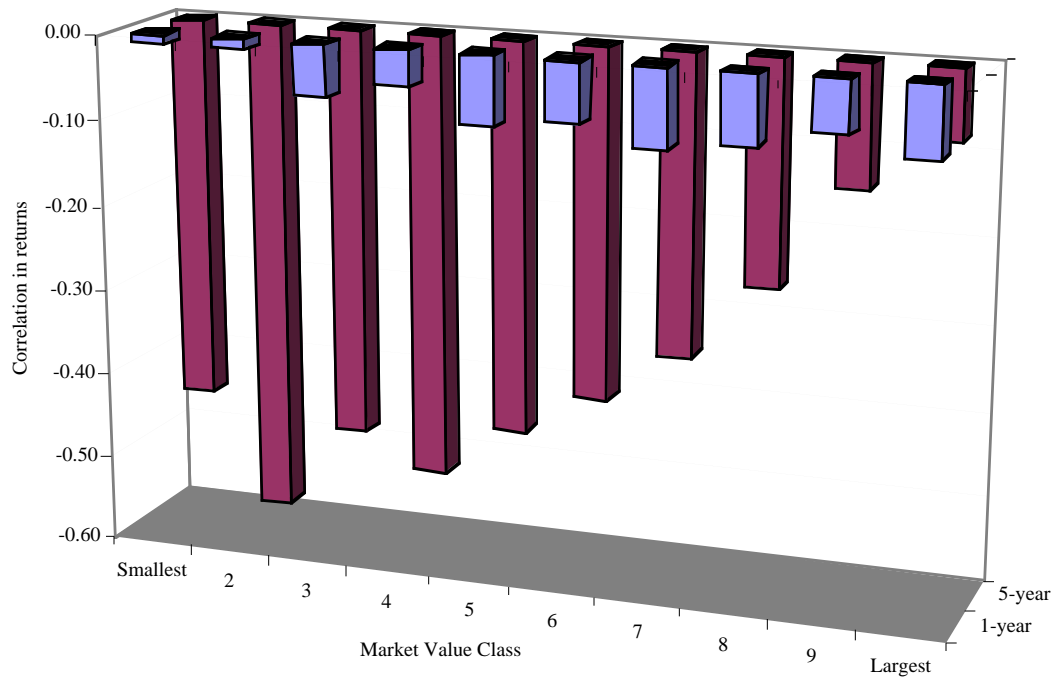
to five-year) in recent years. Here, there is an interesting dichotomy in the results. When long term is defined as months rather than years, there seems to be a tendency towards positive serial correlation. Jegadeesh and Titman present evidence of what they call “price momentum” in stock prices over time periods of up to eight months – stocks that have gone up in the last six months tend to continue to go up whereas stocks that have gone down in the last six months tend to continue to go down. The momentum effect is just as strong in the European markets, though it seems to be weaker in emerging markets.⁶ What may cause this momentum? One potential explanation is that mutual funds are more likely to buy past winners and dump past losers, thus generating price continuity.⁷

However, when long term is defined in terms of years, there is substantial negative correlation in returns, suggesting that markets reverse themselves over very long periods. Fama and French examined five-year returns on stocks from 1941 to 1985 and present evidence of this phenomenon. They found that serial correlation is more negative in five-year returns than in one-year returns, and is much more negative for smaller stocks rather than larger stocks. Figure 7.2 summarizes one-year and five-years serial correlation by size class for stocks on the New York Stock Exchange.

⁶ Rouwenhorst (1998) studied 12 European markets and finds evidence of momentum in each market. In 1999, he presented evidence of momentum in emerging markets. Another paper by Bekaert, Erb, Harvey and Viskanta (1997) finds that momentum investing is not consistently profitable in emerging markets.

⁷ Grinblatt, Titman and Wermers (1995) present evidence that is consistent with this explanation.

Figure 7.2: One year and Five year Correlations: Market Value Class: 1941- 1985



Source: Fama and French (1988)

This phenomenon has also been examined in other markets, and the findings have been similar. There is evidence that returns reverse themselves over long time periods.

Given the findings of little or no correlation in the short term and substantial correlation in the long term, it is interesting that so many technical analysts focus on predicting intraday or daily prices. The bigger payoff seems to be in looking at price patterns over much longer periods, though there are caveats we will present in the next chapter on these long term strategies.

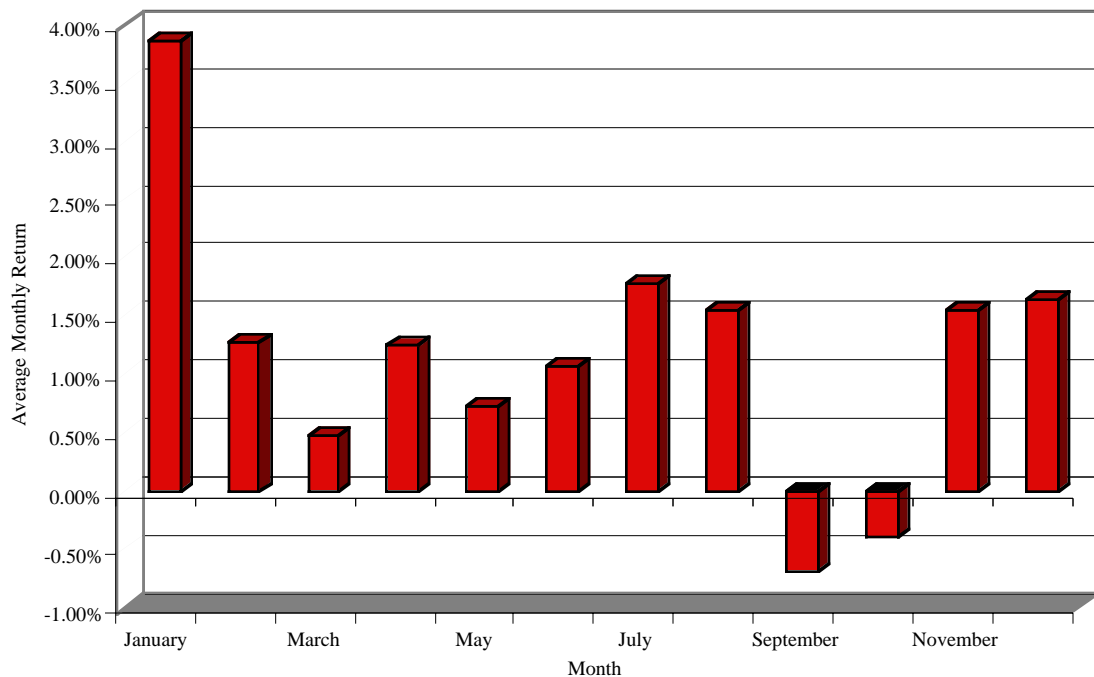
c. Seasonal and Temporal Patterns in Prices

One of the most puzzling phenomena in asset prices is the existence of seasonal and temporal patterns in stock prices that seem to cut across all types of asset markets. As we will see in this section, stock prices seem to go down more on Mondays than on any other day of the week and do better in January than in any other month of the year. What is so surprising about this phenomenon, you might ask? It is very difficult to justify the existence of patterns such as these in a rational market – after all, if investors know that stocks do better in January than in any other month, they should start buying the stock in December and shift the positive returns over the course of the year. Similarly, if investors know that stocks are likely to be marked down on Monday, they are likely to begin marking them down on Friday and hence shift the negative returns over the course of the week.

The January Effect

Studies of returns in the United States and other major financial markets consistently reveal strong differences in return behavior across the months of the year. Figure 7.3 reports average returns by month of the year from 1927 to 2001.

Figure 7.3: Returns by Month of the year - 1927 - 2001

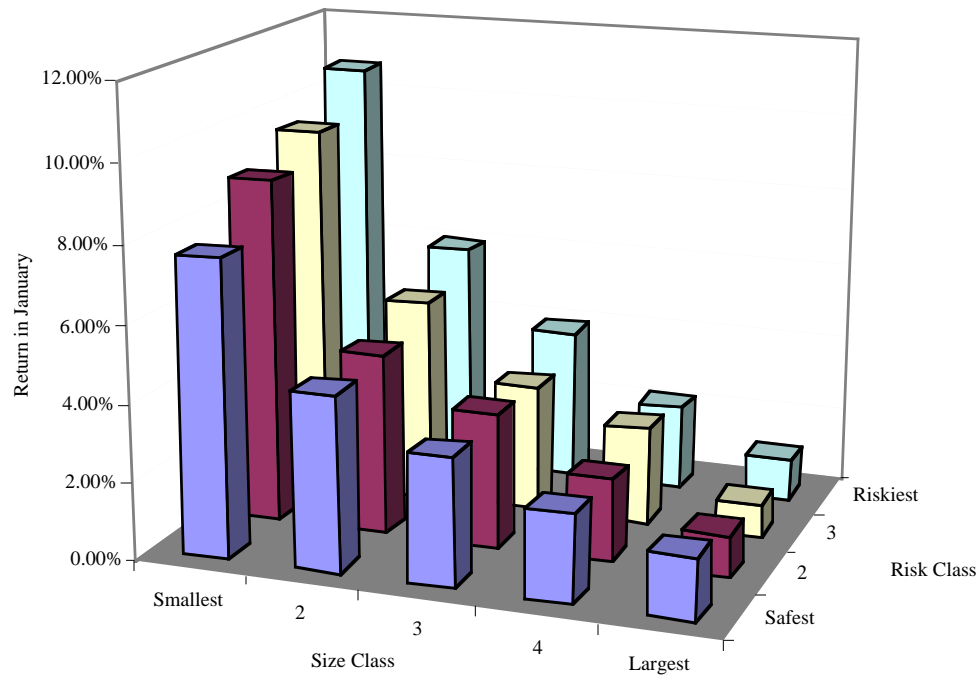


Returns in January are significantly higher than returns in any other month of the year. This phenomenon is called the year-end or January effect, and it can be traced to the first two weeks in January.

The January effect is much more pronounced for small firms than for larger firms, and roughly half of the small firm premium, which is the additional return earned by small firms relative to large firms, is earned in the first few days of January. Figure 7.4 graphs returns in January by size and risk class for data from 1935 to 1986.⁸

⁸ This finding is from Haugen, R. and J. Lakonishok, *The Incredible January Effect*, Dow-Jones Irwin.

Figure 7.4: Returns in January by Size and Risk Class



Source: Chopra and Ritter

Note that the January effect is most pronounced for the smallest, riskiest firms in the market and least pronounced for larger, safer firms.

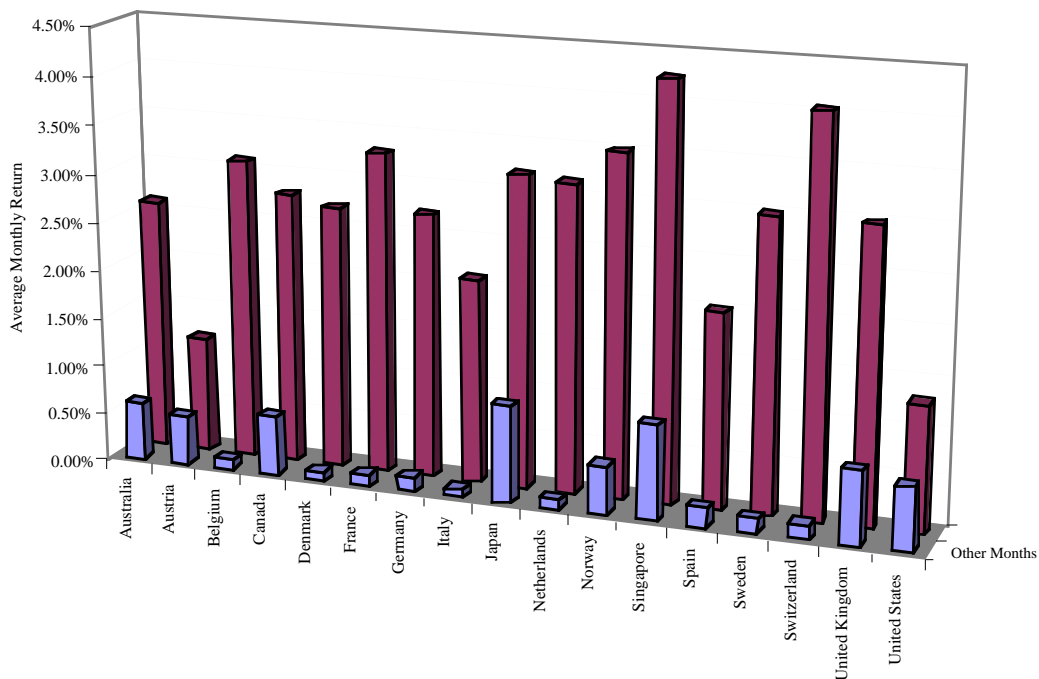
A number of explanations have been advanced for the January effect, but few hold up to serious scrutiny. One is that there is tax loss selling by investors at the end of the year on stocks which have gone down to capture the capital gain, driving prices down, presumably below true value, in December, and a buying back of the same stocks⁹ in January, resulting in the high returns. The fact that the January effect is accentuated for stocks that have done worse over the prior year is offered as evidence for this explanation. There are several pieces of evidence that contradict it, though. First, there are countries, like Australia, which have a different tax year, but continue to have a January effect. Second, the January effect is no greater, on average, in years following bad years for the stock market, than in other years.

⁹ It is to prevent this type of trading that the internal revenue service has a “wash sale rule” that prevent you from selling and buying back the same stock within 45 days. To get around this rule, there has to be some substitution among the stocks. Thus investor 1 sells stock A and investor 2 sells stock B, but when it comes time to buy back the stock, investor 1 buys stock B and investor 2 buys stock A.

A second rationale is that the January effect is related to institutional trading behavior around the turn of the years. It has been noted, for instance, that ratio of buys to sells for institutions drops significantly below average in the days before the turn of the year and picks to above average in the months that follow.¹⁰ It is argued that the absence of institutional buying pushes down prices in the days before the turn of the year and pushes up prices in the days after. Again, while this may be true, it is not clear why other investors do not step in and take advantage of these quirks in institutional behavior.

The universality of the January effect is illustrated in Figure 7.5 where we examine returns in January versus the other months of the year in several major financial markets, and finds strong evidence of a January effect in every market.¹¹

Figure 7.5: The International January Effect



Source: Haugen and Lakonishok

In fact, researchers have unearthed evidence of a January effect in bond and commodity markets as well.

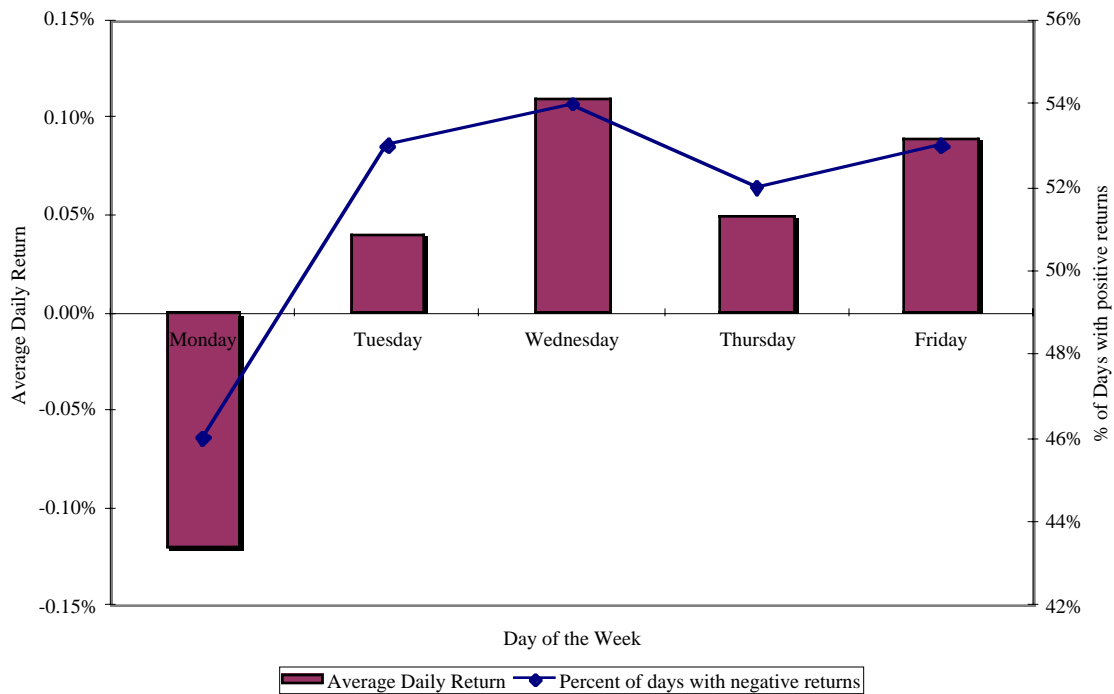
¹⁰ Institutional buying drops off in the last 10 days of the calendar year, and picks up again in the first 10 days of the next calendar year.

¹¹ This is also from Haugen, R. and j. Lakonishok, *The Incredible January Effect*, Dow Jones Irwin.

The Weekend Effect

Are stock returns consistently higher on some days of the week than others? A surprising feature of stock returns is the existence of what is called the weekend effect, another return phenomenon that has persisted over extraordinary long periods and over a number of international markets. It refers to the differences in returns between Mondays and other days of the week. The significance of the return difference is brought out in Figure 7.6, which graphs returns by days of the week from 1927 to 2001.

Figure 7.6: Returns by Day of the Week - 1927-2001



Source: Raw data from CRSP

The returns on Mondays are, on average, negative, whereas the returns on every day of the week are not. In addition, returns on Mondays are negative more often than returns on any other trading day. There are a number of other findings on the Monday effect that researchers have fleshed out.

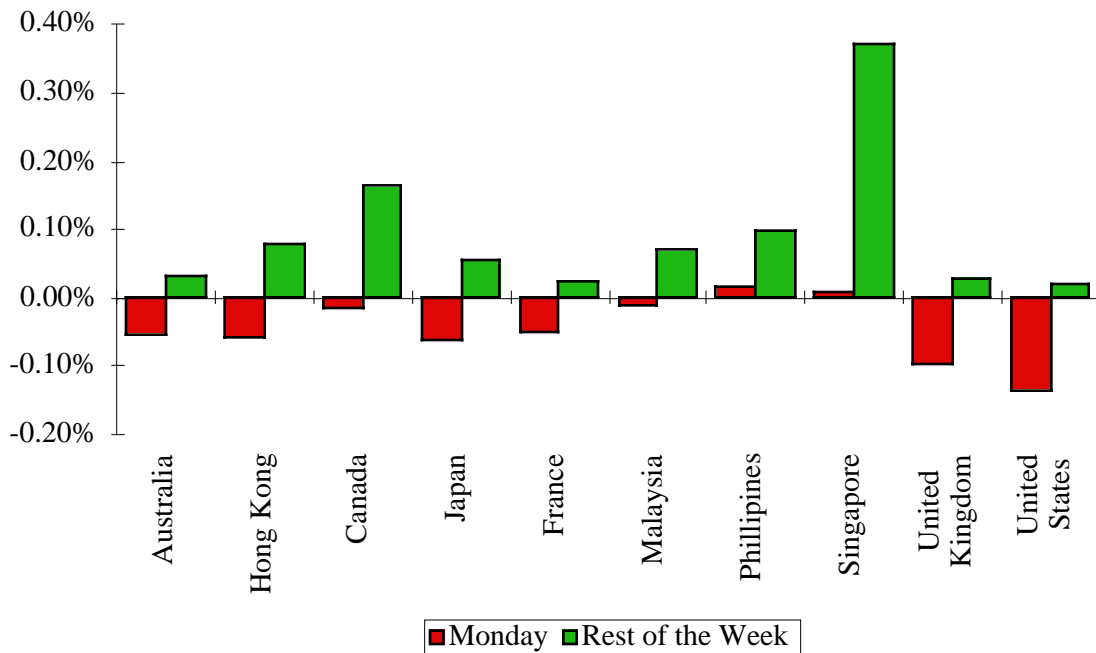
- The Monday effect is really a weekend effect since the bulk of the negative returns are manifested in the Friday close to Monday open returns. In other words, the negative returns on Monday are generated by the fact that stocks tend to open lower on Mondays than from what happens during the day. The returns from intraday returns on Monday (the price changes from open to close on Monday) are not the culprits in creating the negative returns.

- The Monday effect is worse for small stocks than for larger stocks. This mirrors our findings on the January effect.
- The Monday effect is no worse following three-day weekends than two-day weekends.
- Monday returns are more likely to be negative if the returns on the previous Friday were negative. In fact, Monday returns are, on average, positive following positive Friday returns, and are negative 80% of the time following negative Friday returns.¹²

There are some who have argued that the weekend effect is the result of bad news being revealed after the close of trading on Friday and during the weekend. They point to the fact that more negative earnings reports are revealed after close of trading on Friday. Even if this were a widespread phenomenon, the return behavior would be inconsistent with a rational market, since rational investors would build in the expectation of the bad news over the weekend into the price before the weekend, leading to an elimination of the weekend effect.

The weekend effect is strong in most major international markets, as shown in Figure 7.7.

Figure 7.7: Weekend Effect in International Markets

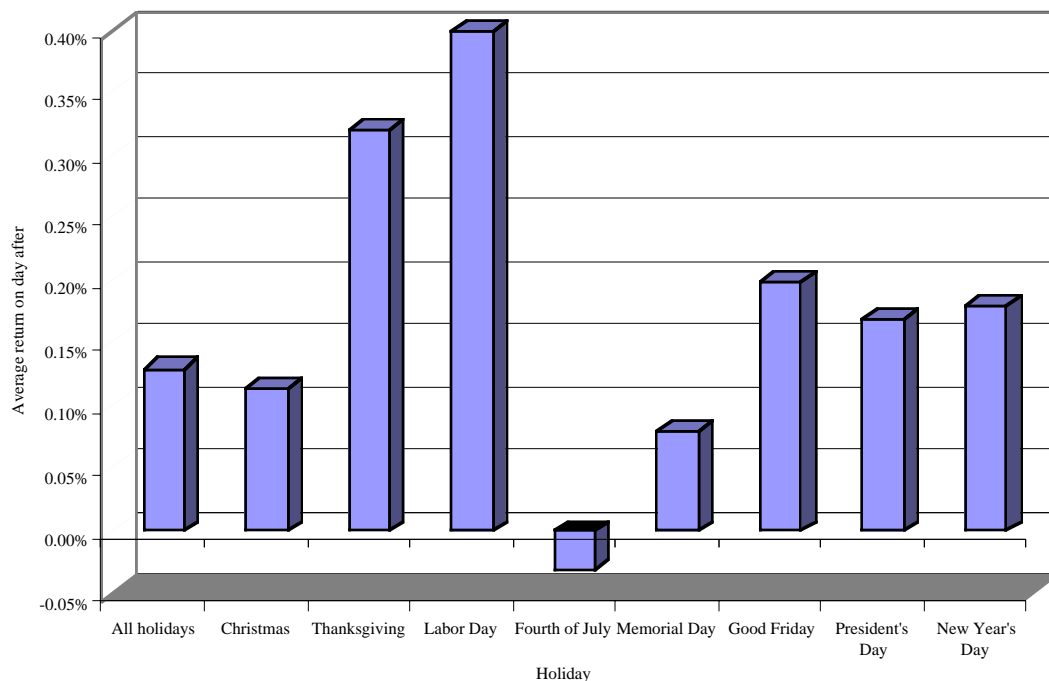


¹² See “The Individual Investor and the Weekend Effect”, Abraham and Ikenberry, *Journal of Financial and Quantitative Analysis*.

The returns on Monday are lower than returns on other days of the week for every international market examined. The presence of a strong weekend effect in Japan, which allowed Saturday trading for a portion of the period studies here indicates that there might be a more direct reason for negative returns on Mondays than bad information over the weekend.

As a final note, the negative returns on Mondays cannot be just attributed to the absence of trading over the weekend. The returns on days following trading holidays, in general, are characterized by abnormally positive, not negative, returns. Figure 7.8 summarizes returns on trading days following major holidays and confirms this pattern.

Figure 7.8: Return on first trading day after



In fact, the returns on the first trading day after a holiday tend to be much more positive than returns on other trading days.¹³

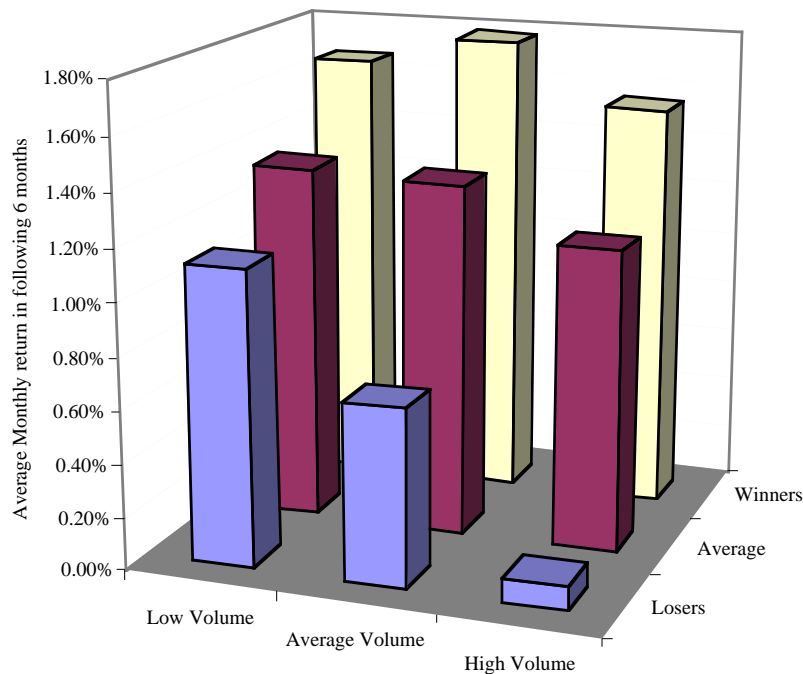
d. Volume Patterns

While the random walk hypothesis is silent about the relationship between trading volume and prices, it does assume that all available information is incorporated in the current price. Since trading volume is part of publicly available information, there should therefore be no information value to knowing how many shares were traded yesterday or the day before.

¹³ See "High Stock Returns before holidays" R.A. Ariel.

As with prices, there is evidence that trading volume carries information about future stock price changes. In a study in 1998, Datar, Naik and Radcliffe show that low volume stocks earn higher returns than high volume stocks, though they attribute the differential return to a liquidity premium on the former. A more surprising result comes from Lee and Swaminathan (1998) who look at the interrelationship between price and trading volume. In particular, they examine the price momentum effect that was documented by Jegadeesh and Titman – that stocks that go up are more likely to keep going up and stocks that go down are more likely to keep dropping in the months after - and show that it is much more pronounced for high volume stocks. Figure 7.9 classifies stocks based upon how well or badly they have done in the last six months (winners, average and loser stocks) and their trading volume (low, average and high) and looks at returns on these stocks in the following six months.

Figure 7.9: Volume and Price Intreaction- NYSE and AMEX stocks - 1965-95



Source: Lee and Swaminathan

Note that the price momentum effect is strongest for stocks with high trading volume. In other words, a price increase or decrease that is accompanied by strong volume is more likely to continue into the next period. Stickel and Verecchia confirm this result with shorter period returns – they conclude that increases in stock prices that are accompanied by high trading volume are more likely to carry over into the next trading day.

In summary, the level of trading volume in a stock, changes in volume and volume accompanied by price changes all seem to provide information that investors can use to pick stocks. It is not surprising that trading volume is an integral part of technical analysis.

Data Mining or Anomalies

When looking at the evidence on seasonal and temporal anomalies in stock price data, we are faced with an interesting dilemma. As stock price data has become both richer (we have gone from annual to intraday data and from just equity markets to bond and derivatives markets) and easier to access and use, it is not surprising that the number of inefficiencies and anomalies discovered have also increased. You could argue that some of these findings can be attributed to the sheer volume of data that is available to us. As hundreds of researchers pore over this data, using finer and finer microscopes, they will find patterns depending upon the portion of the data that they are looking at. In a spirited defense of efficient markets, Fama presents the argument that almost of the anomalies and inefficiencies that researchers have detected over the last 40 years can be attributed purely to chance, rather than irrational or inefficient investors. In fact, he makes the interesting point that those researchers who claim to find inefficiencies cannot seem to agree on whether the inefficiencies indicate a market that over reacts or one that under reacts to new information.¹⁵

Investor Irrationality

Historians who have examined the behavior of financial markets over time have challenged the assumption of rationality that underlies much of efficient market theory. They point to the frequency with which speculative bubbles have formed in financial markets, as investors buy into fads or get-rich-quick schemes, and the crashes with which these bubbles have ended, and suggest that there is nothing to prevent the recurrence of this phenomenon in today's financial markets. In fact, the evidence on price patterns, in the short and long term, in different calendar months and on different weekdays suggests that there is much about markets that we cannot explain with a rational investor model. In this section, we will begin by considering some of the evidence accumulated by psychologists on human behavior and then consider financial market phenomena that seem more consistent with an irrational market than a rational one.

¹⁵ See "Market Efficiency, Long Term Returns and Behavioral Finance" by E.F. Fama, *Journal of Financial Economics*, v 49, 0g 283-306.

Psychological Studies

At the risk of stating the obvious, investors are human and it is not surprising that financial markets reflect human frailties. In an extraordinary book (at least for an academic economist), Robert Schiller presented some of the evidence accumulated of human behavior by psychologists that may help us understand financial market behavior. He categorizes these findings into several areas and we will consider each below.

The Need for Anchors

When confronted with decisions, it is human nature to begin with the familiar and use it to make judgments. Kahnemann and Tversky, whose research has helped illuminate much of what is called behavioral finance, ran an experiment where they used a wheel of fortune with numbers from 1 to 100 to illustrate this point. With a group of subjects, they spun the wheel to get a number and then asked the subjects numerical questions about obscure percentages – the percent of the ancient Egyptians who ate meat, for instance. The subjects would have to guess whether the right answer was higher or lower than the number on the wheel and then provide an estimate of the actual number. They found that the answer given by subjects was consistently influenced by the outcome of the wheel spin. Thus, if the number on the wheel was 10, the answer was more likely to be 15 or 20%, whereas if the number on the wheel was 60%, it was more likely to be 45 or 50. Shiller argues that market prices provide a similar anchor with publicly traded assets. Thus, an investor asked to estimate the value of a share is likely to be influenced by the market price, with the value increasing as the market price rises.

The Power of the Story

For better or worse, human actions tend to be based not on quantitative factors but on story telling. People tend to look for simple reasons for their decisions, and will often base their decision on whether these reasons exist. In a study of this phenomenon, Shafir, Simonson and Tversky gave subjects a choice on which parent they would choose for sole custody of a child. One parent was described as average in every aspect of behavior and standing whereas the other was described more completely with both positive (very close relationship with child, above-average income) and negative characteristics (health problems, travels a lot). Of the subjects studied, 64% picked the second. Another group of subjects was given the same choice but asked which one they would deny custody to. That group also picked the second parent. While the results seem inconsistent – the first group chose the second parent as the custodian and the second group rejected the same parent, given the same facts – they suggest that investors are more comfortable with investment decisions that can be justified with a strong story than one without.

Overconfidence and Intuitive Thinking

As you have undoubtedly become aware from your interactions with friends, relatives and even strangers over time, human beings tend to be opinionated about things they are not well informed on and to make decisions based upon these opinions. In an illustrative study, Fischhoff, Slovic and Lichtenstein asked people factual questions, and found that people gave an answer and consistently overestimated the probability that they are right. In fact, they were right only about 80% of the time that they thought they were. What are the sources of this overconfidence? One might just be evolutionary. The confidence, often in the face of poor odds, may have been what allowed us to survive and dominate as a species. The other may be more psychological. Human beings seem to have a propensity to hindsight bias, i.e., they observe what happens and act as if they knew it was coming all the time. Thus, you have investors that claim to have seen the crash in dot.com companies in the late 1990s coming during earlier years, thought nothing in their behavior suggests that they did.

Herd Behavior

The tendency of human beings to be swayed by crowds has been long documented and used by tyrants over time to impose their will on us. In a fascinating experiment, Asch illustrated this by putting a subject into a group of people, asking them a question to which the answer was obvious and then inducing other people in the group to provide the wrong answer deliberately. Asch noted that the subject changed his answer one-third of the time to reflect the incorrect answer given in the group. While Asch attributed this to peer pressure, subsequent studies found the same phenomenon even when the subject could not see or interact with others in the group. This would suggest that the desire to be part of the crowd is due to more than peer pressure.

While there is a tendency to describe herd behavior as irrational, it is worth noting that you can have the same phenomena occur in perfectly rational markets through a process called information cascade. Schiller provides an example with two restaurants, where people come into town one after another. Assume that the first person to come in picks the first restaurant and assume that the choice is random. The second person who comes into town will observe the first person sitting in the first restaurant, and is more likely to pick the same restaurant. As the number of subjects entering the market increases, you are likely to see the crowd at the first restaurant pick up, while business at the second restaurant will be minimal. Thus, a random choice by the first customer in the market creates enough momentum to make it the dominant restaurant. All too often, in investing, investors at early stages in the process (initial public offering) pile into specific initial public offerings and push their

prices up. Other initial public offerings are ignored and languish at low prices. It is entirely possible that the first group of stocks will be overvalued, while the latter are undervalued. Since herd behavior is made worse by rumors by the spreading of rumors, you could argue that the coming together of the available data and media sites such as CNBC and MSNBC has made it more possible for herd behavior to spend and not less.

Unwillingness to admit mistakes

It may be human to err, but it is also human to claim not to err. In other words, we are much more willing to claim our successes than we are willing to face up to our failures. Kahneman and Tversky, in their experiments on human behavior, noticed that subjects when presented with choices relative to the status quo often made choices based upon unrealistic expectations. They noted that a person who has not made peace with his losses is likely to accept gambles that would otherwise be unacceptable to him. Anyone who has visited a casino will attest to this finding.

In investing, Shefrin and Statman call this the disposition effect, i.e, the tendency to hold on to losers too long and to sell winners too soon.¹⁶ They argue that it is widespread and can cause systematic mispricing of some stocks. Terrance Odean used the trading records of over 10000 customers at a discount brokerage house to examine whether there is evidence of this behavior among investors.¹⁷ He notes that investors realized only 9.8% of their losses each year, whereas they realize 14.8% of their gains.¹⁸ He also finds that investors seem to sell winners too soon, since winning stocks that get sold continue to go up for months after the sale. Overall, he argues that there is evidence of the disposition effect among investors.

Empirical Evidence

While it is evident that human beings do not always behave rationally, it does not necessarily follow that markets will also be irrational. In fact, you could argue (as some believers in market efficiency do) that markets can be efficient even with irrational investors for several reasons. First, it is possible that there is a selection process that occurs in markets where irrational investors lose consistently to rational investors and eventually get pushed out of the market. Second, it is also possible that irrationalities cut in both directions

¹⁶ Shefrin, H. and M. Statman, 1985, The disposition to sell winners too early and ride losers too long: Theory and Evidence, *Journal of Finance*, v40, p777-790.

¹⁷ Odean, T., 1997, Are investors reluctant to realize their losses?, Working paper, University of California, Davis.

¹⁸ The only month in which more losses are realized than gains is December.

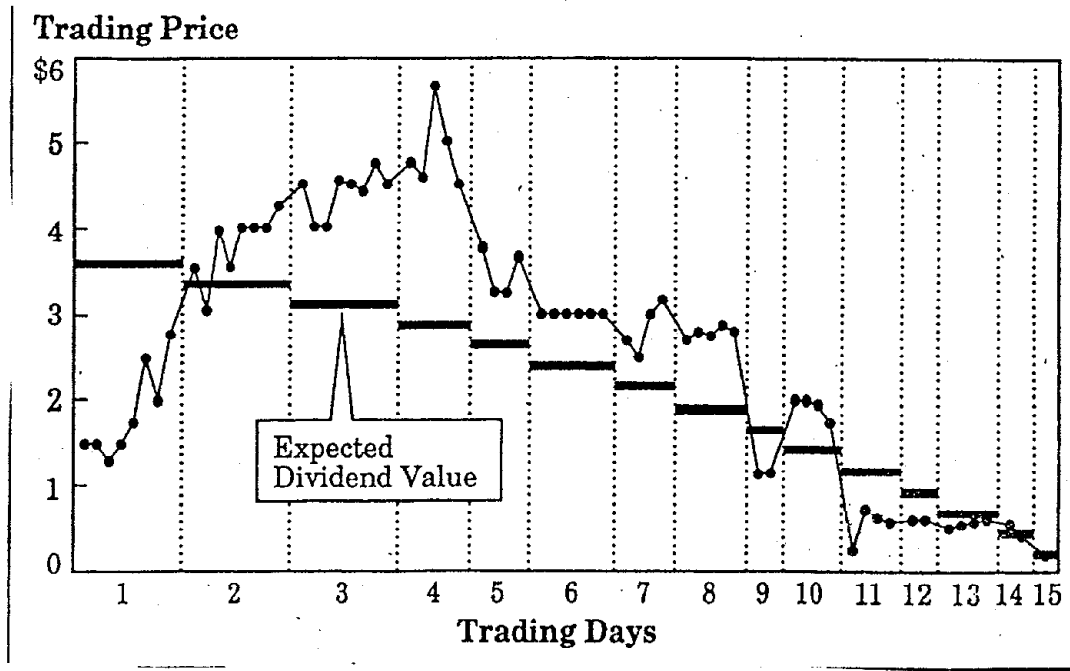
– some leading investors to buy when they should not and others leading them to sell when they should not; if these actions offset each other, you could still have a market price that is unaffected by rational investors. The only way to resolve this debate is to look at the empirical evidence on the presence or absence of irrationality in market behavior. In this section, we will begin by looking at experimental studies that claim to document irrational investors, and then consider the evidence accumulated through the centuries on bubbles and whether their existence alone indicates irrational investors. In fact, this is a discussion we will revisit in the chapters to come, since investment philosophies are based upon specific and often contradictory views of human irrationality.

Experimental Studies

One of the problems we face when we test for irrationality in financial markets is the number of variables that cannot be controlled for. Investors enter and leave markets, new information arrives constantly and the macroeconomic environment changes frequently, making it impossible to construct a controlled experiment. A few researchers have attempted to get around this problem by constructing experimental studies, similar to those used by psychologists and sociologists in the previous section, to examine how investors behave in financial markets.

One such study was done at the University of Arizona. In this study, groups of students were chosen as subjects and asked to play the role of traders in a single asset for 15 trading days. They were told at the start of the experiment that a payout would be declared on this asset after each trading day, and that it would take one of four values- 0, 8, 28 or 60 cents – with equal probability. Consider how a rational investor would value this very simple asset. Since the average payout is 24 cents, the asset's expected value on the first trading day of a fifteen day experiment should be \$3.60 (24×15), the second day should be \$3.36 and so on. The traders were allowed to trade each day and the entire experiment was repeated 60 times. The resulting market prices each day, averaged across all 60 experiments, are reported in figure 7.10 and contrasted with the expected values to a rational investor.

Figure 7.10: Prices from Behavioral Experiment



There is clear evidence here of a 'speculative bubble' forming during periods 3 to 5, where prices exceed expected values significantly. The bubble ultimately bursts, and prices approach the expected value by the end of the 15th period.¹⁹ Furthermore, when price curbs of 15 cents were introduced, the booms lasted even longer because traders knew that prices would not fall by more than 15 cents in a period. Thus, the notion that price limits can control speculative bubbles seems misguided. Does this experiment conclusively prove that investors are irrational? Of course not. It is worth noting, though, that if bubbles are feasible in as simple a market as this one, where every investor obtains the same information, it is clearly feasible in real financial markets, where there is much more differential information and much greater uncertainty about expected value.

In fairness, it should be noted that the evidence from other experimental studies is largely supportive of rationality. Investors do seem to make reasonable judgments based upon the information they have, and markets do a good job of aggregating this information in the market price.

¹⁹ Some of the experiments were run with students, and some with Tucson businessmen, with 'real world' experience. The results were similar for both groups.

Market Bubbles

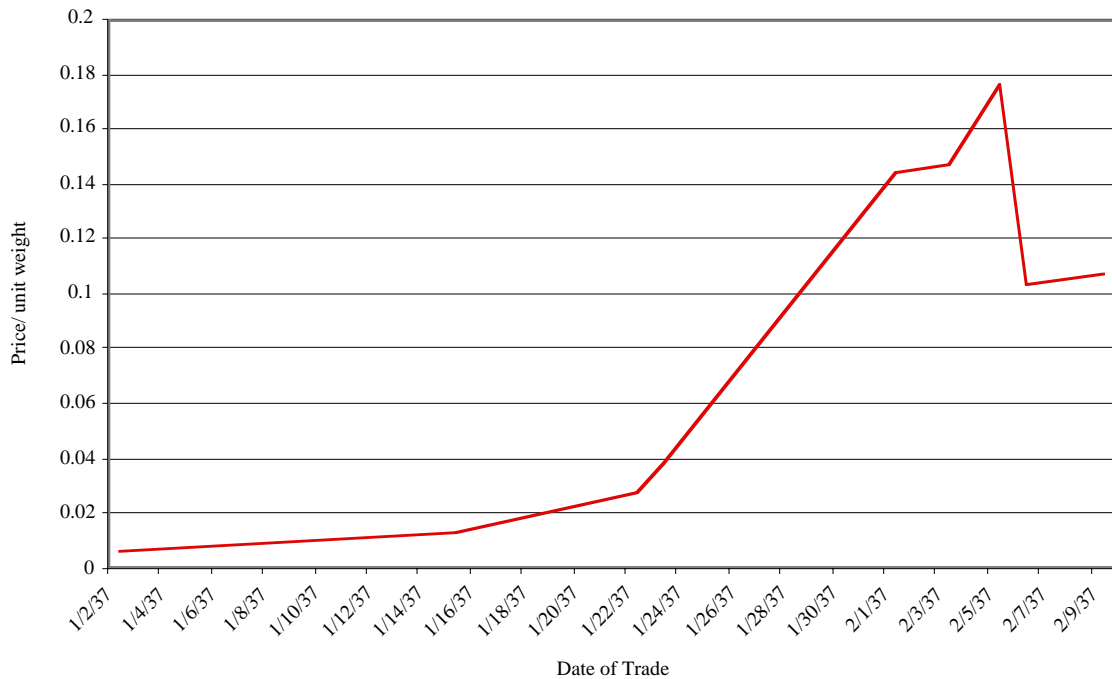
Proponents of market irrationality have pointed to market bubbles as a primary exhibit in their case against efficient markets. Through the centuries, markets have boomed and busted, and in the aftermath of every bust, irrational investors have been blamed for the crash. As we will see in this section, it is not that simple. You can have bubbles in markets with only rational investors, and assessing whether a bubble is due to irrational investors is significantly more difficult than it looks from the outside.

A Short History of Bubbles

As long as there have been markets, there have been bubbles. Two of the earliest bubbles to be chronicled occurred in the 1600s in Europe. One was the amazing boom in prices of tulip bulbs in Holland that began in 1634. A single Tulip bulb (Semper Augustus was one variety) sold for more than 5000 guilders (the equivalent of more than \$ 60,000 today) at the peak of the market. Stories abound, though many of them may have been concocted after the fact, of investors selling their houses and investing the money in tulip bulbs. As new investors entered the market in 1636, the frenzy pushed up bulb prices even more until the price peaked in early February. Figure 7.11 presents the price of one type of bulb (Switzers) in January and February of 1637.²⁰

²⁰ This graph is based upon data provided by Garber(1990) in “Crashes and Panics: The lessons of History”, Dow Jones Irwin. It should be pointed out that he does not believe that the pricing of tulip bulbs was irrational for much of the period.

Figure 7.11: Price of a Tulip Bulb (Switser) - January - February 1637



Source: Raw data from Garber

Note that the price peaked on February 5, 1637, but an investor who bought tulip bulbs at the beginning of the year would have seen his or her investment increase almost 30 fold over the next few weeks.

A little later in England, a far more conventional bubble was created in securities of a firm called the South Seas Corporation, a firm with no assets that claimed to have the license to mint untold riches in the South Seas. The stock price was bid up over the years before the price plummeted. The crash, which is described in vivid detail in Charles Mackay's classic book titled "Extraordinary Delusions and the Popular Madness of Crowds", left many investors in England poorer.²¹

Through the 1800s, there were several episodes of boom and bust in the financial markets in the United States and many of these were accompanied by banking panics.²² As markets became broader and more liquid in the 1900s, there was a renewed hope that

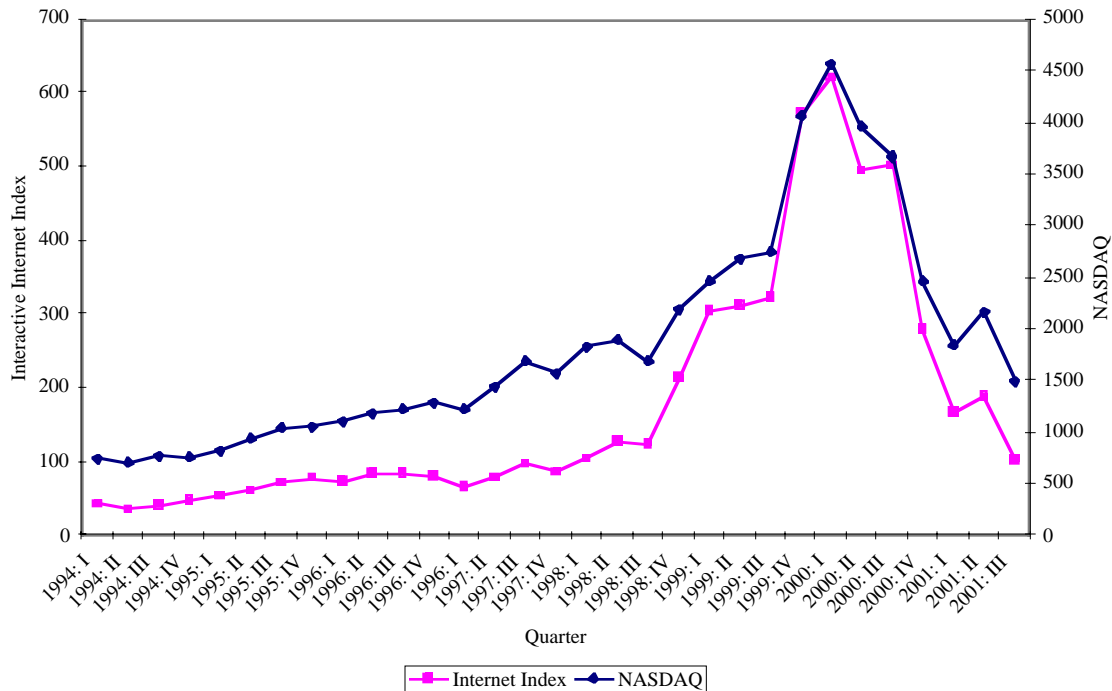
²¹ To get a flavor of financial markets in England at the time of the South Sea bubble, you should look at "A Conspiracy of Paper", a novel set in the era by David Liss. Edward Chancellor's "Devil takes the hindmost" provides historical perspective on the bubble.

²² The crash of 1873 was precipitated by the failure of firm called Jay Cooke, a financial-service firm in Philadelphia. The New York Stock Exchange was closed for ten days and several banks closed their doors in the aftermath.

liquidity and more savvy investors would make bubbles a phenomenon of the past, but it was not to be. In 1907, J.P. Morgan had to intervene in financial markets to prevent panic selling, a feat that made his reputation as the financier of the world. The 1920s saw a sustained boom in U.S. equities and this boom was fed by a number of intermediaries ranging from stockbrokers to commercial banks and sustained by lax regulation. The crash of 1929 precipitated the great depression, and created perhaps the largest raft of regulatory changes in the United States, ranging from restrictions on banks (the Glass-Steagall Act) to the creation of a Securities Exchange Commission.

The period after the second world war ushered in a long period of stability for the United States, and while there was an extended period of stock market malaise in the 1970s, the bubbles in asset prices tended to be tame relative to past crashes. In emerging markets, though, bubbles continued to form and burst. In the late 1970s, speculation and attempts by some in the United States to corner the precious metals markets did create a brief boom and bust in gold and silver prices. By the mid-1980s, there were some investors who were willing to consign market bubbles to history. On October 19, 1987, the U.S. equities market lost more than 20% of its' value in one day, the worst single day in market history, suggesting that investors, notwithstanding technological improvements and more liquidity, still shared a great deal with their counterparts in the 1600s. In the 1990s, we witnessed the latest in this cycle of market bubbles in the dramatic rise and fall of the "dot-com" sector. New technology companies with limited revenues and large operating losses went public at staggering prices (given their fundamentals) and kept increasing. After peaking with a market value of \$ 1.4 trillion in early 2000, this market too ran out of steam and lost almost all of this value in the subsequent year or two. Figure 7.12 summarizes the Internet index and the NASDAQ from 1994 to 2001:

Figure 7.12: The Tech Boom



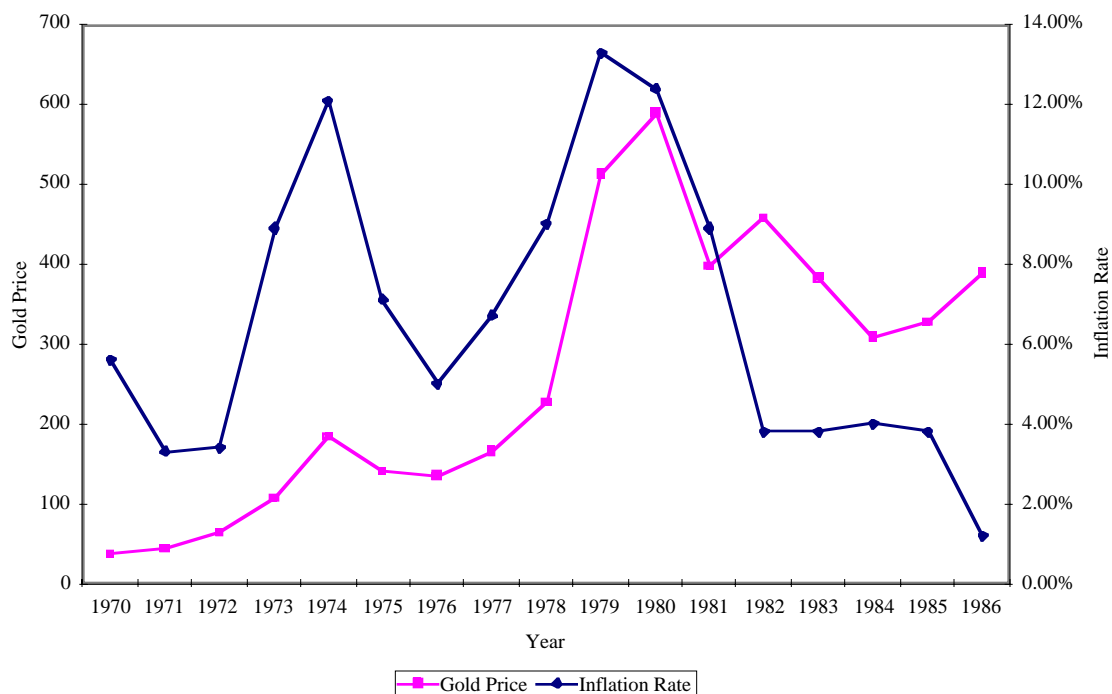
Source: Raw data from Bloomberg

The chart again has the makings of a bubble, as the value of the index internet index increased almost ten fold over the period, dragging the tech-heavy NASDAQ up with it.

Rational Bubbles?

A rational bubble sounds like an oxymoron, but it is well within the realms of possibility. Perhaps the simplest way to think of a rational bubble is to consider a series of coin tosses, with a head indicating a plus day and a tail a minus day. You would conceivably get a series of plus days pushing the stock price above the fair value, and the eventual correction is nothing more than a reversion back to a reasonable value. Note too that it is difficult to tell a bubble from a blunder. Investors in making their assessments for the future can make mistakes in pricing individual assets, either because they have poor information or because the actual outcomes (in terms of growth and returns) do not match expected values. If this is the case, you would expect to see a surge in prices followed by an adjustment to a fair value. In fact, consider what happened to gold prices in the late 1970s. As inflation increased, many investors assumed (incorrectly in hindsight) that high inflation was here to stay and pushed up gold prices accordingly. Figure 7.13, which graphs gold prices from 1970 to 1986, looks very much like a classic bubble, but may just indicate our tendencies to look at things in the rear view mirror, after they happen.

Figure 7.13: Gold Prices: 1970-86



Source: Raw data from Bloomberg

Note that the surge in gold prices closely followed the increase in inflation in the late 1970s, reflecting its value as a hedge against inflation. As inflation declined in the 1980s, gold prices followed. It is an open question, therefore, whether this should be even considered a bubble.

Bubble or Blunder: Tests

There are some researchers who argue that you can separate bubbles from blunders by looking at how prices build up over time. Santoni and Dwyer (1990), for instance, argue that you need two elements for a bubble – positive serial correlation in returns and a delinking of prices and fundamentals as the bubble forms. They test the periods prior to 1929 and 1987 crashes to examine whether there is evidence of bubbles forming in those periods. Based upon their analysis, there is no evidence of positive serial correlation in returns or of a reduction in the correlation between prices and fundamentals (which they define as dividends) in either period. Therefore, they argue that neither period can be used as an example of a bubble.

While there is truth to the underlying premise, these tests may be too weak to capture bubbles that form over long periods. For instance, Santoni and Dwyer's conclusion of no serial correlation seems to be sensitive to both the time periods examined and the

return interval used. In addition, detecting a delinking of prices and fundamentals statistically may be difficult to do if it happens gradually over time. In short, these may be useful indicators but they are not conclusive.

Bubbles: From Inception to Crash

One of the more fascinating questions in economics examines how and why bubbles form and what precipitates their bursting. While each bubble has its own characteristics, there seem to be four phases to every bubble.

Phase 1: The Birth of the Bubble

Most bubbles have their genesis in a kernel of truth. In other words, at the heart of most bubbles is a perfectly sensible story. Consider, for instance, the dot.com bubble. At its center was a reasonable argument that as more and more individuals and businesses gained online access, they would also be buying more goods and services online. The bubble builds as the market provides positive reinforcement to some investors and businesses for irrational or ill-thought out actions. Using the dot.com phenomenon again, you could point to the numerous start-up companies with half-baked ideas for e-commerce that were able to go public with untenable market capitalizations and the investors who made profits along the way.

A critical component of bubbles building is the propagation of the news of the success to other investors in the market, who on hearing the news, also try to partake in the bubble. In the process, they push prices up and provide even more success stories that can be used to attract more investors, thus providing the basis for a self-fulfilling prophecy. In the days of the tulip bulb craze, this would have had to be word of mouth, as successful investors spread the word, with the success being exaggerated in each retelling of the story. Even in this century, until very recently, the news of the success would have reached investors through newspapers, financial newsmagazines and the occasional business show on television. In the dot.com bubble, we saw two additional phenomena that allowed news and rumors to spread even more quickly. The first was the internet itself, where chat rooms and web sites allowed investors to tell their success stories (or make them up as they went along). The second was the creation of cable stations such as CNBC, where analysts and money managers could present their views to millions of investors.

Phase 2: The Sustenance of the Bubble

Once a bubble forms, it needs sustenance. Part of the sustenance is provided by the institutional parasites that make money off the bubble and develop vested interests in preserving and expanding the bubbles. Among these parasites, you could include:

- Investment banks: Bubbles in financial markets bring with them a number of benefits to investment banks, starting with a surge in initial public offerings of firms but expanding to include further security issues and restructurings on the part of established firms that do not want to be shut out of the party.
- Brokers and analysts: A bubble generates opportunities for brokers and analysts selling assets related to the bubble. In fact, the ease with which investors make money as asset prices go up, often with no substantial reason, relegates analysis to the backburner.
- Portfolio Managers: As a bubble forms, portfolio managers initially watch in disdain as investors they view as naïve push up asset prices. At some point, though,, even the most prudent of portfolio managers seem to get caught up in the craze and partake of the bubble, partly out of greed and partly out of fear.
- Media: Bubbles make for exciting business news and avid investors. While this is especially noticeable in the dot.com bubble, with new books, television shows and magazines directly aimed at investors in these stocks, even the earliest bubbles had their own versions of CNBC.

In addition to the institutional support that is provided for bubbles to grow, intellectual support is usually also forthcoming. There are both academics and practitioners who argue, when confronted with evidence of over pricing, that the old rules no longer apply. New paradigms are presented justifying the high prices, and those who disagree are disparaged as old fashioned and out of step with reality.

Phase 3: The Bursting of the Bubble

All bubbles eventually burst, though there seems to be no single precipitating event that causes the reassessment. Instead, there is a confluence of factors that seem to lead to the price implosion. The first is that bubbles need ever more new investors (or at least new investment money) flowing in for sustenance. At some point, you run out of suckers as the investors who are the best targets for the sales pitch become fully invested. The second is that each new entrant into the bubble is more outrageous than the previous one. Consider, for instance, the dot.com bubble. While the initial entrants like America Online and even Amazon.com might have had a possibility of reaching their stated goals, the new dot.com companies that were listed in the late 1990s were often idea companies with no vision of how to generate commercial success. As these new firms flood the market, even those who are apologists for high prices find themselves exhausted trying to explain the unexplainable.

The first hint of doubt among the true believers turns quickly to panic as reality sets in. Well devised exit strategies break down as everyone heads for the exit doors at the same

time. The same forces that created the bubble cause its demise and the speed and magnitude of the crash mirror the formation of the bubble in the first place.

Phase 4: The Aftermath

In the aftermath of the bursting of the bubble, you initially find investors in complete denial. In fact, one of the amazing features of post-bubble markets is the difficulty of finding investors who lost money in the bubble. Investors either claim that they were one of the prudent ones who never invested in the bubble in the first place or that they were one of the smart ones who saw the correction coming and got out in time.

As time passes and the investment losses from the bursting of the bubble become too large to ignore, the search for scapegoats begins. Investors point fingers at brokers, investment banks and the intellectuals who nurtured the bubble, arguing that they were misled.

Finally, investors draw lessons that they swear they will adhere to from this point on. “I will never invest in a tulip bulb again” or “I will never invest in a dot.com company again” becomes the refrain you hear. Given these resolutions, you may wonder why price bubbles show up over and over. The reason is simple. No two bubbles look alike. Thus, investors, wary about repeating past mistakes, make new ones, which in turn create new bubbles in new asset classes.

Upside versus Downside bubbles

Note that most investors think of bubbles in terms of asset prices rising well above fair value and then crashing. In fact, all of the bubbles we have referenced from the tulip bulb craze to the dot-com phenomenon were upside bubbles. But can asset prices fall well below fair market value and keep falling? In other words, can you have bubbles on the downside? In theory, there is no reason why you could not, and this makes the absence of downside bubbles, at least in the popular literature, surprising. One reason may be that investors are more likely to blame external forces – the bubble, for instance – for the money they lose when they buy assets at the peak of an upside bubble and more likely to claim the returns they make when they buy stocks when they are at the bottom of a downside bubble as evidence of their investment prowess.

Another may be that it is far easier to create investment strategies to take advantage of under priced assets (in a downside bubble) than it is to take advantage of over priced assets. With the former, you can always buy the asset and hold until the market rebounds. With the latter, your choices are both more limited and more likely to be time limited. You can borrow the asset and sell it (short the asset), but not for as long as you want – most short selling is for a few months. If there are options traded on the asset, you may be able to

buy puts on the asset though, until recently, only of a few months duration. In fact, there is a regulatory bias in most markets against such investors who are often likely to be categorized as speculators. As a consequence of these restrictions on betting against overpriced assets, bubbles on the upside are more likely to persist and become bigger over time, whereas bargain hunters operate as a floor for downside bubbles.

A Closing Assessment

Based upon our reading of history, it seems reasonable to conclude that there are bubbles in asset prices, though only some of them can be attributed to market irrationality. Whether investors can take advantage of bubbles to make money seems to be a more difficult question to answer. Part of the reason for the failure to exploit bubbles seems to stem from greed; even investors who believe that assets are over priced want to make money off the bubble due to the difficulty of determining when a bubble will burst. Over valued assets may get even more over valued and these overvaluations can stretch over years, thus imperiling the financial well being of any investor who has bet against the bubble. There is also an institutional interest on the part of investment banks, the media and portfolio managers, all of whom feed of the bubble, to perpetuate the bubble.

The Foundations of Technical Analysis

It is best to let technical analysts provide the basis for their approach in their own words. Magee in his classic book on technical analysis made the following argument: *"It is futile to assign an intrinsic value to a stock certificate. One share of US Steel, for example, was worth \$261 in the early fall of 1929, but you could buy it for only \$22 in June 1932. By March 1937 it was selling for \$126 and just one year later for \$38. ... This sort of thing, this wide divergence between presumed value and intrinsic value, is not the exception; it is the rule; it is going on all the time. The fact is that the real value of US Steel is determined at any give time solely, definitely and inexorably by supply and demand, which are accurately reflected in the transactions consummated on the floor of the exchange."*

If we were to summarize the assumptions that underlie technical analysis, we would list the following:

- (1) *Market value is determined solely by the interaction of supply and demand.* We do not think that non-chartists would have any quarrels with this assumption, which describes how prices are set in any market.
- (2) *Supply and demand are governed by numerous factors, both rational and irrational.* The market continually and automatically weighs all these factors. Note that a random walker would have no qualms about this assumption either. He would point out that

any irrational factors are just as likely to be on one side of the market as on the other.

(3) *Disregarding minor fluctuations in the market, stock prices tend to move in trends that persist for an appreciable length of time.* This is where random walkers would part ways with chartists. In a rational market, any trend that can be discerned by investors using charts should provide profit opportunities that when taken advantage of should eliminate the trend.

(4) *Changes in trend are caused by shifts in demand and supply.* These shifts, no matter why they occur, can be detected sooner or later in the action of the market itself. This is at the core of technical analysis. Charts, the believers argue, send advance warning of shifts in demand and supply in the form of price and volume patterns.

The views of technical analysts are best described by another quote from Magee: *“The market price reflects not only the differing fears and guesses and moods, rational and irrational, of hundreds of potential buyers and sellers, but it also reflects their needs and resources- in total, factors which defy analysis and for which no statistics are obtainable. These are nevertheless all synthesized, weighted and finally expressed in the one precise figure at which a buyer and seller get together and make a deal. The resulting price is the only figure that counts.”*

Both the anecdotal and the empirical evidence seem to suggest that investors often are irrational, at least based upon the economic definition of rationality. Whether this irrationality results in systematic price patterns is a little more difficult to assess, though the serial correlation in prices, both over short and long periods, and the periodic appearance of price bubbles in asset markets seems to indicate that irrational behavior has price effects. Finally, even if there are systematic price patterns caused by irrationality, there is the question of whether you can take advantage of these price patterns. It is entirely possible that the price patterns are so unpredictable that no investor can take advantage of them to earn excess returns. Technical analysts and chartists would disagree.

Technical Indicators and Charting Patterns

Over the years, technical analysts have developed hundreds of technical indicators and detected dozens of chart patterns that they contend help them forecast future price changes. While we cannot describe or even list all of them, we can categorize them based upon the nature of irrationality that we attribute to markets. Consolidating all of the irrationalities that have been attributed to financial markets, we have created five groupings:

- Market participants over react to new information: If this is true – prices rise too much on good news and fall too much on bad news – you would draw on contrarian

indicators which would help you to gauge the direction in which the crowd is going and to go against it.

- Market participants are slow learners: In many ways, this is the polar opposite of the first grouping. If investors are slow learners, prices will under react to new information and you would expect price direction to persist and use momentum strategies, which would gauge market direction and move with it.
- Investors change their minds frequently and often irrationally, causing significant shifts in demand and supply, causing prices to move. If you believe that this is the way markets work, you would use technical indicators and charting patterns to detect these shifts.
- There are a group of investors who lead markets, and finding out when and what they are buying and selling can provide a useful leading indicator of future price movements. If this is what you believe about markets, you would track the trading of these leading investors and try to follow them.
- There are external forces that govern up and down movements in markets that override fundamentals and investor preferences. Technical indicators and charting patterns that allow up to see their larger cycles in stock prices can allow us to get ahead of other investors.

Within each, we can consider different technical indicators that we can broadly categorize into three groups – price indicators, which are based upon past price movements, volume indicators, that look at trading volume and sentiment indicators, that use qualitative measures of how bullish or bearish investors feel about stocks.

Markets overreaction - Contrarian Indicators

There are many practitioners and some economists, especially in the behavioral school, who believe that investors overreact to new information. This, in turn, can create patterns in stock prices that can be exploited by investors to earn excess returns. In this section, we consider some of the indicators, which we label contrarian, that have been developed by analysts who subscribe to this view.

The Basis for Overreaction and Implications

Why would markets over react to new information? Some researchers in experimental psychology suggest that people tend to overweight recent information and underweight prior data in revising their beliefs when confronted with new information. Others argue that a few investors tend to panic when confronted with new information, and that they take the rest of the market with them. As evidence, you could point to the strong evidence of price reversals over long periods that we presented earlier in this chapter.

If markets overreact, it follows that large price movements in one direction will be followed by large price movements in the opposite direction. In addition, the more extreme the initial price movement, the greater will be the subsequent adjustment. If markets overreact, the road to investment success seems clear. You buy assets when others are most bearish about it and selling, and sell assets when other investors are most optimistic and buying. If your assumption about market overreaction is correct, you will earn excess returns as markets correct themselves over time.

Technical Trading Rules based upon Contrarian Opinion

There are a number of indicators, some based upon price patterns, some based upon trading volume and some on market views that are designed to provide you with a sense of market direction. The objective is to not follow the market direction but to go against it and these are contrarian indicators. We will consider three widely used indicators in this section, each of which focused on a different subset of investors.

Trades that are in lots of less than a 100 are called odd-lots and are usually made by small investors. There are data services that track the number of odd-lot trades – both buys and sells - in individual stocks and in the market. As small investors become more enthusiastic about a stock, odd lot buys increase relative to sells. When they become pessimistic, the reverse occurs. To the extent that you view small investors as more likely to over react to information, you would sell as odd lot buying increases and buy as odd lot selling decrease.

But what if you believe that it is institutional investors who panic and not small investors? After all, large price movements are usually caused by institutional buying and selling, rather than by individual traders. There are indicators that track the stocks that institutions are selling and buying, with the objective of doing the opposite. There are also indicators that track the percent of mutual fund portfolios that is invested in cash and near cash investments, a good indicator of how bullish or bearish mutual fund investors are. When mutual funds are optimistic about the market, cash holdings tend to fall, whereas cash holdings increase as they become more pessimistic. If you believe that mutual fund managers over react, you would buy when they are bearish and sell when they are bullish.

Finally, you could look at investment advisors who claim to have divined the future. Investment advisory services often have their lists of most desirable and least desirable stocks. Value Line and Standard and Poor's categorize stocks into classes based upon their perceived attractiveness as investments. In keeping with the notion that the market is usually wrong, you would sell those stocks that investments advisors are most bullish on and buy those stocks where they are most bearish.

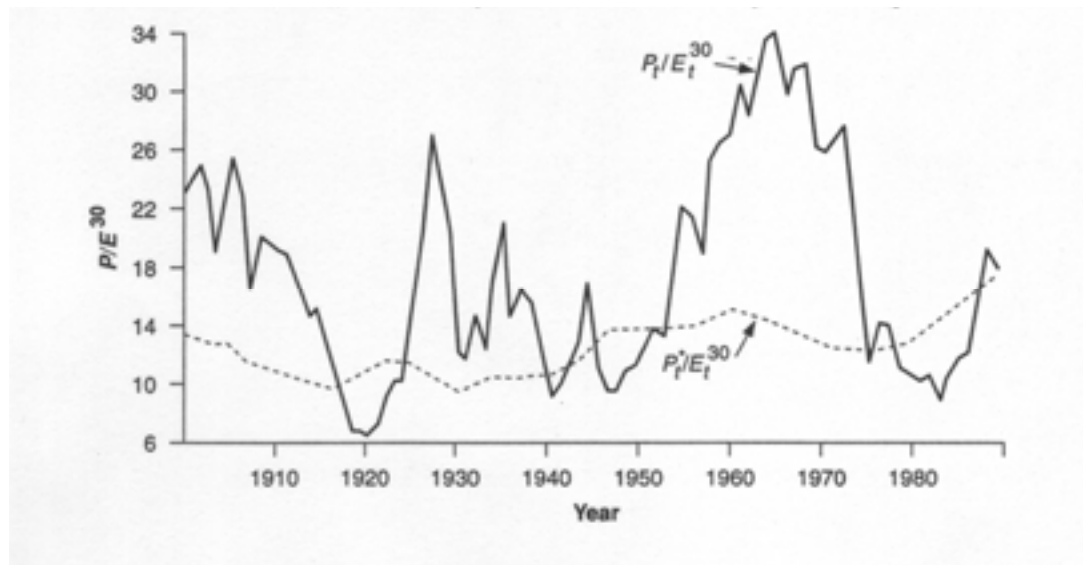
Shifting Demand

Technical analysts often argue that the greatest profits are to be made at what can be called inflection points – a fancy term for shifts in price trends from positive to negative or vice versa. Since price is ultimately determined by demand and supply, analysts often look for leading indicators of shifts in demand, especially when they are caused by emotion rather than fundamentals. If they succeed, they will make money.

The Basis for Shifting Demand and Implications

The basis for the shifting demand argument is that demand shifts cause price changes and that these demand shifts often have no basis in economic fundamentals. The anecdotal evidence seems to bear out this view. Markets often move for no discernible reason and the volatility in stock prices seems to vastly exceed the volatility in underlying value. The empirical evidence also backs up the view that prices are more volatile than fundamental value. Shiller compared stock price movements over time to movements in the present value of dividends (which he viewed as a measure of fundamental value) and concluded that stock prices were significantly more volatile (See figure 7.14)

Figure 7.14: Are markets too volatile?



Source: Shiller

Note that the smoothed out line is the present value of dividends, whereas the volatile line represents the S&P 500.

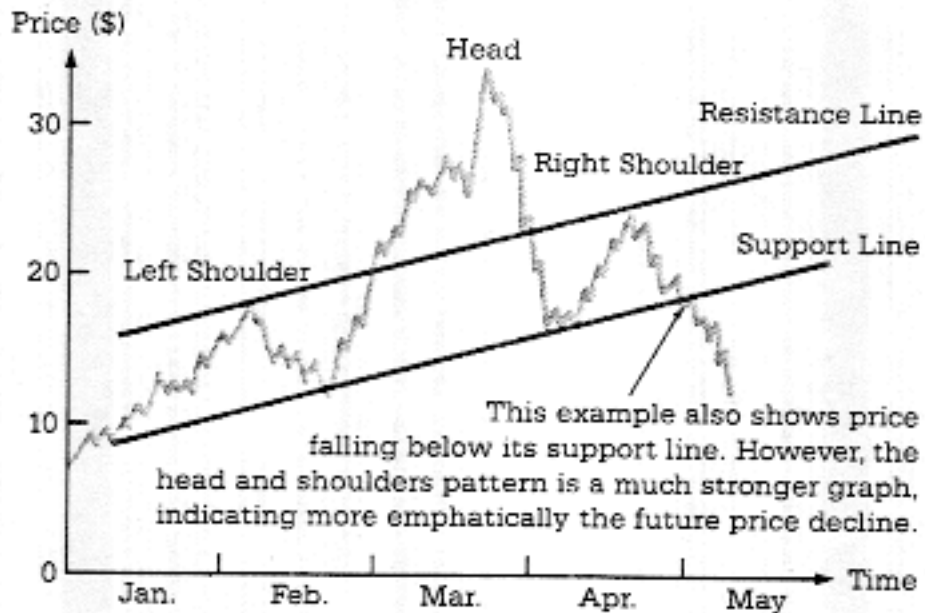
It should be noted, though, that neither the anecdotal evidence nor Shiller's study conclusively proves emotional volatility. In fact, some researchers have argued that if the value of a stock is based upon expectations, small news announcements can cause big shifts in expectations and stock prices.

Technical Trading Rules aimed at detecting Shifting Demand

There are numerous pricing patterns and indicators that chartists claim provide advance warning of shifting demand. We will consider four broad measures here. The first relate to the entire market, and measure the breadth of the market by looking at the number of stocks that advance relative to those that decline. The argument here is that a market that goes up with limited breadth (a few stocks are creating much of the upward momentum, while the rest are flat or declining) is a market where demand (and prices) are likely to decline soon. In fact, an extension of this measure is the advance/decline line, which is reported in many financial newspapers, where you graph the ratio of the number of stocks that have gone up to the number of stocks that have dropped. Here again, analysts argue that a divergence between index levels and the advance/decline line – a drop in the index accompanied by an improvement in the advance/decline line may indicate an upcoming shift towards buying.

The second is the presence (at least perceived presence) of support and resistance lines in prices. A resistance line is an upper bound on the price whereas a support line represents a lower bound on the price. Both are extracted by looking at past prices. Thus, a stock that has tended to move between \$ 20 and \$ 40 over the last few periods has a support line at \$ 20 and a resistance line at \$ 40. It may be pure coincidence though we think not but support and resistance lines often are nice round numbers – you very seldom see a resistance line at \$ 39.88 and a support line at \$ 21.13. Figure 7.15 provides a chart with support and resistance lines.

Figure 7.15: Support and Resistance Lines



The fact that the stock stays below the resistance line and above the support line is not news, but a stock that breaks through either gets attention. When a stock breaks through the resistance line, technical analysts view it as a sign of a shift in demand upwards and the beginning of a sustained upward movement in prices. Conversely, when a stock falls below the support line, analysts view it as a breakdown in demand and the precursor of a further decline in prices. While the notion of arbitrary support and resistance lines strikes us as fanciful, if enough investors buy into their existence, there can be a self-fulfilling prophecy. To see why, assume that a stock with a resistance line of \$ 40 million sees its stock price go up to \$40.50. Investors who believe that this is a beginning of a surge in prices will all try to buy the stock on the event, causing the stock price to go up. Whether such a price increase can be sustained for more than a few days is an open question. In the graph, you can also see another widely followed chart pattern, called “head and shoulders”. In fact, there are hundreds of patterns that chartists have uncovered over time that have been offered as leading indicators of price changes.²³

Central to much of technical analysis is a reverence for moving averages, i.e., averages of stock prices over the last few months or weeks. Often, you will see price charts

²³ For a comprehensive listing of indicators, see “The Encyclopedia of Technical Market Indicators” by Robert Colby and Thomas Myers, Irwin.

with a moving average line superimposed on actual prices. Again, analysts view any deviation of stock prices from a moving average line as an indication of an underlying shift in demand that can be exploited for profits.

Analysts have also long used a charting technique called point and figure to detect trends in prices. The essential feature of a point and figure chart is that it is composed of a series of Xs and Os. Each X represents a price movement of a given size called a box size. As long as prices continue to rise, Xs are added to the column. If there is a price decline of more than a given magnitude (called the reversal size), a new column of Os is opened. Figure 7.16 presents a point and figure chart.

Figure 7.16: Point and Figure Chart

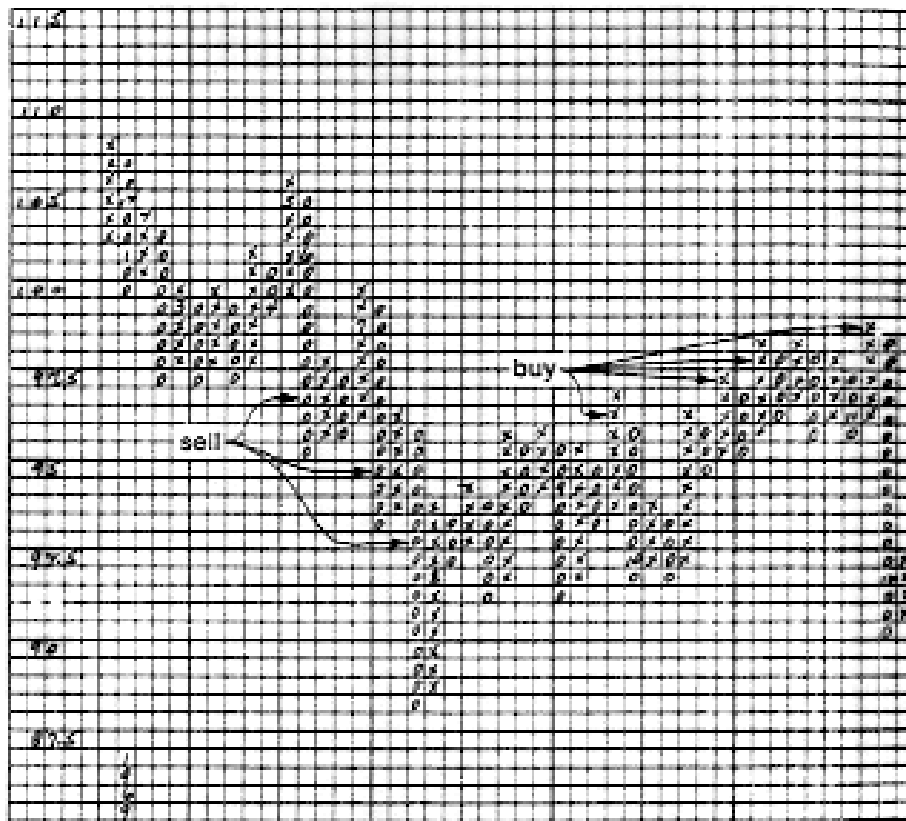


FIG. 23-5 Point and figure chart of Standard & Poor's composite 500. (From A. W. Colson, *Technical Indicator Analysis*, Chartercraft, Inc., Larchmont, N.Y.)

In recent years, information on trading volume for individual stocks has become increasingly accessible. Technical analysts now routinely look at trading volume for clues of future price movements, either in conjunction with price changes or by itself. For instance, an increase in the stock price that is accompanied by heavy trading volume is considered a more positive prognosticator of future price increases than one generated with light volume.

Empirical Evidence on Technical Indicators

There is not much empirical evidence for or against many of the individual charting patterns. Part of the reason for this is that many of these patterns are so subjectively defined – different analysts use different and often shifting definitions of what comprises a support or a resistance line, for instance - that they cannot be tested empirically, which serves both sides of the argument very well. Supporters of charting can then use their own tests which are often biased to offer proof that their patterns works. Opponents of technical analysis can rest secure in their absolute conviction that charting is for the naïve and the misguided and not worry about evidence to the contrary.

It is quite ironic that some of the best defenses of technical analysis have been offered by academics who would not categorize themselves as chartists or technical analysts. Lo, Wang and Mamaysky (2000) present a fairly convincing defense of technical analysis from the perspective of financial economists. They use daily returns of stocks on the New York Stock Exchange and NASDAQ from 1962 and 1996 and use the most sophisticated computational techniques (rather than human visualization) to look for pricing patterns. They find that the most common patterns in stocks are double tops and bottoms, followed by the widely used head and shoulders pattern. In other words, they find evidence that some of the most common patterns used by technical analysts exist in prices. Lest this be cause for too much celebration among chartists, they also point out that these patterns offer only marginal incremental returns (an academic code word for really small) and offer the caveat that these returns may not survive transactions costs.

Are currency markets different?

While there is little empirical evidence to back the use of charts in the stock market, a number of studies claim to find that technical indicators may work in currency markets. To name a few:

- Filter rules, where you buy a currency if it goes up by x% and sell if it goes down by the same amount earned substantial profits in the Deutsche mark, yen and sterling markets between 1973 and 1981.²⁴
- Moving average rules would have generated excess returns in foreign currency markets.²⁵
- Head and Shoulder patterns would have generated excess returns in the pound sterling, Canadian dollar, French franc and Swiss franc markets between 1973 and 1994.²⁶

Though there are dissenting voices, there clearly seem to be more opportunities for technical analysis in currency markets. Some attribute it to central bank intervention. When central banks target exchange rates, they can generate speculative profits for investors. Another possibility is that the foreign currency market is less efficient than the stock market.

Slow Learning Markets: Momentum Indicators

If investors are slow to assess the effects of new information on stock prices, you can see sustained up or down movements in stock prices after news comes out about the stock – up movements after good news and down movements after bad news. There are analysts who contend that this is indeed the case and create trading rules that take advantage of this slow learning process. Since these rules are based upon the assumption that trends in prices tend to continue for long periods, they can be categorized as momentum rules.

The Basis for Slow Learning and Implications

What is the evidence that markets learn slowly? The best support for slow learning markets comes from studies that look at information events such as earnings announcements or acquisitions. As we will see later in this book, there is evidence that markets continue to adjust to the information well after it has come out. For instance, a firm that reports much better than expected earnings will generally see its stock price jump on the announcement and continue to drift upwards for the next few days. The same seems to occur to a target firm in an acquisition. While there are alternative explanations for price

²⁴ See “Analysis of Short-Run Exchange Rate Behavior: March 1973 to November 1981” by Dooley, M.P. and J.R. Shafer in *Exchange Rate and Trade Instability, Causes, Consequences and Remedies*, 1983, Ballinger.

²⁵ See “Time Varying Risk Premia, Volatility and Technical Trading Rules” by B.C. Kho, *Journal of Financial Economics*, v41, 246-290.

²⁶ See “Head and Shoulders: Not a flaky pattern”, by Osler, C.L. and P.H.K. Chang, Staff Paper, 1995, Federal Reserve Bank of New York.

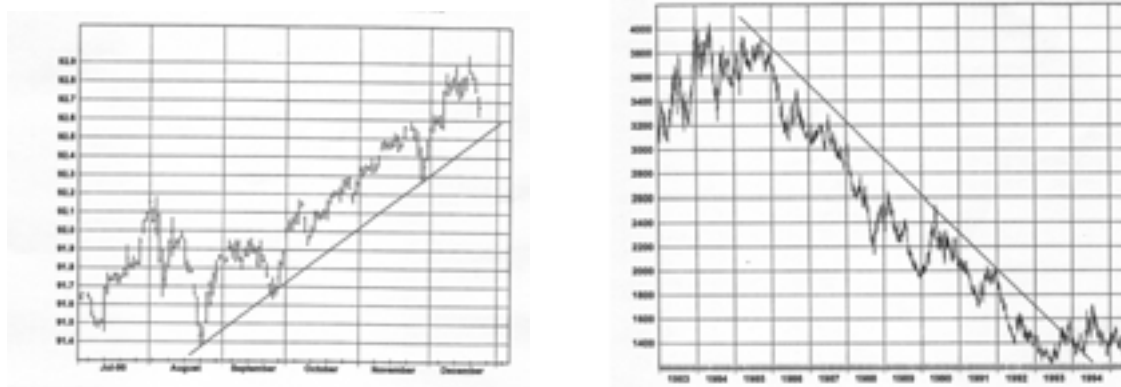
drifts, one potential explanation is that markets learn slowly and that it takes them a while to assimilate the information.

If markets learn slowly, you should expect to see prices move in the same direction after a precipitating action. If the initial news was good – a good earnings report or an earnings upgrade from an analyst – you should expect to see upward price momentum. If the news was bad, you should expect to see the opposite. In fact, recent empirical studies (referenced in the earlier part of this chapter) have found evidence of price momentum in equity markets in the United States at least in the short term.

Technical Indicators to take advantage of slow learning markets

Momentum investors firmly believe that the trend is your friend and that it is critical that you look past the day-to-day movements in stock prices at the underlying long-term trends. The simplest measure of trend is a trend line. Figure 7.17 contains two trend lines – the graph on the left is for a silver futures contracts over the few months of its existence and the graph on the right is for cocoa futures over a much longer time period.

Figure 7.17: Trend Lines



In this silver futures contract to the left, you see an uptrend line, drawn by connecting a series of lows in prices, each one higher than the other. On the right, cocoa prices had been declining over the period in question and a down trend line is drawn by connecting a series of lower highs. As momentum investors, you would buy stocks that are going up and staying above the uptrend line. If the price falls below the uptrend line, it is viewed as a negative sign. Conversely, if the price rises above a down trend line, it is considered a bullish sign.



Stocks with highest relative strength: Take a look at the 50 stocks with the highest relative strength over the last 6 months.

A closely followed momentum measure is called relative strength, which is the ratio of the current price to an average over a longer period (say six months or a year). Stocks that score high on relative strength are therefore stocks that have gone up the most over the period, whereas those that score low are stocks that have gone down. The relative strength can be used either in absolute terms, where only stocks that have gone up over the period would be considered good investments. Alternatively, the relative strength can be compared across stocks, and you invest in stocks that show the highest relative strength – i.e, have gone up the most, relative to other stocks.

Following the Informed Investors: Leading Indicators

This approach is the flip side of the contrarian approach. Instead of assuming that investors, on average, are likely to be wrong, you assume that they are right. To make this assumption more palatable, you do not look at all investors but only at the investors who presumably know more than the rest of the market.

The Basis for Following Smart Investors and Implications

Are some investors smarter and better informed than others? Undoubtedly. Do they make higher returns as a consequence? Not necessarily. As Keynes was fond of pointing out, a stock market is a beauty contest, where the prize goes to the person who best gauges who the other judges in the contest will pick as the winner. In investment terminology, the high returns often go to the investor who can best pick the stocks that other investors will buy.

There are two keys to making a strategy of following other investors work. The first is identifying the smart investors, who may not always be the largest or best known. It stands to reason that investors who have access to the best information are most likely to beat the market and would be the ones that you should follow. The second is to find out when and what these smart investors are trading in a timely fashion, so that you can imitate

them. This is often difficult to do. Even though insiders and institutions have to file with the Securities and Exchange Commission (SEC), providing details about their trades, the filings are made several weeks after the trades occur.

Technical Indicators for Followers

There are several technical indicators that attempt to pinpoint what better informed investors are buying and selling. Here, we consider two. The first looks at short sales made by market specialists. Since these specialists are close to the action and have access to information that the rest of us cannot see (such as the order book and trading on the floor), it can be argued that they should have an inside track on over priced and under priced stocks. Thus, a surge in specialist short sales in a stock would be a precursor for bad news on the stock and a big price drop. Some analysts look at all short sales made on a stock, arguing that only larger, more sophisticated investors can short stock in the first place. A study by Senchack and Starks in 1993 provides some support for this indicator by noting that stock returns tend to be more negative for stocks where the short interest (short sales as a percent of the outstanding stock) is higher.

In the last few years, as the SEC has speeded up the process of recording transactions by insiders and has made this data more easily accessible to the public. You can therefore look up stocks where insider buying or selling has increased the most. In fact, the ratio of insider buying to selling is often tracked for stocks with the idea that insiders who are buying must have positive information about a stock whereas insiders who are selling are likely to have negative information.

Long Term Cycles: Mystical Indicators

The final set of technical indicators are based upon long term cycles in prices that exercise an inexorable hold on how prices move. Since these long-term cycles operate independently of fundamentals, it is very difficult to explain them without resorting to mysticism.

Basis for long term cycles and Implications

There are two ways in which you can defend the use of long-term cycles. One is to abandon any basis in rationality and argue that there are a number of phenomena in nature that cannot be explained with models.²⁷ You can think of such investors as subscribers to the karmic theory of investing. In other words, everything that happens has already been pre-destined and there is nothing that we can do to stop it. This requires an almost religious

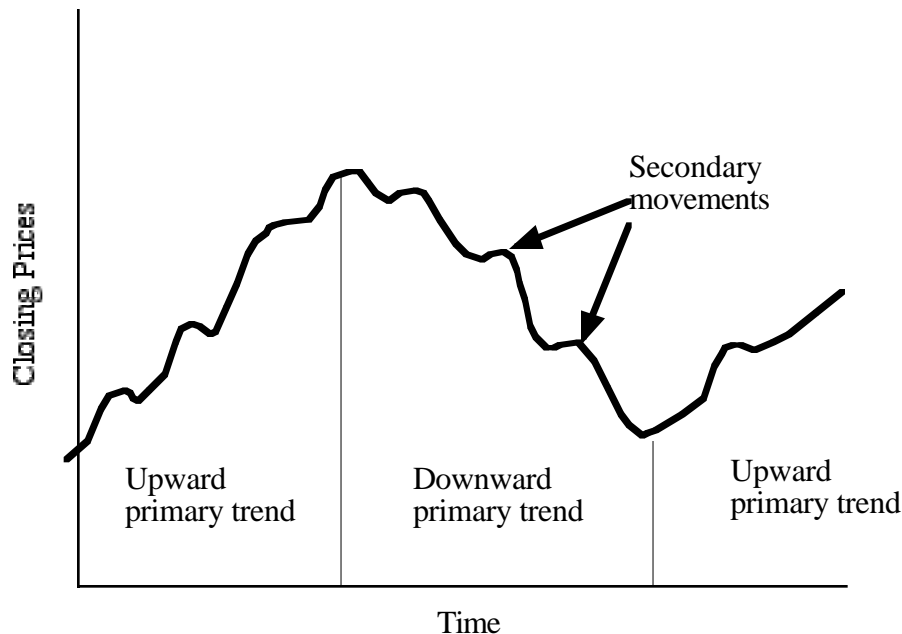
²⁷ Scientists would undoubtedly disagree.

belief that cycles will replicate themselves. The other defense is based on market behavior. You can argue that investors, even though they might be separated over time, behaved in very much the same way in the South Sea Bubble as they did in the dot-com bubble. Consequently, long term cycles reflect the pricing mistakes that investors make and remake over time. As a cautionary note, you should realize that if you look for patterns too intently in charts, you will find them, especially if you use visual techniques (rather than statistical ones).

Technical Indicators based upon Cycles

While there are numerous cycles that analysts see in stock prices, we will consider two in this section. In the first, the Dow Theory, the market is considered as having three movements, all going at the same time. The first is the narrow movement (daily fluctuations) from day to day. The second is the short swing (secondary movements) running from two weeks to a few months and the third is the main movement (primary trends) covering at several years in its duration. Proponents of the theory claim that you can tell where you are in the primary cycle by charting the industrial and transportation components of the Dow Index and looking for confirmation (i.e, both indices moving in the same direction). In figure 7.18, the Dow Theory is presented:

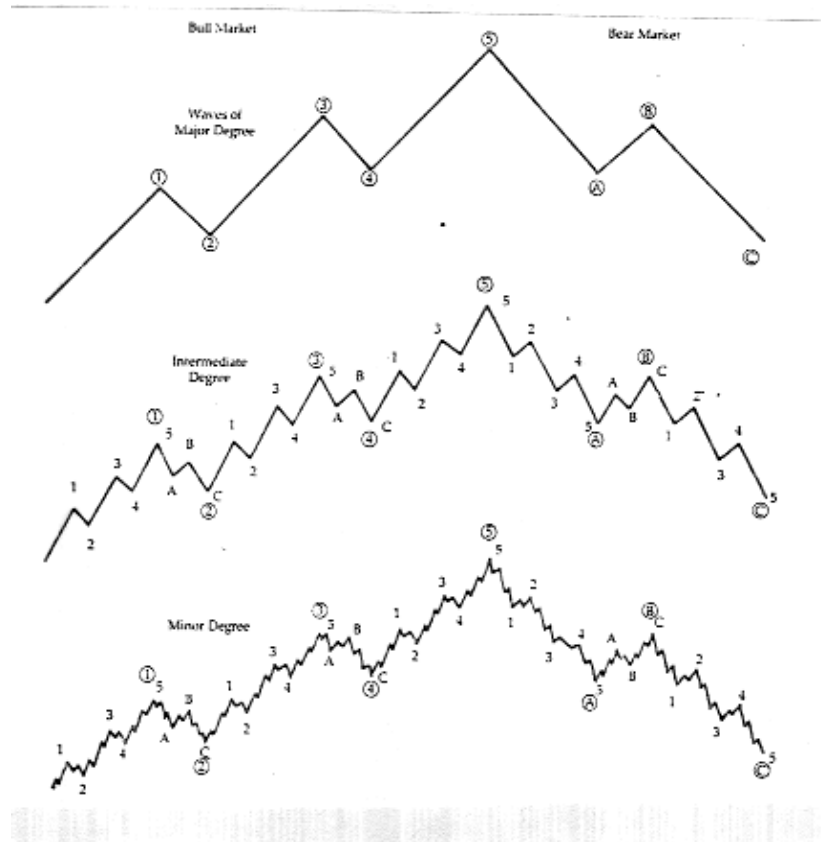
Figure 7.18: The Dow Theory



In 1922, William Hamilton wrote a book titled “The Stock Market Barometer” about the Dow Theory, where he presented evidence on the measure’s efficacy at predicting market movements. A recent study²⁸ appraised Hamilton’s predictions in the Wall Street Journal between 1901 and 1929 and concluded that he had far too many correct calls than could be attributed to chance and that you would have earned excess returns following his advice.

While the Dow Theory has been around for decades, the Elliott Wave acquired a wide following in the 1980s. Elliot's theory was that the market moves in waves of various sizes, from those encompassing only individual trades to those lasting centuries, perhaps longer. In the classic Elliot wave, a cycle lasts 200 years and has 8 waves – five up and three down – with smaller cycles within each of these waves. By classifying these waves and counting the various classifications, he argued that it was possible to determine the relative positions of the market at all times.

Figure 7.19: The Elliott Wave



²⁸ See “The Dow Theory: William Peter Hamilton’s Track Record Reconsidered”, by Brown, Goetzmann and Kumar. They conclude that following Hamilton’s advice would have generated excess returns of about 4.04% a year.

In the aftermath of the 1987 crash, there were several newsletters that based upon the Elliott Wave.²⁹ Most of them faded in the years after, as the predictive power of the model was found to be wanting.

Other cycles include: the *Kitchen cycle* (inventories, 3-5 years); the *Juglar Cycle* (fixed investment patterns, 7-11 years); and *Kuznets Cycle* (building patterns, 15-25 years). Other more controversial theories include: the *Kondratyev Cycle* (also called "the long economic cycle," about 54 years) in three stages of upswing, crisis, and depression. The *Babson chart* of business barometers uses statistics and charts to model a 20-year cycle in four stages: overexpansion, decline, depression, and improvement.

Determinants of Success at Charting and Technical Analysis

Can you succeed with technical indicators and charts? The answer that has been long given by academics and fundamentals is no, but that answer may need to be reassessed in light of the research on price patterns (especially price momentum) and trading volume in recent years. There seems to be enough evidence now for us to conclude that it is foolhardy to ignore recent price movements and changes in trading volume when investing in a stock. So what are the essential ingredients for success with technical analysis? These seem to be a few:

- If you decide to use a charting pattern or technical indicator, you need to be aware of the investor behavior that gives rise to its success. This is not just to satisfy your curiosity but also to ensure that you can modify or abandon the indicator if the underlying behavior changes.
- It is important that you back-test your indicator to ensure that it delivers the returns that are promised. In running these tests, you should pay particular attention to the volatility in performance over time and how sensitive the returns are to holding periods. There are some strategies that work only in bull markets, for example, and only for specific holding periods – say 1 month or less.
- The excess returns on many of the strategies that we described in this chapter seem to depend upon timely trading. In other words, to succeed at some of these strategies, you may need to monitor prices continuously, looking for the patterns that would trigger trading.

²⁹ The best known book on the Elliott Wave was written by Frost and Prechter and is titled "The Elliott Wave Principle". Gehm (1983) provides a critical look at the Elliott Wave and argues that its ambiguity makes it impossible to test.

- Building on the theme of time horizons, success at charting can be very sensitive to how long you hold an investment. Recall, for instance, that momentum indicators seem to work for a few months and that reversals seem to occur beyond that time period. Finding the optimal holding period and staying disciplined seem to be key to earning the returns that we sometimes see on paper.
- The strategies that come from technical indicators are generally short-term strategies that require frequent and timely trading. With some strategies, you may need to trade several times during the course of a day or a week. Not surprisingly, these strategies also generate large trading costs that can very quickly eat into any excess returns you may have.

In summary, investors who can track markets continuously and trade cheaply may be able to take advantage of price patterns and volume indicators to earn excess returns, if they can pinpoint the right indicators and stay disciplined. As price and volume data becomes increasingly available to all investors, though, it is likely that these strategies will be more useful as secondary strategies, used to augment returns on a primary strategy. For instance, a growth investor who buys stocks with rising earnings may also consider adding price momentum to the mix of variables that she looks at before making her investment choices. Investors who cannot or do not want to track markets continuously are unlikely to earn enough returns on these strategies to cover transactions costs.

Conclusion

Investors have always claimed to find patterns in charts that help them make better investment decisions. Skeptics have viewed these claims as fiction and have argued that there is no basis to technical analysis. In recent years, evidence has steadily accumulated that there is information in past price movements and trading volume and that there may be a foundation for some of the claims made by chartists. In particular, stocks that have done well in the recent past seem to be more likely to do well in the near future (price momentum) and trading volume changes seem to lead price changes in some markets.

All technical indicators have their basis in quirks in human behavior. We categorize technical trading indicators based upon the type of behavior that may lead to their success. Contrarian indicators such as mutual fund holdings or odd lot ratios, where you track what investors are buying and selling with the intention of doing the opposite, are grounded in the belief that markets over react. A number of technical indicators are built on the presumption that investors often change their views collectively, causing shifts in demand and prices, and that patterns in charts – support and resistance lines, price relative to a moving average- can predict these changes. With momentum indicators, such as relative strength and trend lines,

you are assuming that markets often learn slowly and that it takes time for prices to adjust to true values. If you believe that there are some traders who trade ahead of the market, either because they have better analysis tools or information, your indicators will follow these traders – specialist short sales and insider buying/selling, for instance – with the objective of piggy-backing on their trades. Finally, if you believe that there are long-term cycles in stock prices, your investment strategy may be driven by the cycle you subscribe to and where you believe you are in the cycle.

If you are a short-term investor with the discipline to stick with a tested indicator, low trading costs and continuous access to information, you may be able to use technical indicators as the basis for your investment strategy. Even those who do not want to build their entire strategy around price patterns and trading volume may still find them useful to augment returns on their primary strategies.

Lessons for Investors

To be a successful technical analyst, you need to:

1. Understand human nature: Investors are human and display all off the foibles of human nature. Some of them tend to be over confident and to over react and move in herds. At the same time, others display too little confidence, learn too slowly and are born contrarians. What happens in markets represents the tug and the pull between these groups. When you use an indicator, you need to understand the assumption about human behavior that underlies it.
2. Not mistake random price movements for price patterns: Even when prices move randomly, you can generate charts that look like they have patterns. Even bubbles and crashes, which are used by many analysts as evidence of irrationality, can exist in rational markets.
3. Have a time horizon that matches your indicator: Some indicators require time horizons of a few hours, others require a few weeks and some may even stretch for a few months.
4. Be disciplined: If you decide to use a technical indicator to pick stocks, assuming you have back-tested the indicator, you will need to stay within your specified strategy.