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# Charting and Technical Analysis

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# The Random Walk Hypothesis

## Information

All information about the firm is publicly available and traded on.

New information comes out about the firm.

## Current

## Market Expectations

Investors form unbiased expectations about the future

## Next period

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.

# The Basis for Price Patterns

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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 then down.

# The Empirical Evidence on Price Patterns

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- Investors have used **price charts and price patterns** as tools for predicting future price movements for as long as there have been financial markets.
- The first studies of market efficiency focused on the **relationship between price changes over time**, to see if in fact such predictions were feasible.
- 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** (annual and five-year returns) price movements.

# I. Serial correlation

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- Serial correlation measures the correlation between price changes in consecutive time periods

- Measure of how much price change in any period depends upon price change over prior time period.

- **0**: imply that price changes in consecutive time periods are uncorrelated with each other

- **>0**: evidence of price momentum in markets

- **<0**: Evidence of price reversals

## Serial Correlation and Excess Returns

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- From viewpoint of investment strategy, **serial correlations can 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.
  - The correlations must be **large enough** for investors to generate profits to cover **transactions costs**.

# Serial Correlation in Short-period Returns

<i>Author</i>	<i>Data</i>	<i>Variables</i>	<i>Time Interval</i>	<i>Correlation</i>
Kendall & Alexander(28)	19 indices - UK	price	1 weeks	0.131
			2 weeks	0.134
			4 weeks	0.006
Moore (28)	30 companies - US	log prices	1 week	-0.056
Cootner (28)	45 companies US	log prices	1 week	-0.047
Fama (46)	30 companies - US	log prices	1 day	0.026
			4 days	-0.039
			9 days	-0.053
King (28)	63 companies - US	log prices	1 month	0.018
Niarchos (119)	15 companies - Greece	log prices	1 month	0.036
Praetz (128)	16 indices	log prices	1 week	0.000
Griffiths (73)	20 companies	log prices	1 week	-0.118
	5 companies - UK	prices	9 days	-0.026
Jennergren (90)	15 companies - UK	log prices	1 month	0.011
			1 day	0.068
			2 days	-0.070
			5 days	-0.004
Jennergren & Kosvold (91)	30 companies -Sweden	log prices	1 day	0.102
			3 days	-0.021
			5 days	-0.016

## Summary of Findings

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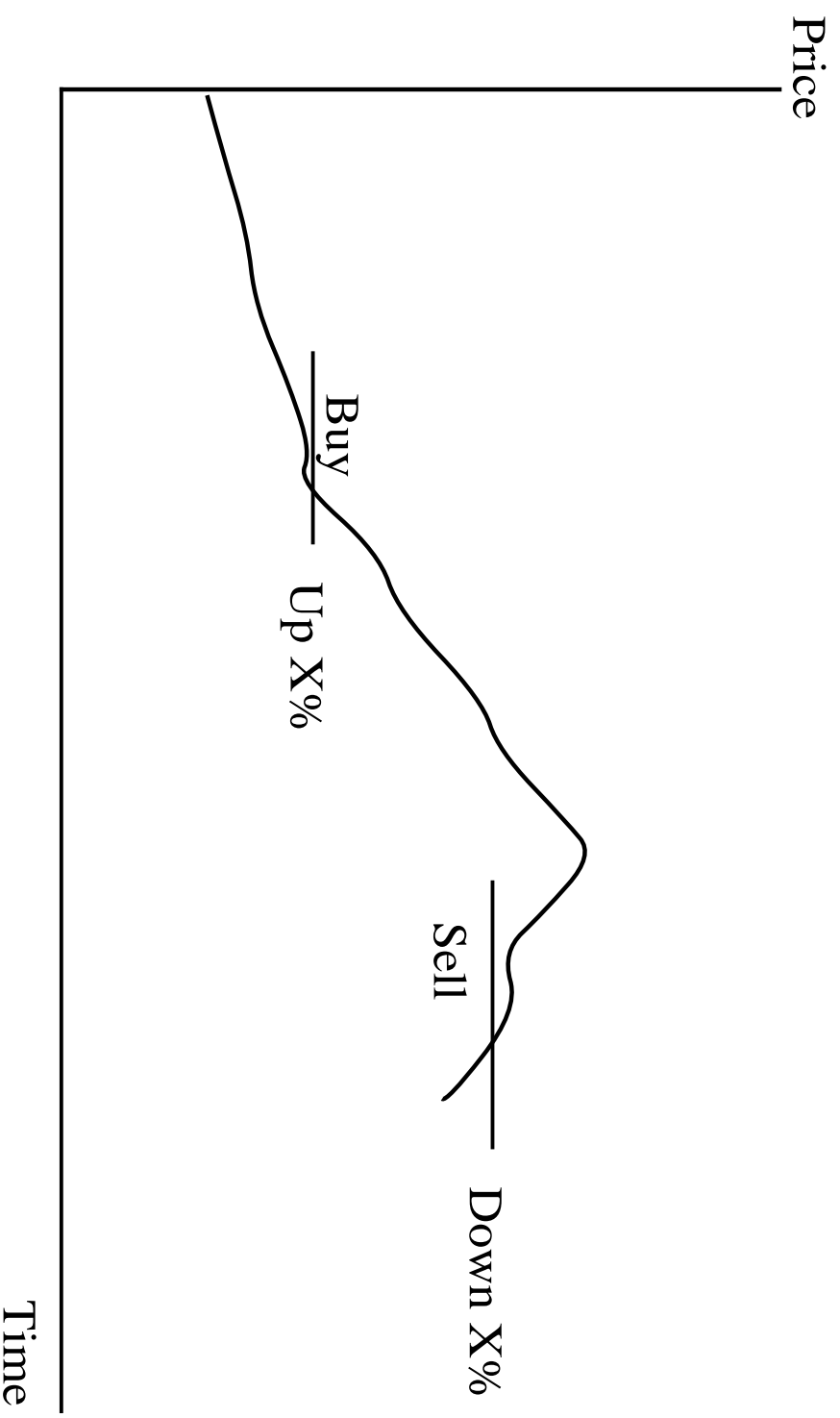
- **Serial correlations in most markets is small.** While there may be statistical significance associated with these correlations, it is unlikely that there is enough correlation to generate excess returns.
- The serial correlation in short period returns is also **affected by price measurement issues** and the market micro-structure characteristics.
- **Non-trading** in some of the components of the index can create a **carry-over effect** from the prior time period, this can result in **positive serial correlation** in the index returns.
- 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.  
Bid-Ask Spread =  $-\sqrt{2}$  (Serial Covariance in returns)  
where the serial covariance in returns measures the covariance between return changes in consecutive time periods.

## II. Filter Rules

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**In a filter rule, an investor buys an investment if the price rises X% from a previous low and holds the investment until the price drops X% from a previous high. The magnitude of the change (X%) that triggers the trades can vary from filter rule to filter rule. with smaller changes resulting in more transactions per period and higher transactions costs.**

# Illustration of Filter Rule



## Assumptions underlying strategy

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- This strategy is **based upon the assumption that price changes are serially correlated** and that there is price momentum, i.e., stocks which have gone up strongly in the past are more likely to keep going up than go down.

- The following table **summarizes results** from a study on returns, before and after transactions costs, on a trading strategy based upon filter rules ranging from 0.5% to 20%. ( A 0.5% rule implies that a stock is bought when it rises 0.5% from a previous low and sold when it falls 0.5% from a prior high.)

## Returns on Filter Rule Strategies

<i>Value of X</i>	<i>Return with Strategy</i>	<i>Return with Buy &amp; Hold</i>	<i>No of Trades</i>	<i>Return after costs</i>
0.5%	11.5%	10.4%	12,514	-103.6%
1.0%	5.5%	10.3%	8,660	-74.9%
2.0%	0.2%	10.3%	4,764	-45.2%
3.0%	-1.7%	10.1%	2,994	-30.5%
4.0%	0.1%	10.1%	2,013	-19.5%
5.0%	-1.9%	10.0%	1,484	-16.6%
6.0%	1.3%	9.7%	1,071	-9.4%
8.0%	1.7%	9.6%	653	-5.0%
10.0%	3.0%	9.6%	435	-1.4%
12.0%	5.3%	9.4%	289	2.3%
14.0%	3.9%	10.3%	224	1.4%
16.0%	4.2%	10.3%	172	2.3%
18.0%	3.6%	10.0%	139	2.0%
20.0%	4.3%	9.8%	110	3.0%

## Results of Study

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- **The only filter rule that beats the returns from the buy and hold strategy is the 0.5% rule, but it does so before transactions costs. This strategy creates 12,514 trades during the period which generate enough transactions costs to wipe out the principal invested by the investor.**
- **While this test is dated, it also illustrates a basic problem with strategies that require frequent short term trading. Even though these strategies may earn excess returns prior to transactions costs, adjusting for these costs can wipe out the excess returns.**

### III. Relative Strength Rules

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- A variant on the filter rule is the **relative strength measure**, which relates recent prices on stocks or other investments to either average prices over a specified period, say over six months, or to the price at the beginning of the period.
- Stocks which score **high on the relative strength** measure are considered **good investments**.
- This investment strategy is also based upon the **assumption of price momentum**.

## IV. Runs Tests

- A runs test is a **non-parametric variation on the serial correlation**, and it is based upon a count of the number of runs, i.e., sequences of price increases or decreases, in the price changes. Thus, the following price changes, where U is an increase and D 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 expected** in a series of this length, assuming that price changes are random.
- There are statistical tables that summarize the expected number of runs, assuming randomness, in a series of any length.
  - 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**.

## Studies of Price Runs

- 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

- Based upon these results, there is **evidence of positive correlation in daily returns** but no evidence of deviations from normality for longer return intervals.
- **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

## Long Term Serial Correlation

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- In contrast to the studies of short term correlation, there is evidence of strong correlation in long term returns.
- When long term is defined as months, there is positive correlation - a momentum effect.
- When long term is defined as years, there is negative correlation - reversal in prices. The effect is much stronger for smaller companies.

# Evidence of long term correlation

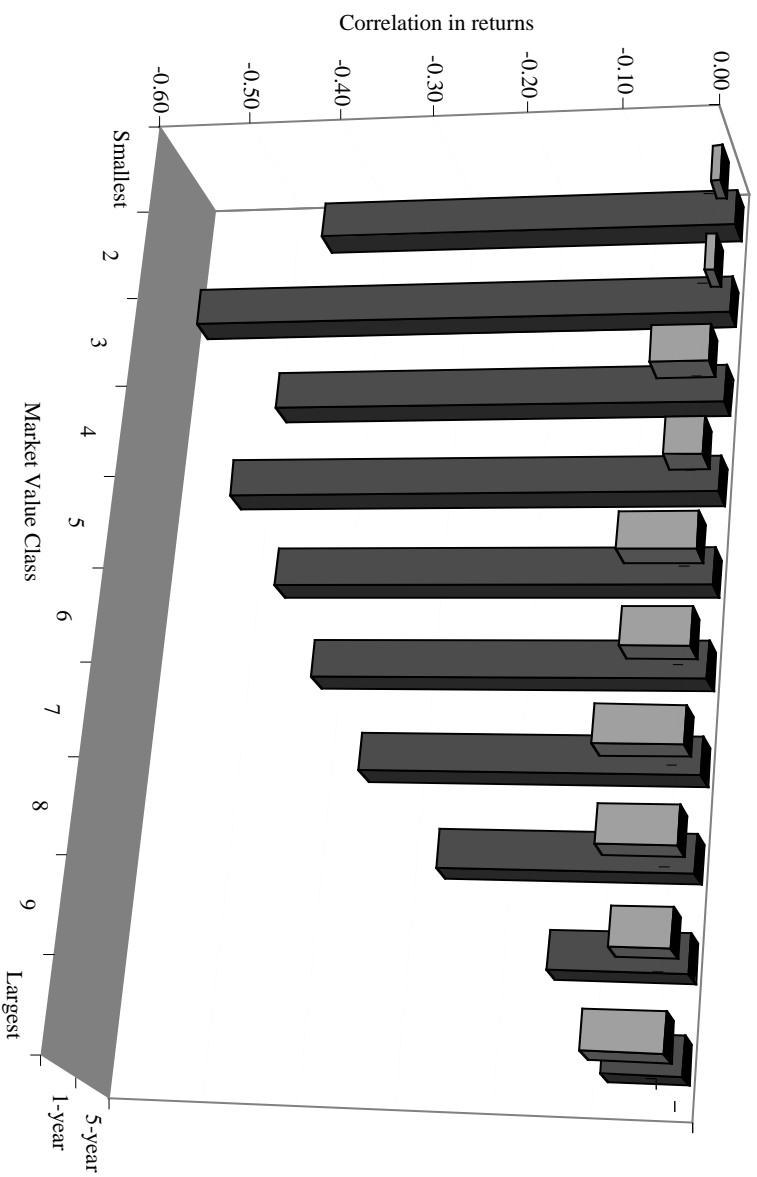


Figure 7.2: One year and Five year Correlations: Market Value Class: 1941 - 1985

# Seasonal and Temporal Effects on Prices

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- Empirical studies indicate a variety of seasonal and temporal irregularities in stock prices. Among them are:
  - The January Effect: Stocks, on average, tend to do much better in January than in any other month of the year.
  - The Weekend Effect: Stocks, on average, seem to do much worse on Mondays than on any other day of the week.
  - The Mid-day Swoon: Stocks, on average, tend to do much worse in the middle of the trading day than at the beginning and end of the day.
- While these empirical irregularities provide for interesting conversation, **it is not clear that any of them can be exploited to earn excess returns.**

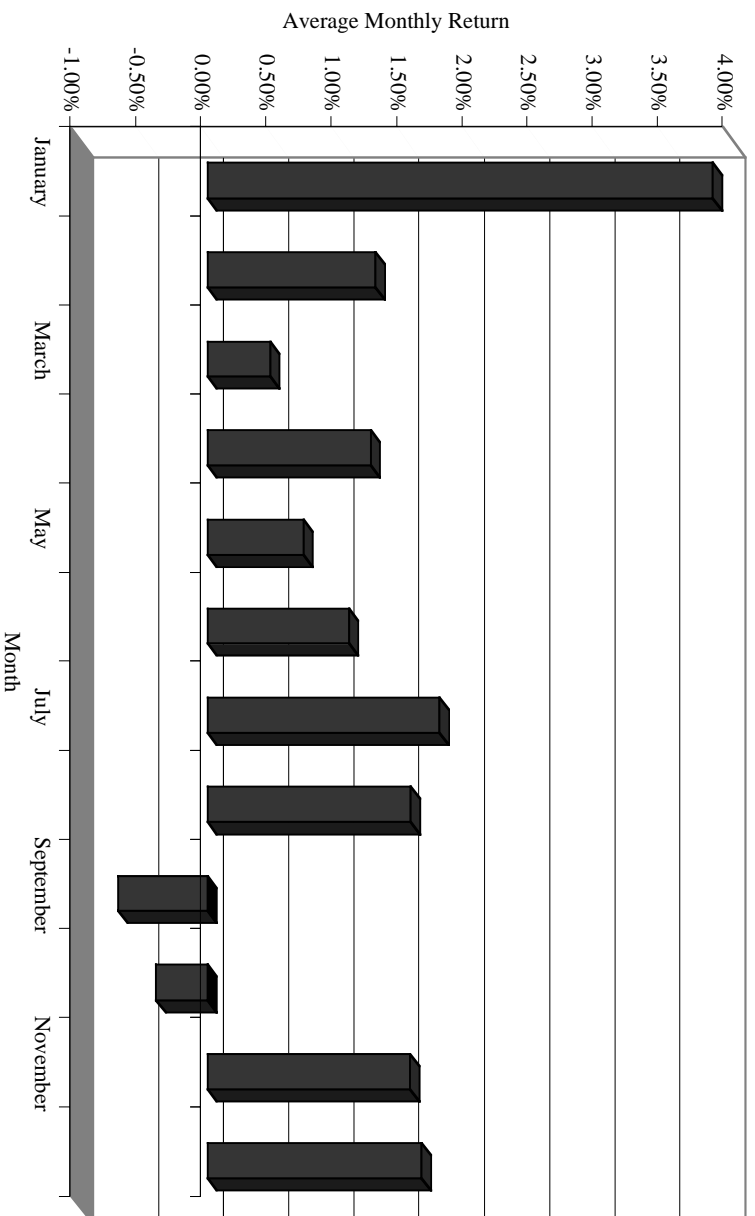
## A. The January Effect

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- 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.
- **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 accentuated for small firms** than for larger firms, and roughly half of the small firm premium, described in the prior section, is earned in the first two days of January.

# Returns in January

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



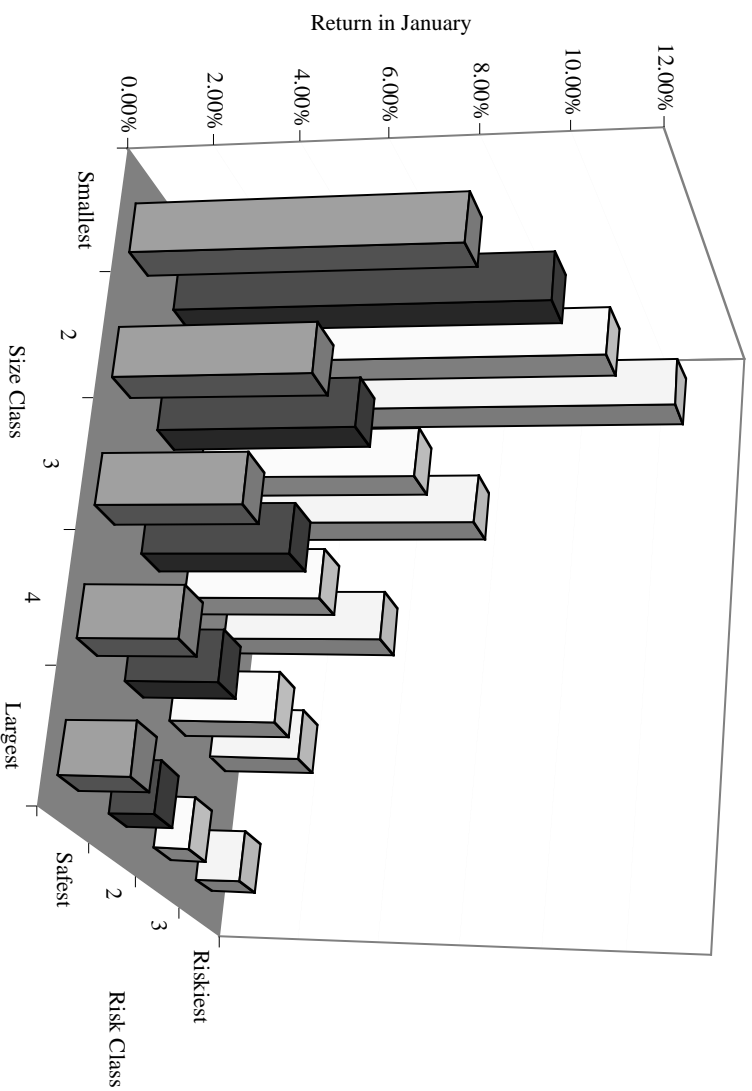
## Explanations for the January Effect

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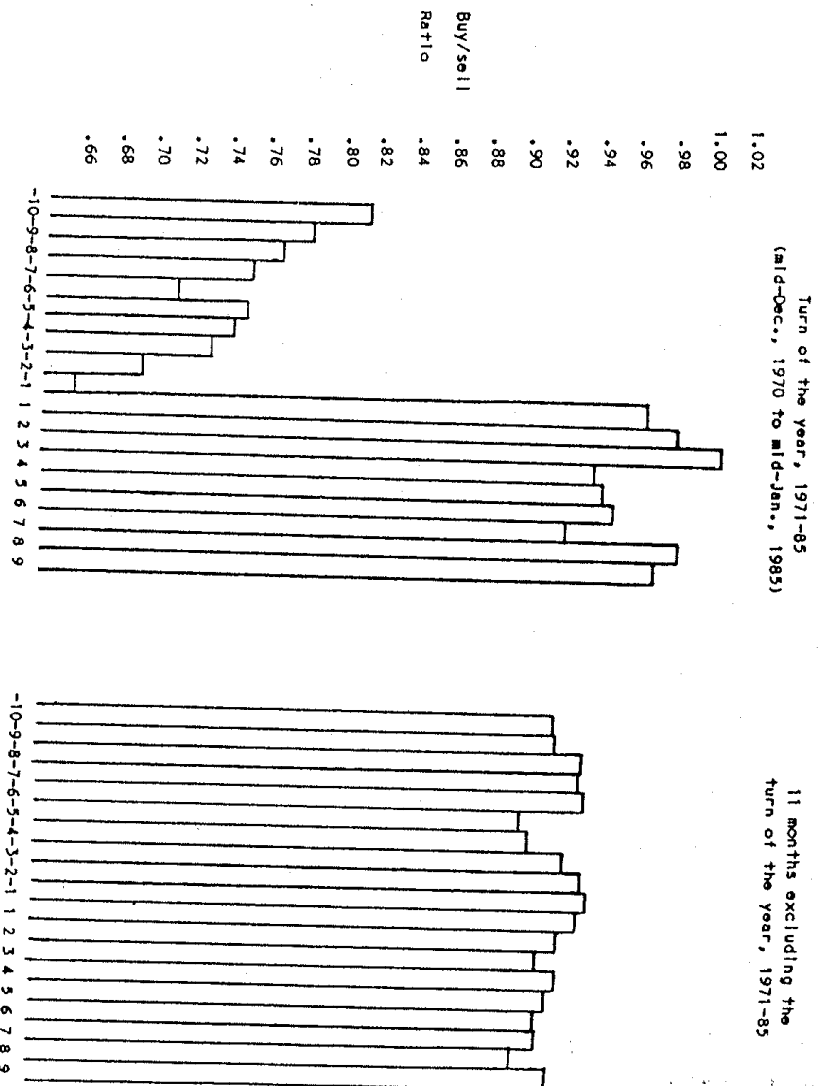
- A number of explanations have been advanced for the January effect, but few hold up to serious scrutiny.
  - **Tax loss selling by investors** at the end of the year on stocks which have 'lost money' to capture the capital gain, driving prices down, presumably below true value, in December, and a buying back of the same stocks in January, resulting in the high returns. Since wash sales rules would prevent an investor from selling and buying back the same stock within 45 days, 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.

# The Size Effect in January

Figure 7.4: Returns in January by Size and Risk Class



# Institutional Buying/Selling around Year-end



# Returns in January vs Other Months - Major Financial Markets

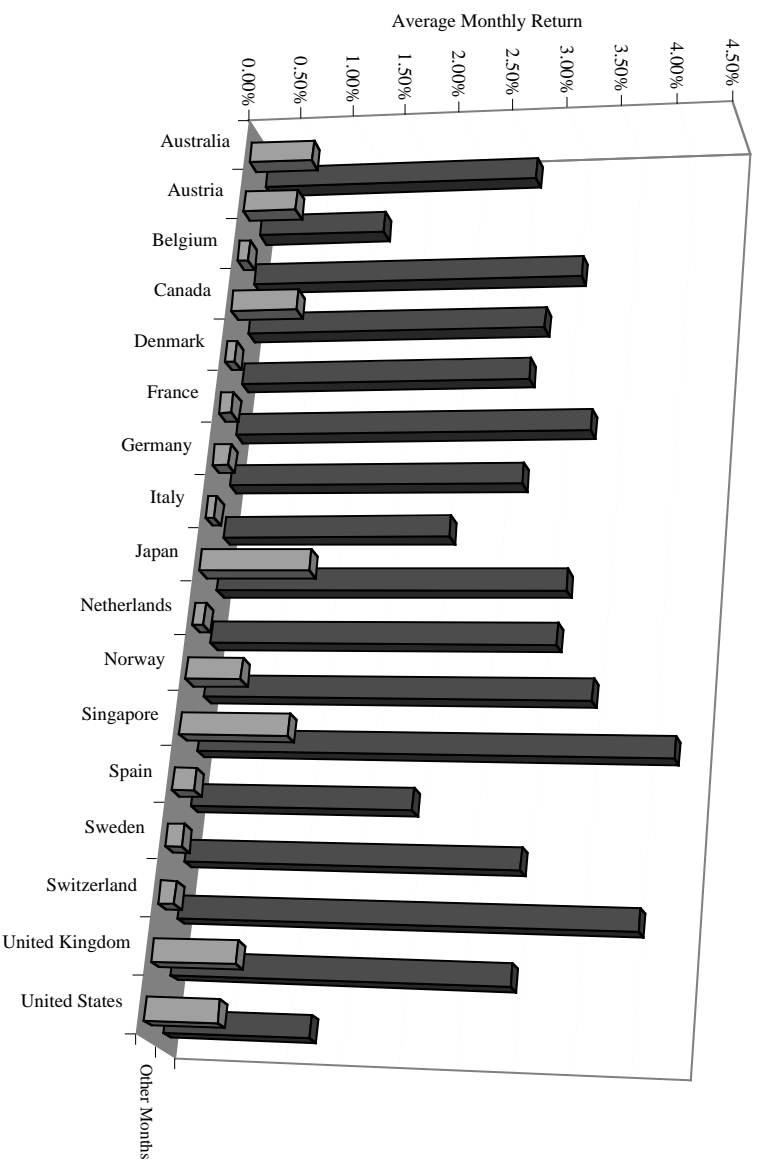


Figure 7.5: The International January Effect

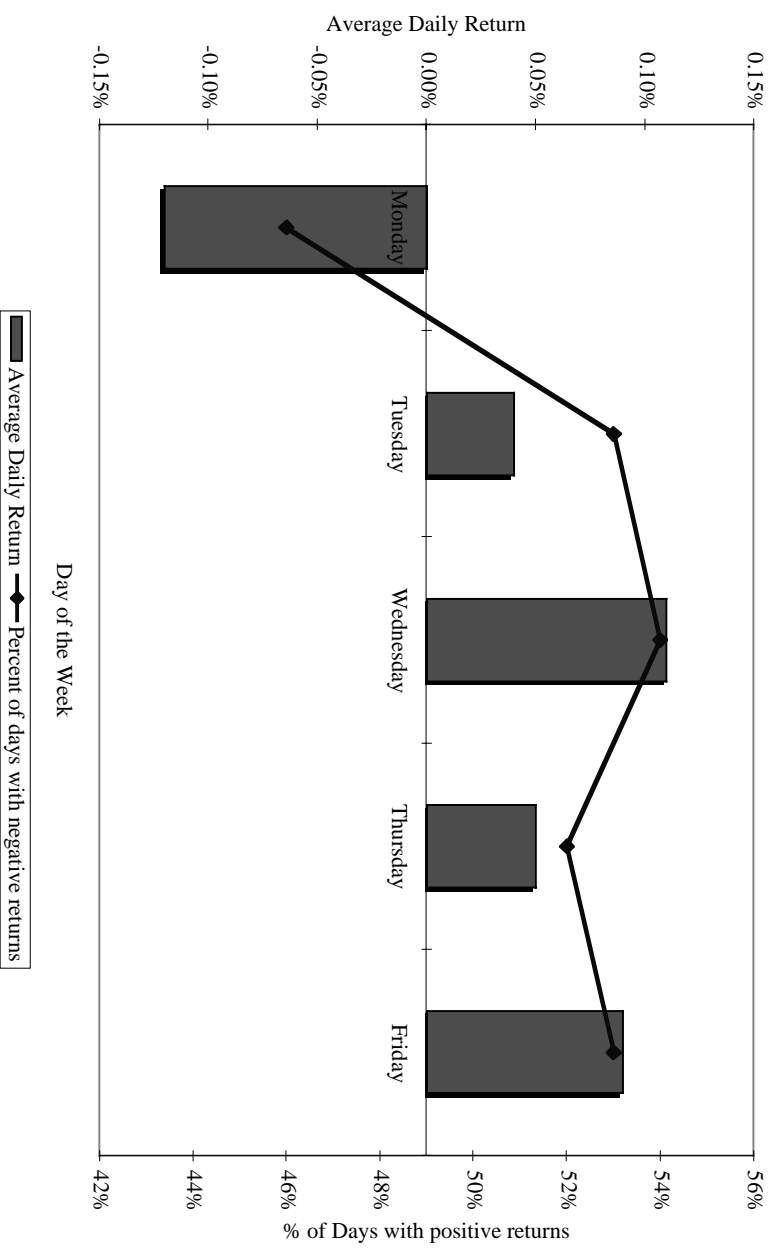
## B. The Weekend Effect

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- The weekend effect is another phenomenon that has **persisted over long periods** and over a number of international markets. It refers to the differences in returns between Mondays and other days of the week.
- Over the years, returns on Mondays have been consistently lower than returns on other days of the week.

# Returns by Weekday

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



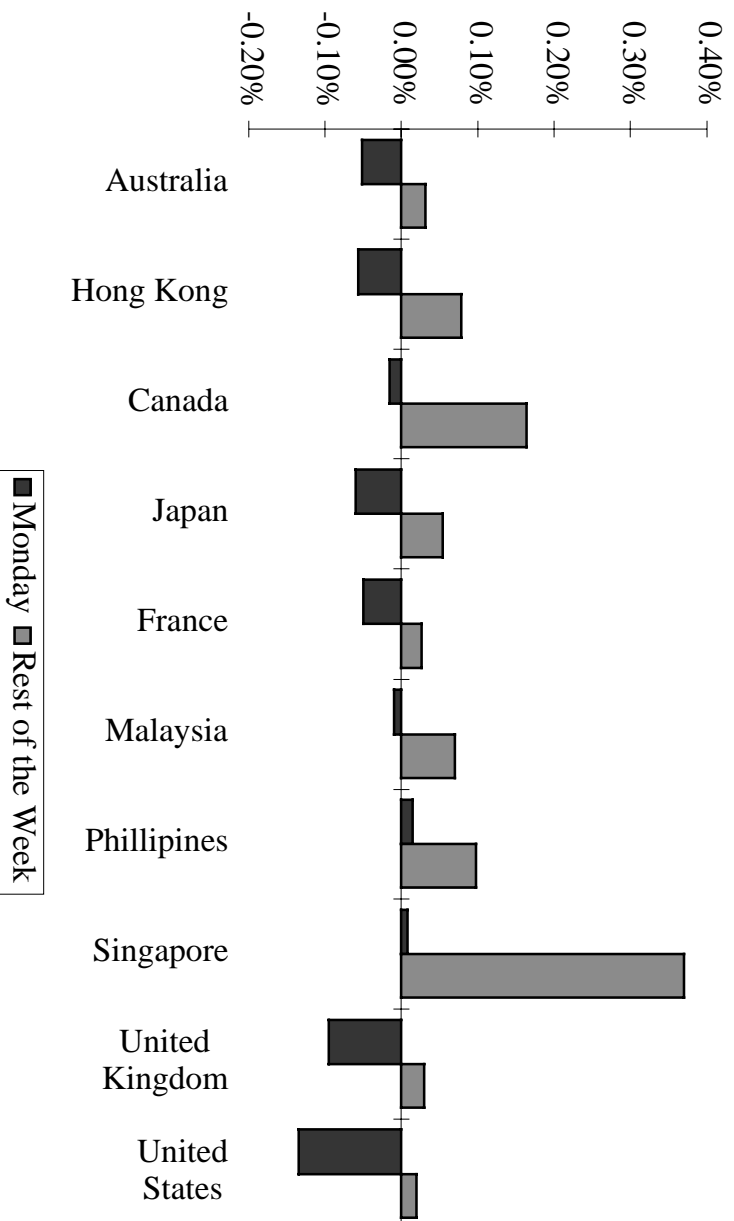
## The Weekend Effect: Explanations

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- First, the Monday effect is really a **weekend effect** since the bulk of the negative returns is manifested in the **Friday close to Monday open returns**. The returns from intraday returns on Monday are not the culprits in creating the negative returns.
- Second, the Monday effect is **worse for small stocks** than for larger stocks.
- Third, the Monday effect is **no worse following three-day weekends** than two-day weekends.
- 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. 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 in International Markets

Figure 7.7: Weekend Effect in International Markets



## Further Notes on the Weekend Effect

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- 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 positive, not negative, returns.

# The Holiday Effect: Is there one?

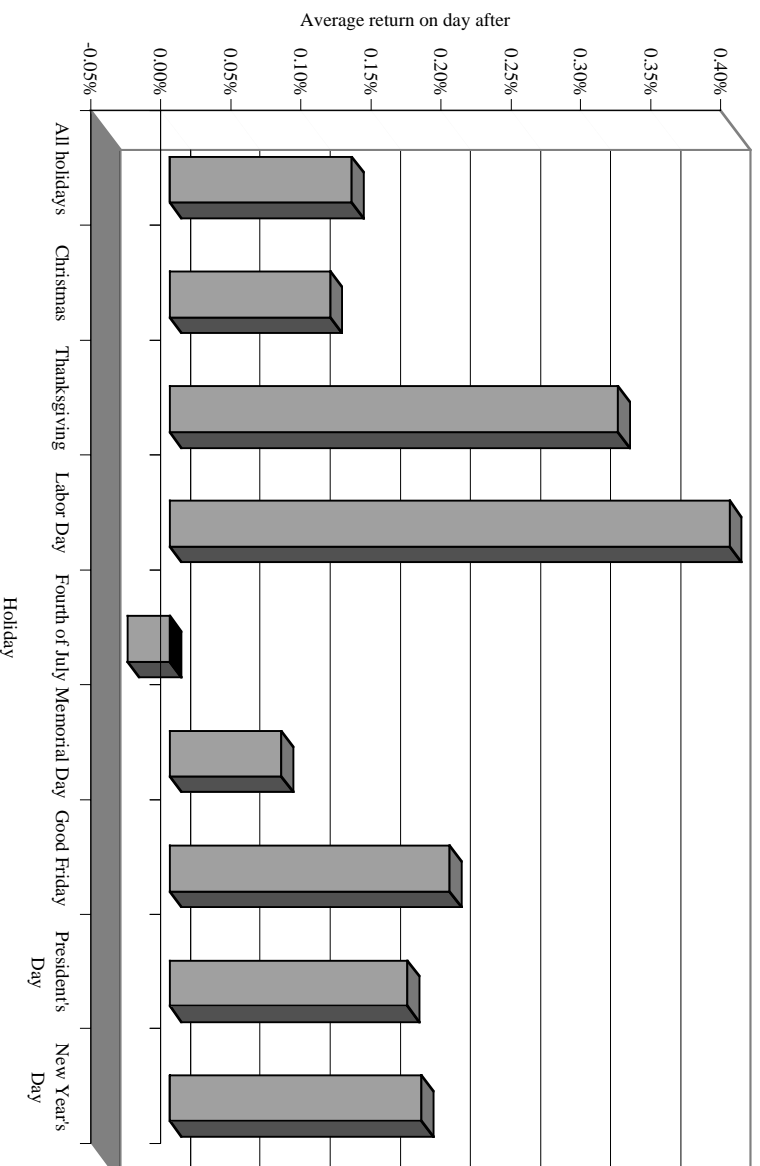
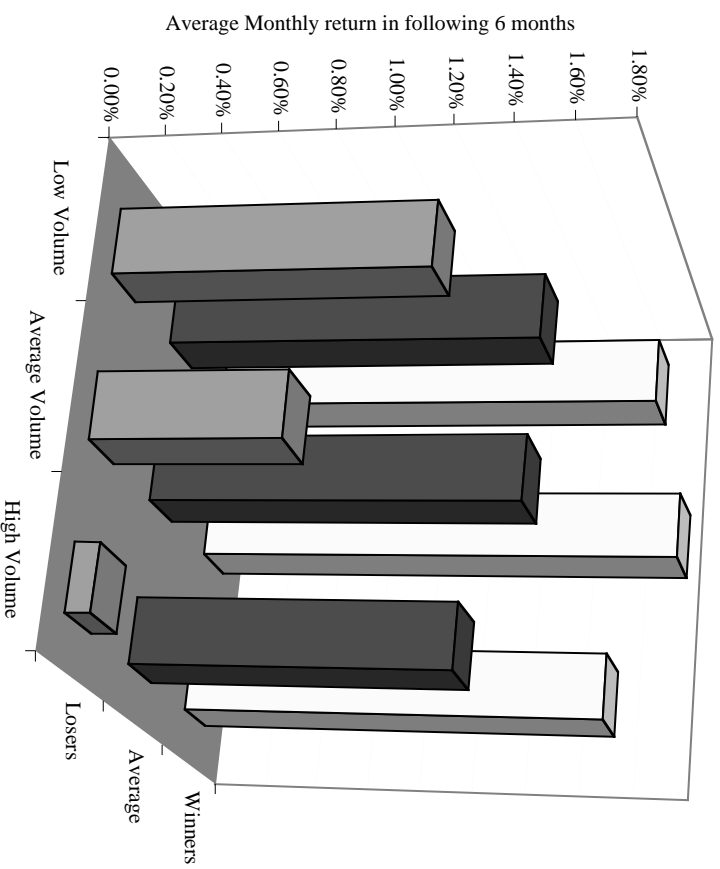


Figure 7.8: Return on first trading day after

# Volume and Price: The Evidence

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



Source: Lee and Swaminathan

# Foundations of Technical Analysis: What are the assumptions?

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- (1) **Price is determined solely by the interaction of supply & demand**
- (2) **Supply and demand are governed by numerous factors both rational and irrational.** The market continually and automatically weighs all these factors. (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 one side of the market as on the other.)
- (3) **Disregarding minor fluctuations in the market, stock prices tend to move in trends which persist for an appreciable length of time.** (Random walker would disagree with this statement. For any trend to persist there has to be some collective 'irrationality')
- (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. (In the financial economist's view the market (through the price) will instantaneously reflect any shifts in the demand and supply.

## On why technical analysts think it is futile to estimate intrinsic values

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- "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.**" (From Magee on Technical Analysis)

## The Counter Response

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- Of course, the statistics which the fundamentalists study play a part in the supply and demand equation- that is freely admitted. But there are many other factors affecting it. The market price reflects not only the **differing fears and guesses and moods, rational and irrational, of hundreds of potential buyers and sellers.. as well as their needs and resources-** in total, factors which **defy analysis** and for which no statistics are obtainable but which nevertheless are all synthesized, weighted and finally expressed in the one precise figure at which a buyer and seller get together and make a deal. **This is the only figure that counts.**

## Are investors rational?

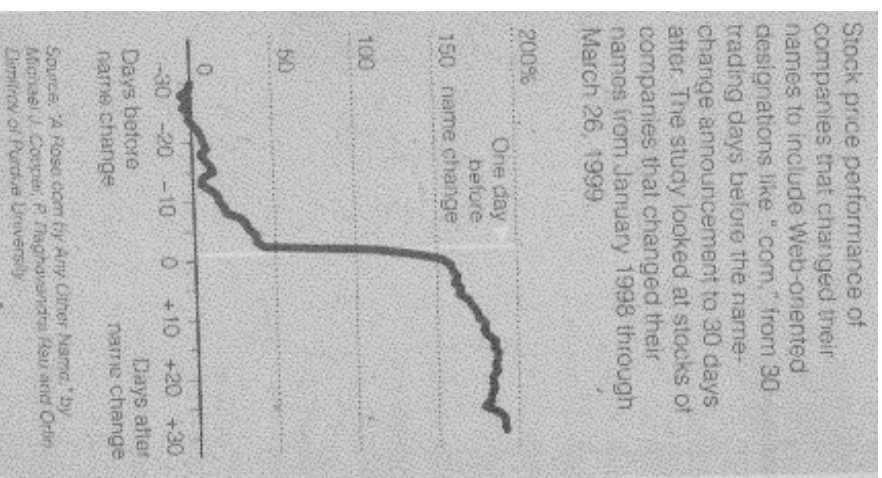
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- Historians who have examined the behavior of financial markets over time have challenged the **assumption of rationality** that underlies much of efficient market theory.

- They point out to the frequency with **speculative bubbles have formed in financial markers**, as investors buy into fads or get-rich-quick schemes, and the crashes with these bubbles have ended, and suggest that there is nothing to prevent the recurrence of this phenomenon in today's financial markets. There is some evidence in the literature of irrationality on the part of market players.

# A Sobering Thought for Believers in Rationality

Stock price performance of companies that changed their names to include Web-oriented designations like ".com." from 30 trading days before the name-change announcement to 30 days after. The study looked at stocks of companies that changed their names from January 1998 through March 26, 1999.



Source: "A piece from 'Any Other Name,'" by Michael J. Cooper, P. Raghavendra Rau and Omer Barnea of Purdue University.

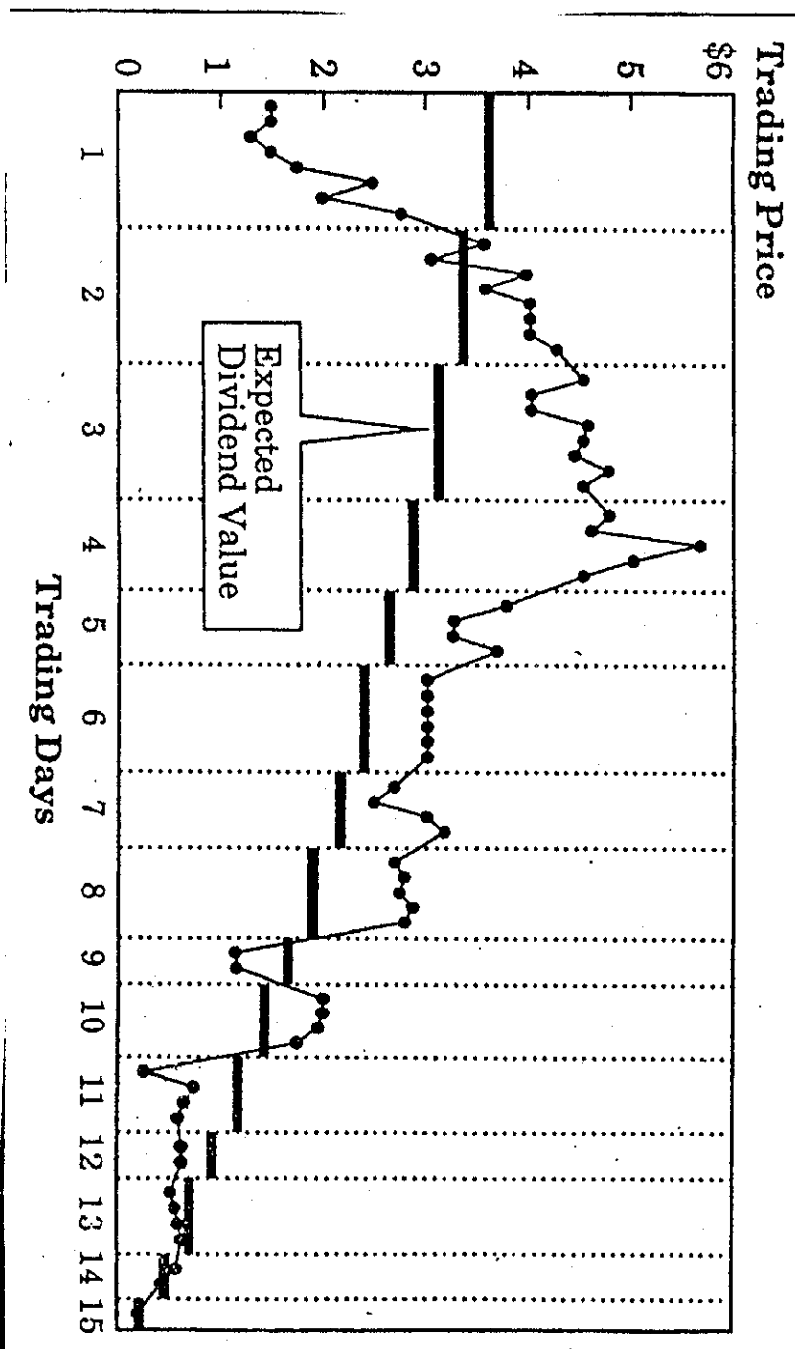
## a. Experimental Studies of Rationality

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- While most **experimental studies** suggest that traders are rational, there are some examples of irrational behavior in some of these studies.

- One such study was done at the University of Arizona. In an experimental study, traders were told that a **payout** would be declared after each trading day, determined randomly from four possibilities - **zero, eight, 28 or 60 cents**. The average payout was 24 cents. Thus the share's expected value on the first trading day of a fifteen day experiment was **\$3.60** ( $24 \times 15$ ), the second day was \$3.36 .... The traders were allowed to trade each day. The results of 60 such experiments is summarized in the following graph.

# Trading Price by Trading Day



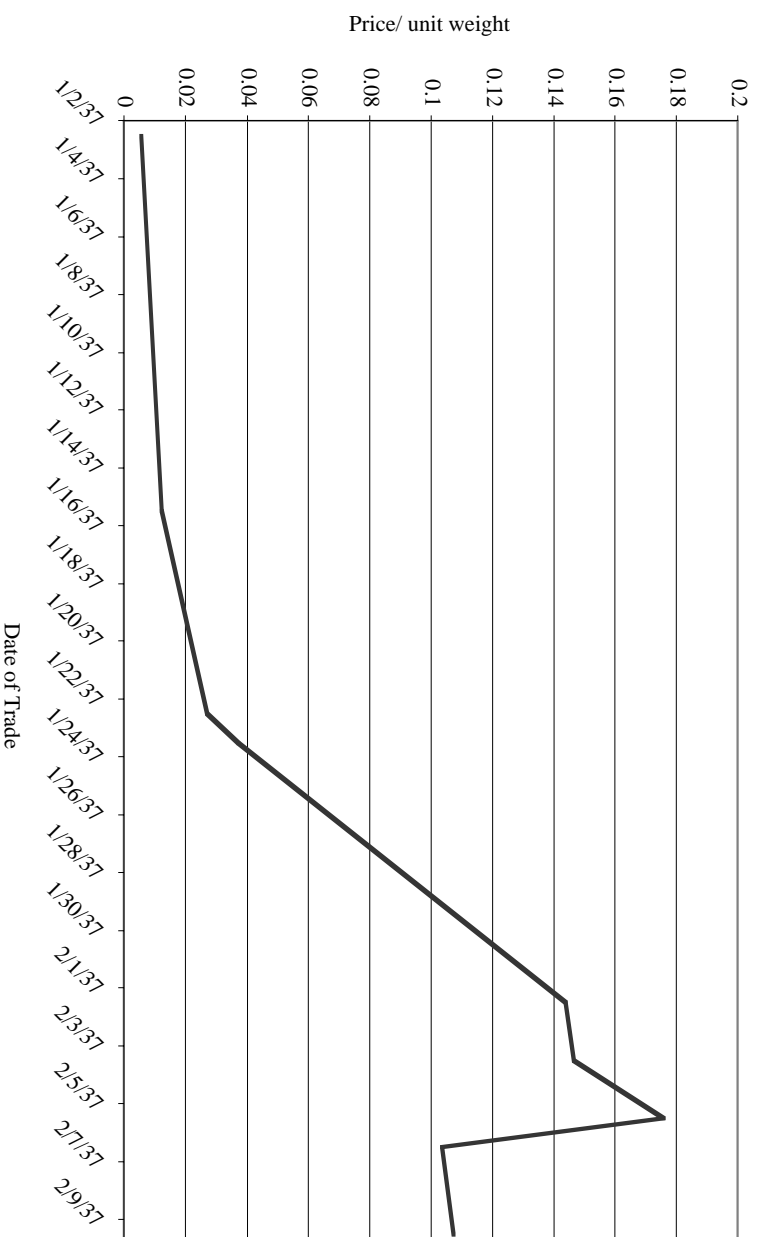
## Results of Experimental Study

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- 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 expected value by the end of the period.
- If this is feasible in a simple market, 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.
- Some of the experiments were run with **students**, and some with **Tucson businessmen**, with 'real world' experience. The results were similar for both groups.
- 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.

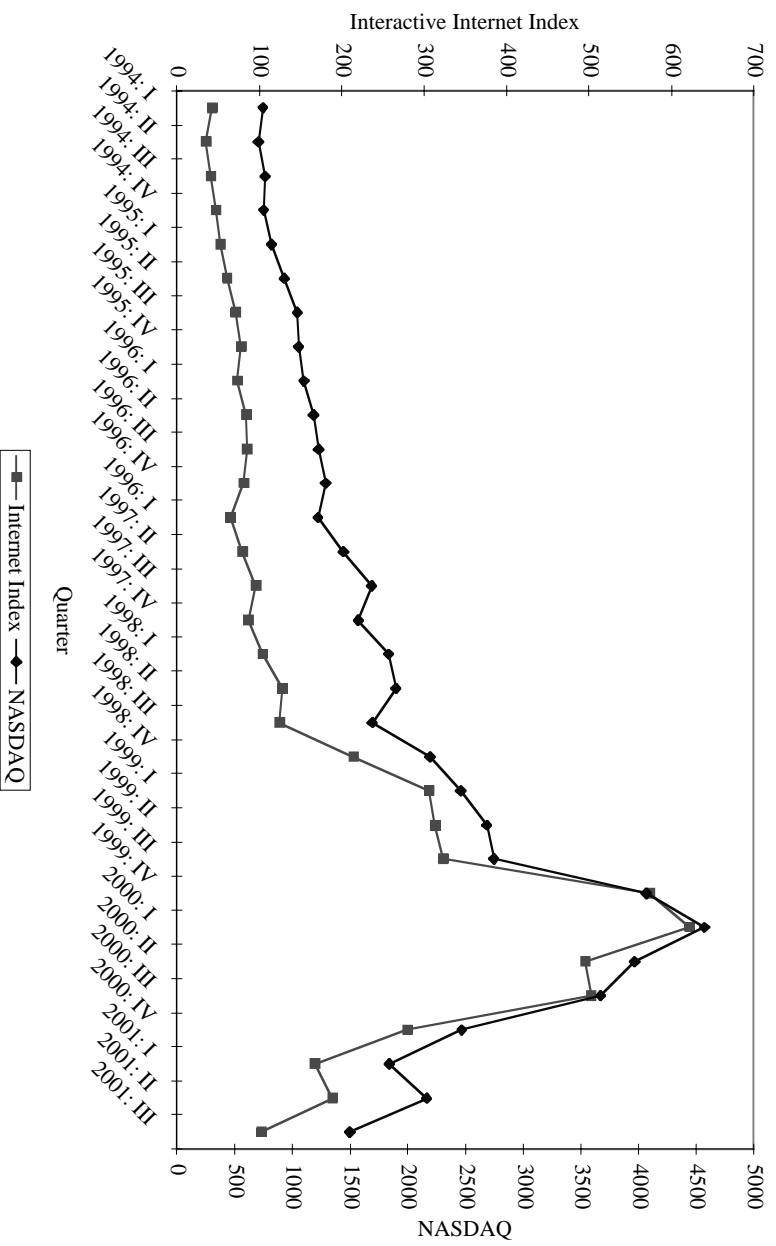
# b. A Real Bubble?

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



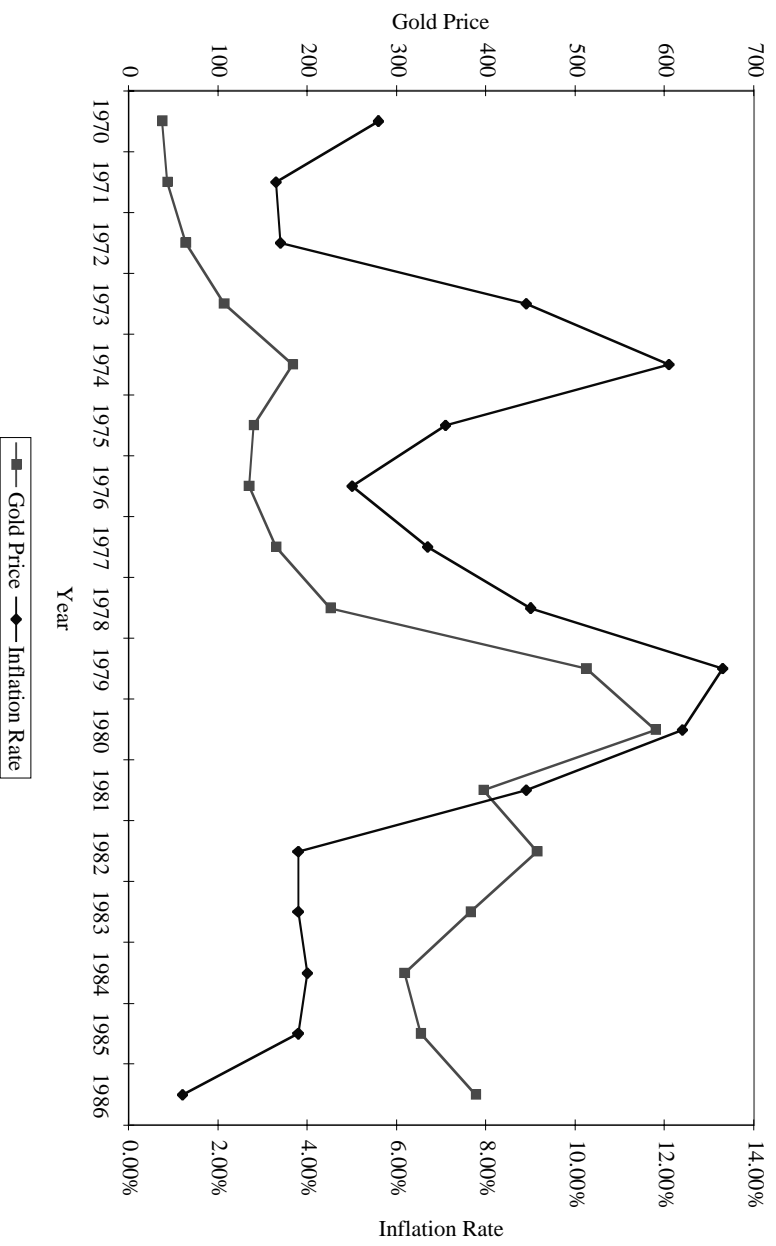
# What about this bubble?

Figure 7.12: The Tech Boom



# Or this one?

Figure 7.13: Gold Prices: 1970-86



# I. Markets overreact: The Contrarian Indicators

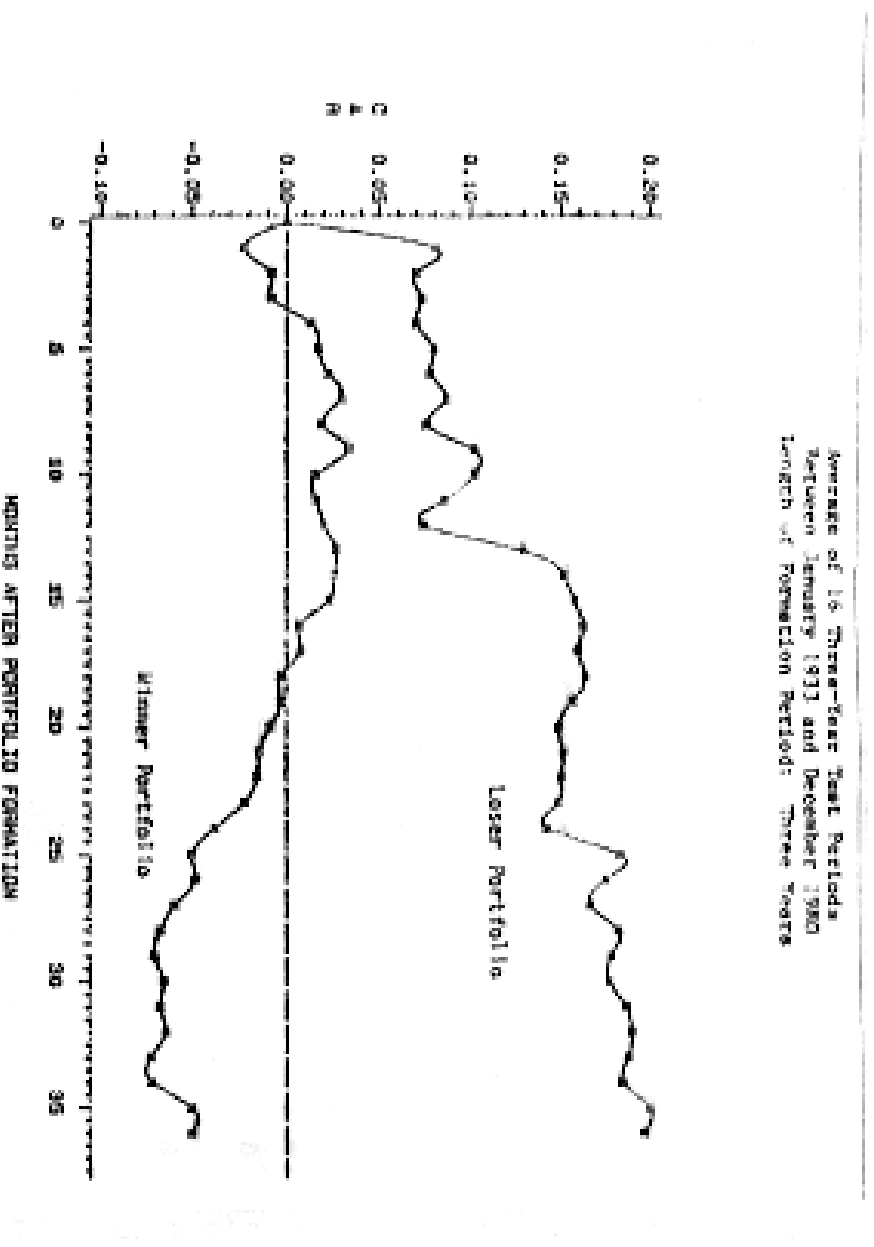
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Basis: Research in experimental psychology suggests that people tend to overreact to unexpected and dramatic news events. In revising their beliefs, individuals tend to overweight recent information and underweight prior data.

Empirical evidence: If markets overreact then

- (1) Extreme movements in stock prices will be followed by subsequent price movements in the opposite direction.
- (2) The more extreme the price adjustment, the greater will be the subsequent adjustment

# Evidence that Markets Overreact



## Issues in Using Contrarian Indicators

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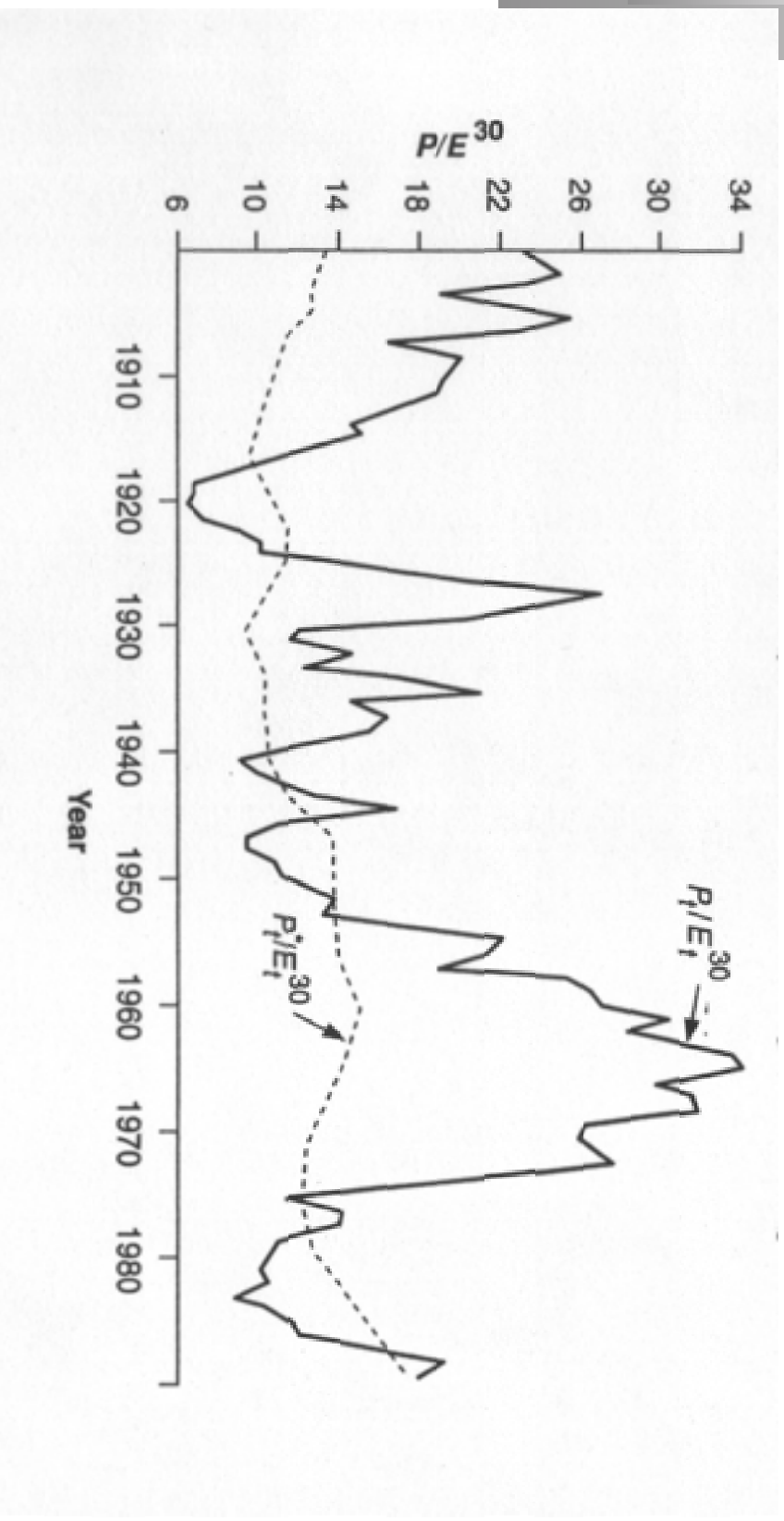
- (1) Why, if this is true, is it that contrarian investors are so few in number or market power that the overreaction to new information is allowed to continue for so long?
- (2) In what sense does this phenomenon justify the accusation that the market is inefficient?
- (3) Is the market more efficient about incorporating some types of information than others?

# Technical trading rules: Contrarian Opinion

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1. Odd-lot trading: The odd-lot rule gives us an indication of what the man on the street thinks about the stock (As he gets more enthusiastic about a stock this ratio will increase).
2. Mutual Fund Cash positions: Historically, the argument goes, mutual fund cash positions have been greatest at the bottom of a bear market and lowest at the peak of a bull market. Hence investing against this statistic may be profitable.
3. Investment Advisory opinion: This is the ratio of advisory services that are bearish. When this ratio reaches the threshold (eg 60%) the contrarian starts buying.

## II. Detecting shifts in Demand & Supply: The Lessons in Price Patterns



# 1. Breadth of the market

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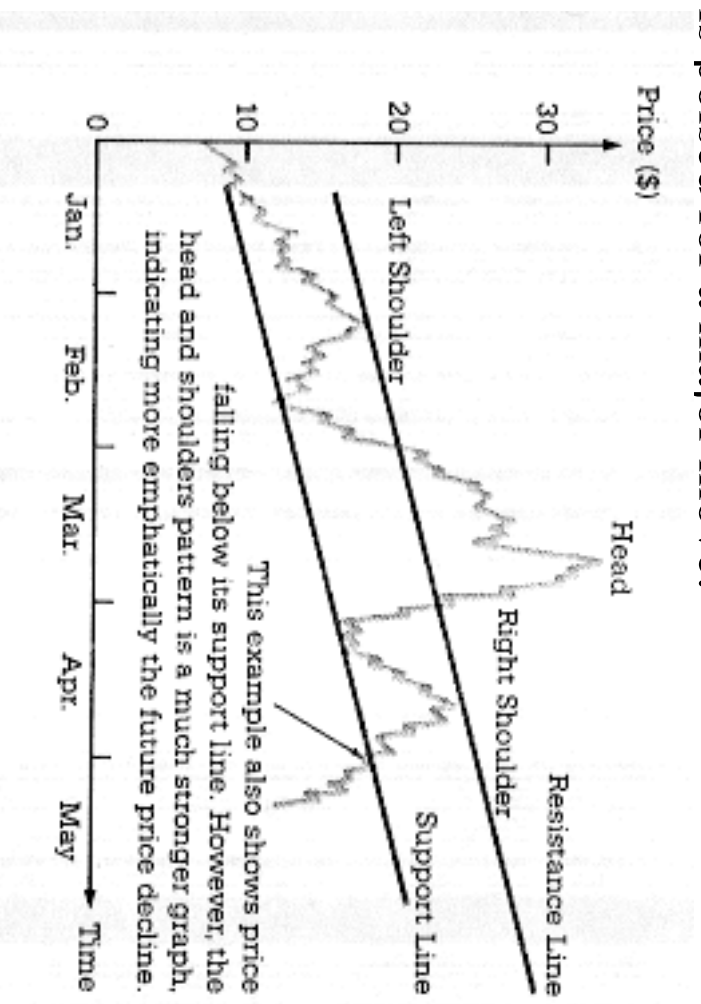
Measure: This is a measure of the number of stocks in the market which have advanced relative to those that have declined. The broader the market, the stronger the demand.

Related measures:

- (1) Divergence between different market indices (Dow 30 vs NYSE composite)
- (2) Advance/Decline lines

## 2. Support and Resistance Lines

A common explanation given by technicians for market movements is that markets have support and resistance lines. If either is broken, the market is poised for a major move.



## Possible Rationale

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- (1) Institutional buy/sell programs which can be triggered by breakthrough of certain well defined price levels (eg. Dow 1300)
- (2) Self fulfilling prophecies: Money managers use technical analysis for window dressing.

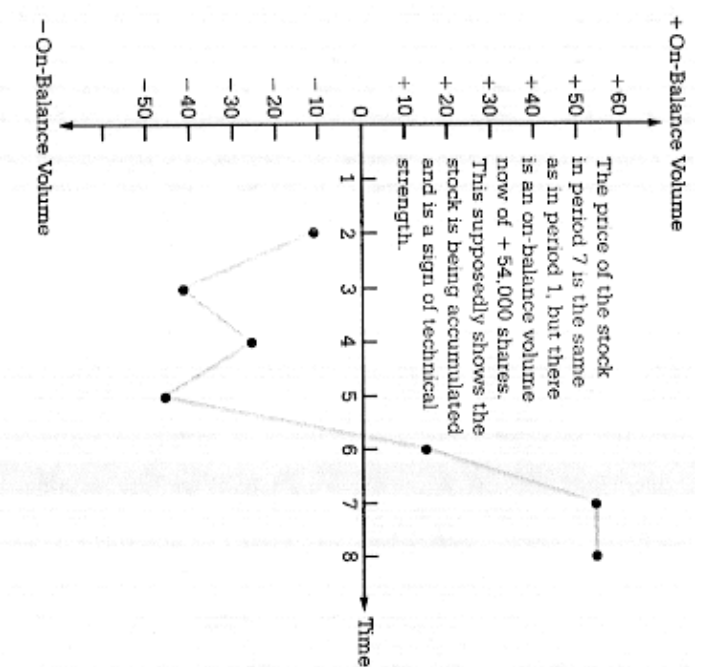
## 3. Moving Averages

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- A number of indicators are built on looking at moving averages of stock prices over time. A moving average line smooths out fluctuations and enables the chartist to see trends in the stock price. How that trend is interpreted then depends upon the chartist.

## 4. Volume Indicators

Some technical analysts believe that there is information about future price changes in trading volume shifts.



# 5. Point and Figure Charts

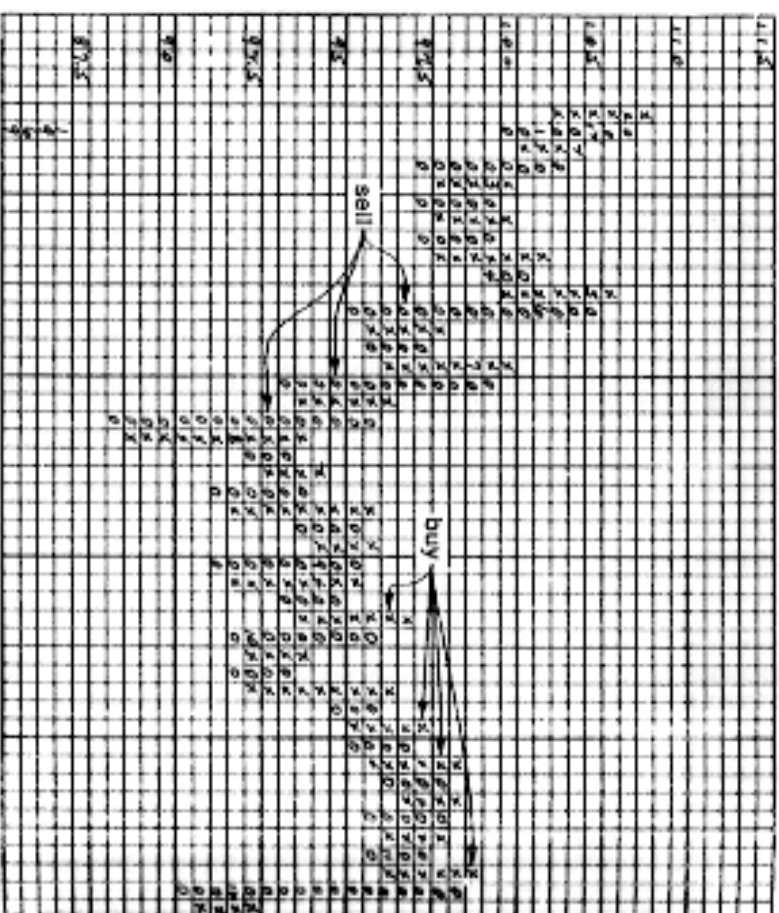


FIG. 23-5 Point and figure chart of Standard & Poor's composite 500. (From A. W. Cohen, Technical Indicator Analysis. Chartcraft, Inc., Larchmont, N.Y.)

### III. Market learn slowly: The Momentum Investors

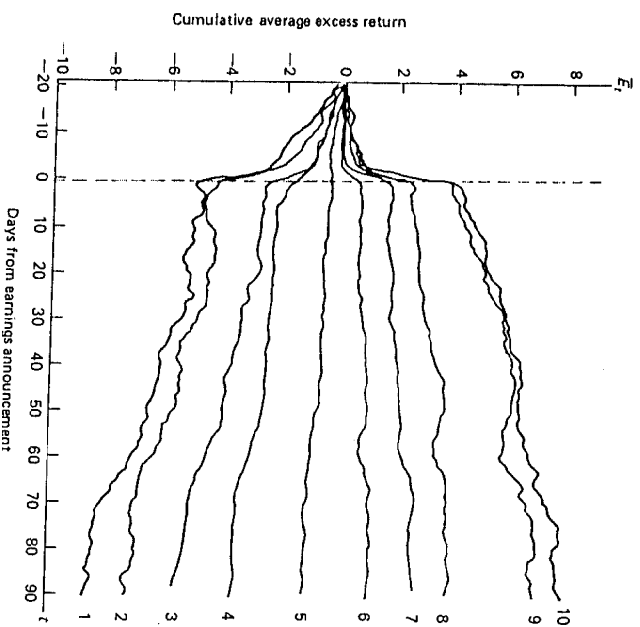
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Basis: The argument here is that markets learn slowly. Thus, investors who are a little quicker than the market in assimilating and understanding information will earn excess returns. In addition, if markets learn slowly, there will be price drifts (i.e., prices will move up or down over extended periods) and technical analysis can detect these drifts and take advantage of them.

The Evidence: There is evidence, albeit mild, that prices do drift after significant news announcements. For instance, following up on price changes after large earnings surprises provides the following evidence.

# Price Drifts after Earnings Announcements

Note the price drift, especially after the most extreme earnings announcements.



## Momentum Indicators

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- **Relative Strength:** The relative strength of a stock is the ratio of its current price to its average over a longer period (eg. six months). The rule suggests buying stocks which have the highest relative strength (which will also be the stocks that have gone up the most in that period).
- **Trend Lines:** 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.

## IV. Following the Smart Investors: The Followers

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- 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 smartest investors, who presumably know more than the rest of us.

## Insider Buying and Selling

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- You can look up stocks where insider buying or selling has increased the most.
- 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.

## Specialist Short Sales

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- The assumption is that specialists have more information about future price movements than other investors. Consequently, when they sell short, they must know that the stock is overvalued.
- Investors who use this indicator will often sell stocks when specialists do, and buy when they do.

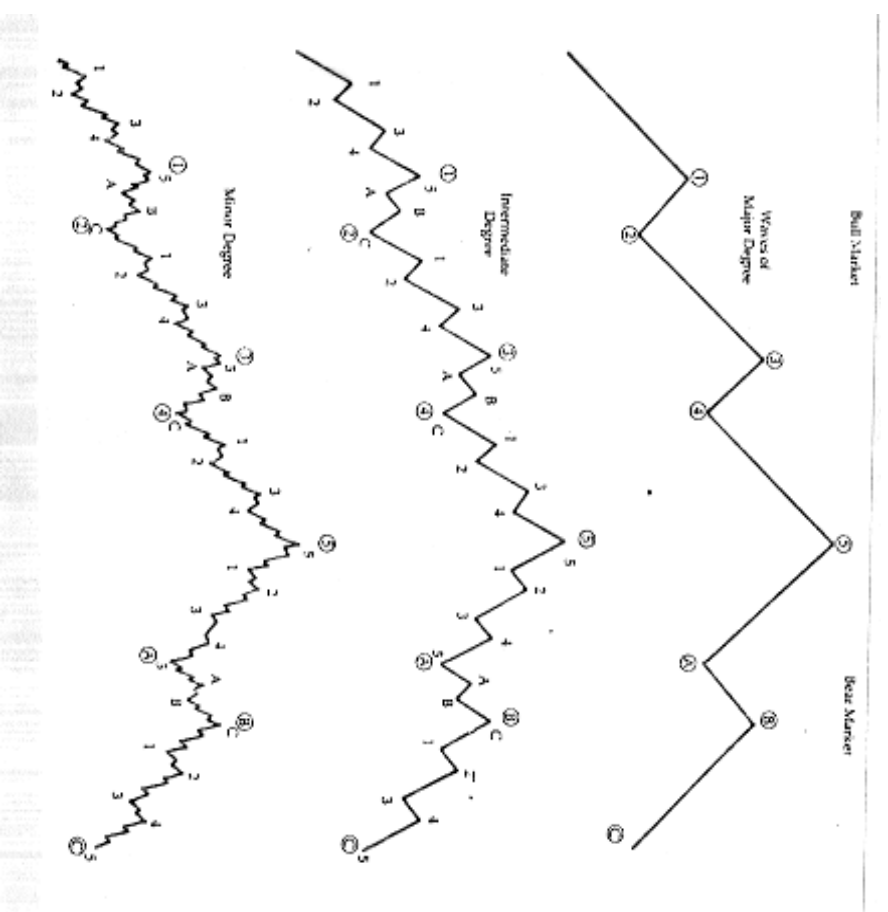
## V. Markets are controlled by external forces: The Mystics

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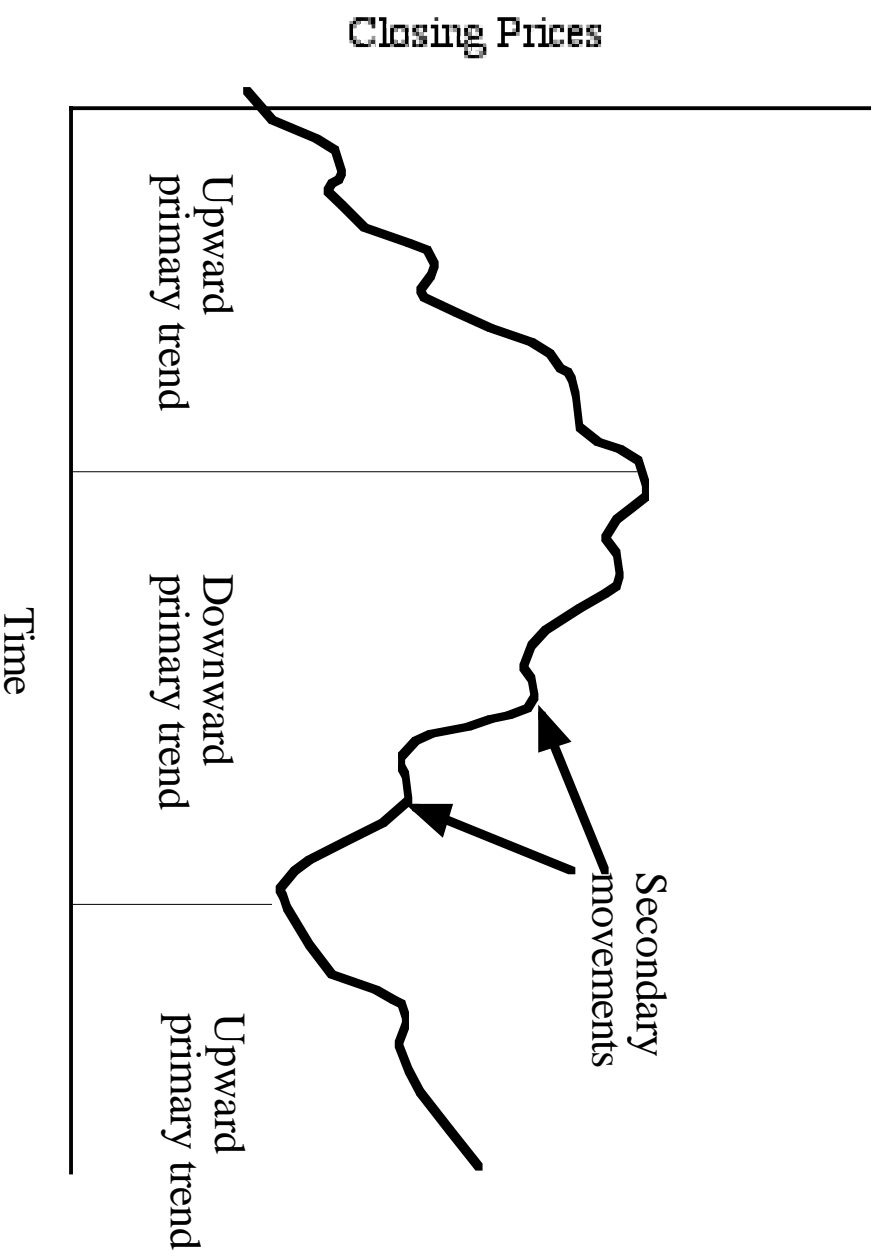
The Elliot Wave: Elliot's theory is that the market moves in waves of various sizes, from those encompassing only individual trades to those lasting centuries, perhaps longer. "By classifying these waves and counting the various classifications it is possible to determine the relative positions of the market at all times". "There can be no bull of bear markets of one, seven or nine waves, for example.

The Dow Theory:" The market is always 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 month and the third is the main movement (primary trends) covering at least four years in its duration.

# The Elliott Wave



# The Dow Theory



# Determinants of Success at Technical Analysis

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- 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. 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.
- 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.
- Building on the theme of time horizons, success at charting can be very sensitive to how long you hold an investment.
- The strategies that come from technical indicators are generally short-term strategies that require frequent and timely trading. Not surprisingly, these strategies also generate large trading costs that can very quickly eat into any excess returns you may have.