

Bubble Mania

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I. Introduction

While many economists define a “bubble” as a deviation from stock market fundamentals, Charles Kindleberger defines a bubble as an upward price movement over an extended range that tends to implode (Kindleberger 1996). An extended negative bubble is a crash. The nature of these beasts makes them very important to the investor. Business schools teach students about the efficient market hypothesis and the economically rational individual. Bubbles make investing difficult because prices deviate from their fundamental valuations. Without market fundamentals being able to predict prices, the investor is forced to learn new ways of investing. My research will analyze market indicators to help predict bubbles. A market indicator is a factor that tends to reflect the movement of stock market prices.

Three competing viewpoints exist on the cause of bubbles. The more traditional theory applied to market bubbles is the adaptive expectation theory. When individuals apply this theory, they look to the past to judge the correct price of a stock. Ratios and trend analysis are important to picking a winning portfolio. Subscribers to the adaptive expectations theory believe investors are backward looking in deciding on the correct price to pay for a stock. In the literature review section, several previous studies will be presented to solidify this argument.

Contrary to the adaptive expectations theory, the rational expectations theory builds off the concept that investors are forward looking. Investors act on the basis that they realize the correct model of how the world works and that they use all available

information in deciding on their actions (Poole 2000). Investors incorporate monetary policy and other macroeconomic variables into their investment decisions. Unlike price to earnings ratios and trend analysis, rational expectation variables are not based solely on past performance. As with the adaptive expectations model, previous studies on rational expectations will be studied in the literature review.

With both rational expectations and adaptive expectations, investors base the price of a stock off of some expected future profits discounted for the time value of money. The equation might look like this:

$$P_{\text{stock}} = (\text{Sum future Profits} / (1+r)^t) / \text{Outstanding Shares}$$

where P is price of stock, r is the interest rate, and t is the future time period that payments are expected to be discounted. The difference between the two theories

“Bubbles make investing difficult because prices deviate from their fundamental valuations.”

is how they arrive at the expected future profit sum. The adaptive expectations model looks towards the past to judge this sum, while the rational expectations model looks towards the

future and incorporates macroeconomic policies into the valuation. Both theories present a viable explanation of the direction of stock prices over the long run.

The long run theories of adaptive expectations and rational expectations do not present an adequate reason on why stock prices fluctuate so immensely from their fundamentals. If the stock market grows an average of 6% per year, why did S & P 500 prices increase in the 1980s and 1990s so drastically? These changes in price valuation are so dra-

matic that traditional models have a difficulty explaining them (Poole 2000). But if investors followed what others did, the volatility in stock valuation might be explained. As Keynes said:

A conventional valuation which is established as the outcome of the mass psychology of a large number of ignorant individuals is liable to change violently as the result of the sudden fluctuation of opinion due to factors which do not really make much difference in the prospective yield (Shiller 2000).

So if investors are uninformed, how can the unimportant variables that they use to base their investments on be measured? Furthermore, how do I even discover these extraneous variables? This task of discovery is quite impossible due to the large number of differing opinions on how stock should be priced. However, it is possible to judge the aggregate effect of a crowd's decisions by analyzing how people react after they incorporate numerous variables into their investing decision. A good measure of people's reaction are opinion indices like those based on consumer confidence or consumer sentiment. If the crowd feels generally bullish about the market, a bubble might form until it is popped by a general bearish feeling about the market. This general feeling of bullish or bearish market sentiments is called herd mentality. This study focuses on investor confidence and investor sentiment so that crowd psychology can be analyzed.

While impossible to illuminate the individual causes of herd mentality, the overall effect can be discovered through opinion polls. My hypothesis is that when investors exhibit herd mentality in choosing stocks, they create a market bubble. Herd mentality is measured through consumer confidence surveys. Market bubbles will be the deviation of actual S&P 500 prices from the predicted fundamental S&P 500 prices.

Through my research design, I will derive a trend of the average price of the S&P 500 for the past 100 years. This trend will be a representation of the fundamental valuation of the stock market. Previous studies suggest the S&P 500 should trend upward at 6-7% per year (Lynch 1989). Then, I analyze the deviation from this trend during the mid-1980s bubble and the technology bubble of the late 1990s. I run a regression using consumer confidence and sentiment indices. My modified hypothesis is that the

deviation of actual S&P 500 prices from predicted "fundamental" S&P 500 prices during the years 1985-2001 is started by changes in consumer confidence and consumer sentiment. If the variables explain a lot of the deviation, then the herd mentality theory predicts the creation and destruction of bubbles.

II. Literature Review

A. Adaptive Expectations

In investing, there has always been a division between the investor that analyzes the past by looking at price earnings ratios (P/E ratios), earnings per share (EPS), and other ratios and the forward-looking investor relying on rational expectations. Under the adaptive expectations model, investors look into the past to judge what a stock will do in the future. Their argument can be clearly illuminated by the statement "what a company will do in the future is best represented by what they've done in the past." If this model is accurate regarding stock price evaluation, then variables that measure past performance should correctly predict and explain variations in stock prices. Biermann (1995) supports the idea that market prices are determined from backward looking investors. The article discusses the use of price to earnings ratios to determine excess market valuations. Benjamin Graham's book accurately deals with why markets fluctuate and how to deal with the fluctuations (1973). Graham discusses 5 basic points to recognizing market bubbles. Several of these points have to do with price levels in relation to factors like growth and earnings. Graham's book allows a better understanding of gauging market bubbles through an adaptive expectations model.

B. Rational Expectations

With rational expectations, investors focus on the future. If a company has hired a top-notch management staff, then they should be profitable in the future. Economic agents predict future events that are not falsified by actual events. Investors will construct their opinions in such a way that on the average, they are correct. Because of the focus on forward looking behavior, rational expectation theory has drastic implications in regards to bubbles (Shiller 2000).

The major implication with rational expectation theory is that future events are already built into the price equation of the stock so that only random

news will cause the price change of a stock (Baxter and Davis 1998). This randomness in stock price changes leads to the “random walk theory”—a theory about the unpredictability of stock price movements.

While the conclusions reached from rational expectation theory is highly interesting, the theory will not be applied in this project. However, the theory is important to mention in the paper due to its controversial methodology in stock market pricing.

C. Herd Mentality

Until recently, economists have avoided the idea that herd mentality creates bubbles. No formal tests existed for asset-priced bubbles because the hypothesis about how asset holders’ expectations evolve over time did not exist (Diba 1990). However, the advent of the rational expectations hypothesis provided the foundation for rational bubbles.

As Shiller points out in his book titled “Irrational Exuberance,” completely rational people can participate in herd behavior. The behavior is individually rational, but when combined produces group behavior that mirrors irrationality (Shiller 2000). The reason for herd behavior according to his theory is *information cascade*. His idea of an information cascade is simply reliance of an individual on another’s choice. For example, suppose two people decide to go out to eat. The first chooses one of two empty restaurants simply by tossing a coin. The second person sees the first person eating in the restaurant and concludes that it must be better since the first person is eating in it. As Shiller says, “If all of them had been able to pool their first impressions and discuss these as a group, they might have been able to deduce which restaurant was likely to be the better one. But in this scenario they cannot make use of each other’s information, since they do not reveal their own information to others when they merely follow them.” The theory of information cascades is a theory of the failure of information about true fundamental value to be disseminated and evaluated (Shiller 2000). Individuals can be rational individuals and still exhibit herd mentality.

Extraneous factors can be incorporated into the bubble model without violating rational expectations or long-run equilibrium towards fundamental valuation. The creation and destruction of a bubble arises from some extraneous event that is of little significance to the fundamental valuation of a stock (Diba 1990). The very same reason why a bubble forms

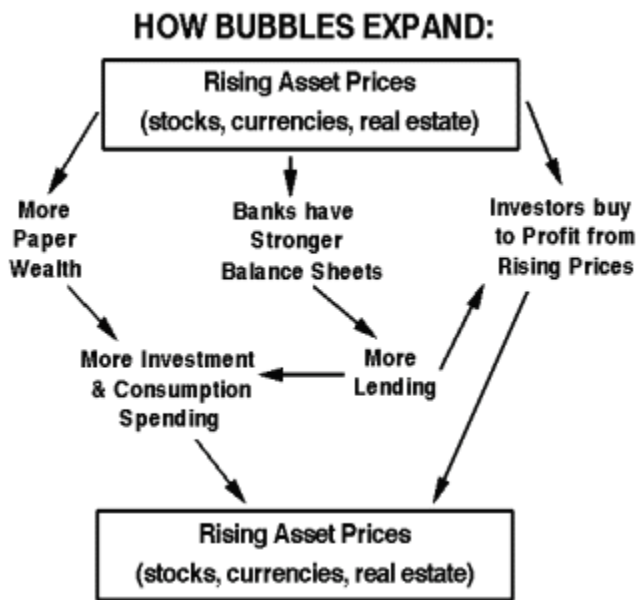
may also destroy the bubble. As mentioned previously, the specific cause of a bubble is quite difficult to measure due to the irrelevance of the factor. However, the growth of a bubble and its deviation from fundamental valuation can be studied through herd mentality. The key importance of how bubbles operate is that the individual investor realizes that the asset is overpriced. Bubbles form because of the herd mentality that exists in crowds. This herd mentality can be explained by how investors view their overvalued assets. A bubble grows at an exponential rate greater than the fundamental valuation growth rate because an agent would not hold an overvalued asset unless they expect it to be overvalued a sufficiently greater amount next period (Diba 1990). Another way of stating this concept is called the greater fool theory. The investor realizes that the stock is overvalued, but is willing to pay the amount because he thinks that there is a greater fool that will pay even more for the price of the stock. The realization of the overvaluation, but willingness to invest is herd mentality. Figure 1 shows a diagram of how bubbles expand.

The cyclical nature of the bubble is evident from the diagram in Figure 1. Initially, asset prices rise (either by a general rise in fundamental prices or herd mentality). However, the bubble forms when investors “jump on the bandwagon” to profit from rising prices. They borrow money from investment institutions because of their increased wealth. This borrowing leads to even greater asset prices. However, the bubble will eventually burst. Figure 2 shows how and why bubbles burst.

Why bubbles pop can be any extraneous factor that has little correlation to how stocks are valued (Diba 1990). However, the downward spiral of stock prices mirror the upward expansion in a bubble. As seen from the diagrams, bubbles are self-perpetuating once they form.

The two most famous market bubbles in history are tulip mania and the South Sea land speculation bubble. Mackay’s book studies the herd mentality of both of these events (Mackay 1996). Mackay’s description of the growth rate of the bubble in the South Sea land speculation relates to the greater fool theory. John Law informed the public of the great prosperity of the company and the people believed that the price could be supported at an even higher level (Mackay 1996). This belief of price support in overvaluation is once again illuminated by herd men-

FIGURE 1
How Bubbles Expand



Note: This diagram also incorporates the effect that banks have on bubble expansion. Diagram is from CAW TCA Newsletter. December 1998 v4 n2.

tality. As Diba points out, over reliance on outside recommendations is a signal of the presence of herd mentality.

A legend of Wall Street, Phillip Carret offers insight into successful “speculation.” His book defines the machinery of markets and the vehicles of speculation to better understand market bubbles (Carret 1997). Chapters 4 and 5 of his book deal with market movements in terms of “ripples and waves.” Instead of using the term market bubble, Carret defines market separation from economic fundamentals as a “tide of speculation.” Through his ideas on the “tide of speculation,” herd mentality plays a vital role in stock market bubbles. An example of the “tide of speculation” is demonstrated in the virtual model constructed by an economist from the University of Bonn named Thomas Lux. Lux created a virtual model of 500 agents trading one commodity (Chang). Some of the traders used a strategy that hinged upon the commodity’s fundamental value, which fluctuated randomly. Others traded based on market trends, a sort of “trader see, trader do” strategy (once again, the greater fool theory arises). Virtual traders could also switch strategies depending on which seemed to be doing better (Chang). “We see in our model, the price dynamics reflect fundamental

FIGURE 2
How Bubbles Contract



Note: This diagram also incorporates the effect that banks have on bubble contraction. Diagram is from CAW TCA Newsletter. December 1998 v4 n2.

values but only to an extent,” Lux says. “We think this shows one needs to pay more attention, one has to stress more the interaction of agents, which has been neglected in economics up to now.”

III. Research Design

Deviation of market prices from fundamental stock prices due to herd mentality is the central theme of this research paper. Investors rationally choose to invest in an overpriced asset because they believe that others will pay even more for the asset. To measure this belief, I use measures of consumer confidence and sentiment. If a high percentage of people are overly optimistic about the economy, the stock market will become overvalued. Herd mentality develops because investors think prices will keep going up—they are too confident in the economic health of the market and ignore warning signs of a troubled economy. The development of bubbles will be the focus of my project.

While bubbles develop because of the bandwagon effect through herd mentality, the self-perpetuating nature of bubble is caused by momentum. Only the effect of herd mentality on a bubble’s creation and destruction will be analyzed. The momentum effect that causes the extreme expansion and contrac-

tion of bubbles will be discussed in the appendix.

To measure herd mentality, I include variables on investor exuberance. As the confidence in the market increases, investors will drive the prices away from the fundamentals (Diba 1990). This separation from market fundamentals is the beginning of a stock market bubble. My research will measure the correlation between investor confidence (measured by several different surveys) and the separation of a predetermined “fundamental” market price. The measure of the fundamental market price is defined in the dependent variable analysis section.

Since investor confidence is a measure of herd mentality, a high correlation between the independent and dependent variable illustrates the relationship of market expansions and contractions with herd mentality.

A. Dependent variable analysis

The premise of a bubble is simply the deviation of stock prices from their fundamental values. However, some interesting questions arise. What is the fundamental value of a stock and how is it determined? When is the deviation from the fundamental price a bubble and when is it simply a random fluctuation? In my model, the fundamental price of the stock market is the average growth in the S&P 500 over the past 50 years. This average growth is measured with a trend line created through regression analysis. By creating a trend line, the deviation of actual prices from their predicted “fundamental” prices can be measured. The deviation from the average growth represents a possible bubble. The definition of when a bubble is present and when it is not is highly debated. Some economists argue that a bubble is present when a 5% deviation occurs from actual stock prices and their fundamental prices (Kindelberger). Others argue that the deviation must be greater. Since the literature I have read often refers to the bubble that the market has been in since the mid 1980s, I will interpret any deviation of actual prices from their predicted fundamental as the result of a market bubble.

Specifically, the deviation of stock market prices will be measured from 1985-2001. Table 1 presents the dependent variable.

The first step of running the regression is to identify a “fundamental” stock

price valuation for the S&P 500. By finding the fundamental price, I can compare the actual price to the fundamental price. The deviation of the price between the two represents a market bubble.

Running a linear regression of monthly S&P500 data from 1951-2001, I discover that the trend line is

$$\ln S\&P\ 500 = 3.321 + .058X$$

Using a log-linear regression, I achieved an R² value of almost 40 points higher than running a simple regression. Also, I deleted the years of 1994-2001 in the equations trend line. As Kindleberger mentioned (1996), the mid 1990s and beyond had such a great increase in prices that the fundamental price equation would have been thrown off a great deal. Therefore, the trend line is only based on historic S&P 500 data from 1951-1993. However, to measure the deviation for post 1993 years, the trend line was simply extended until 2001.

The independent variable is years beginning with 1951 (year 1). 1952 is year 2, etc. However, the dependent variable is ln S&P 500 instead of the S&P 500. To arrive at the S&P 500 as the dependent variable instead of the ln S&P 500, the anti-log must be taken for the equation.

$$e^{\ln S\&P\ 500} = e^{3.321 + e^{.058X}}$$

or

$$S\&P\ 500 = e^{3.321 + e^{.058X}}$$

Now, the fundamental price of the S&P 500 is represented by the equation above—x being the current year minus the base year (1951). To arrive at the S&P 500 predicted fundamental price for the year, input the adjusted basis year (i.e. For 1990 [x=40], the predicted S&P 500 fundamental price should be 281.744. To better understand the equation, figure 3 shows actual S&P 500 prices versus their predicted “fundamental” prices.

The next step was to measure the deviation of S&P 500 prices from the fundamental price line during the years 1985-2001. This deviation is simply actual S&P 500 stock prices minus the predicted fundamental stock prices. The predicted fundamental prices

TABLE 1
Dependent Variable

| Dependent Variable | Description |
|--------------------|--|
| Dev | Deviation of actual S&P 500 prices from predicted fundamental prices for the years 1985-2001 |

were calculated from the regression equation. To make the data easier to understand, I have created Table 2, which lists the deviation of stock prices from 1985-2001.

To summarize, the dependent variable is measured by the deviation of actual S&P 500 prices from the predicted fundamental S&P 500 prices. The fundamental price equation is simply the anti-log of the logarithmic price equation. The logarithmic price equation was calculated using log-linear regression analysis on the S&P 500 prices from the years 1951-1993.

B. Independent Variables

The independent variables represent investors' herd mentality. As defined previously, herd mentality is measured through the confidence level of the economic agents that interact with the economy. Table 3 presents 5 different variables. Each variable is used to measure herd mentality.

Five separate regressions will be run. Each regression will analyze the significance of the variable in explaining the deviation of actual stock prices from the predicted fundamental valuations. For the variables Confide and FH, only data back to 1992 could be gathered. Therefore, the regression analysis will only be from 1992-2001 for those two variables.

The coefficients above all deal with consumer confidence. By measuring consumer confidence, the exuberance of investors can be measured. The ConEcon, ConSent, FH, and Confide variables all measure how consumers feel about the economy. As in Shiller's restaurant example, if everybody is exuberantly happy, then word of mouth will spread to other investors. Shiller compares this compounding effect to Kirman's study of ants (Shiller 2000).

It has been found experimentally that ants, when presented with two identical food sources near their nest, tend to exploit both sources, but one more intensively than another...ants individually recruit other ants to food sources; there is no central direction for the nest as a whole. Recruitment is done by contact and following (tandem recruitment) or by laying a chemical trail (pheromone recruitment). Both of these processes are the ant equivalent of word-of-mouth communication.

Shiller states that recruitment is done through contact. As in Shiller's example of the ants' exploitation of one identical food source over another, in cer-

tain periods of time investors choose stocks because of what others say—not based solely on the fundamental pricing of a stock. Herd mentality exists and drives up the price of stocks. If the stocks seem attractive and word-of-mouth communication is increasing, consumers are generally going to be confident. By measuring this confidence and using regression analysis to compare it to deviations of stock market prices from their fundamentals, the effect of herd mentality on the market can be illustrated.

V. Results

Using the deviation of actual S&P 500 prices from their predicted fundamental valuation as the dependent variable, regressions were run using each of the consumer confidence indices as the independent variable. As mentioned in the previous section, if the variables are highly significant and have a high R^2 value, much of the deviation of stock prices can be explained through changes in consumer confidence. As Shiller mentions, "people are ready to believe the majority view or to believe authorities even when they plainly contradict matter-of-fact judgment." The consumer confidence indices used measure the "majority view." If the majority view (consumer confidence index) is significant in the regression results, herd behavior theory can be applied to stock market pricing. Table 4 presents the five separate regression results.

All of the variables are significant at alpha levels of 0.1. At an alpha level of 0.05, only the ConBus variable is insignificant. While the R^2 values are not extremely high, the unpredictability of the stock market makes the results seem quite satisfactory.

Shiller says "we saw evidence of strangely high investor confidence and undiminished expectations for the market." Once again, herd mentality coincides with consumer confidence. These undiminished expectations are an example of the greater fool theory. Investors jump on the bandwagon when others are confident about the market. This "irrational exuberance" elevates stock markets. The regression results support the argument of investor confidence creating a bandwagon effect. How much stock prices deviate and for how long are matters of momentum. However, confidence creates an exuberance which gets investors paying more and more for stocks. This frenzy drives stock prices away from their fundamentals. When consumer confidence is high, stock prices separate the most from their fundamentals.

TABLE 2
Predicted Deviation

| Year | Fundamental S&P 500 | Actual S&P 500 | Deviation |
|-------------|--------------------------------|---------------------------|------------------|
| 1985 | 210.819 | 188.967 | -21.852 |
| 1986 | 223.408 | 238.921 | 15.512 |
| 1987 | 236.749 | 285.992 | 49.243 |
| 1988 | 250.886 | 268.051 | 17.164 |
| 1989 | 265.868 | 326.314 | 60.446 |
| 1990 | 281.744 | 332.680 | 50.936 |
| 1991 | 298.569 | 381.534 | 82.965 |
| 1992 | 316.398 | 417.116 | 100.718 |
| 1993 | 335.291 | 453.453 | 118.161 |
| 1994 | 355.313 | 460.664 | 105.351 |
| 1995 | 376.531 | 546.878 | 170.347 |
| 1996 | 399.015 | 674.848 | 275.832 |
| 1997 | 422.842 | 875.864 | 453.022 |
| 1998 | 448.093 | 1087.856 | 639.763 |
| 1999 | 474.851 | 1330.597 | 855.746 |
| 2000 | 503.206 | 1419.728 | 916.521 |
| 2001 | 533.255 | 1254.210 | 720.955 |

TABLE 3
Independent Variables

| Independent Variable | Description | Expected Sign |
|-----------------------------|---|----------------------|
| ConEcon | U. Michigan consumer confidence survey of the economy (Percentage of respondents who view economy as healthy) | Positive |
| ConBus | U. Michigan consumer confidence survey of major businesses (Percentage of respondents who have confidence in big business) | Positive |
| ConSent | U. Michigan consumer sentiment survey of the health of economy (Index with base year of 100-Higher the number the more satisfied consumers are with economy) | Positive |
| Confide | Gallop poll consumer confidence survey (Percentage who view economy as in excellent or good health) | Positive |
| FH | Gallop poll of consumers' outlook on the future health of the economy (Percentage of respondents who view the future economic situation as excellent or good) | Positive |

VI. Conclusion

While investors, economists, and researchers are grappling with the idea of “what is a bubble,” this project has tried to clarify the definition and measure their existence. I defined bubbles as simply the separation of actual S&P 500 stock prices from their fundamental valuations. Because herd mentality causes the expansion and contraction of bubbles, it is necessary to measure it in order to predict bubbles. However, it is impossible to quantify the variable “herd mentality.” Instead, consumer confidence was substituted because of its quantifiable nature and correlation with herd mentality. The relationship between confidence indices and stock market deviations could be analyzed. If the regression results showed a high significance, herd mentality drives the separation of stock prices from their fundamentals.

The results showed that a highly significant relationship existed between consumer confidence indices and the deviation of actual S&P 500 prices from their fundamental valuations. Herd mentality drives this deviation which creates a bubble.

Throughout the paper, the focus has been on predicting and measuring bubbles. But for the investor, what should be the course of action. Shiller (2000) suggests a radical approach of getting out of the stock market:

The high recent valuations in the stock market come about for no good reasons. The market level does not, as so many imagine, represent the consensus judgment of experts who have carefully weighed the long-

term evidence. The market is high because of the combined effect of indifferent thinking by millions of people, very few of whom feel the need to perform careful research on the long-term investment value of the aggregate stock market, and who are motivated substantially by their own emotions, random attentions, and perceptions of conventional wisdom.

Contrary to Shiller’s opinion, Phillip Carret opines about a different solution. When asked during a time of persistently declining prices whether the stocks would rally, he laconically responded “They always have.” (Carret 1996). It is up to the individual investor to decide whose opinion weighs with more importance.

In future projects, I will refine the confidence variables. By lagging confidence indices over time, future prices can be predicted. Also, I will look at other factors that influence stock market bubbles. Does past performance of certain stocks indicate an overvaluation? Are the Adaptive Expectations and rational expectations theories accurate at reflecting the price levels of stocks?

One of the most interesting questions is what drives a bubble. If herd mentality creates and destroys a bubble, how does momentum play a factor in the continuation of a bubble? These ideas offer a plethora of future research.

Appendix

The stock market boom is made up of a multitude of factors. To suggest that herd mentality alone drives

TABLE 4
Regression Results

| | Variable | Coefficient | Significance | R2 Value |
|---------------|----------|-------------|--------------|----------|
| Regression #1 | Constant | -633.74 | 0.03 | 0.27 |
| | ConEcon | 4005.84 | | |
| Regression #2 | Constant | -2819.63 | 0.08 | 0.19 |
| | ConBus | 3823.37 | | |
| Regression #3 | Constant | -1728.42 | 0.01 | 0.41 |
| | ConSent | 21.59 | | |
| Regression #4 | Constant | -256.71 | 0.00 | 0.83 |
| | Confide | 19.88 | | |
| Regression #5 | Constant | -334.42 | 0.03 | 0.46 |
| | FH | 18.34 | | |

stock prices would be unfounded and absurd. While herd mentality may start the process of bubble formation and destruction, other factors like momentum, amplification mechanisms, and cultural influences affect the deviation of stock prices from their fundamentals. Shiller's book *Irrational Exuberance* lists twelve different causes for the great expansion of stock prices in the 1990s. To fully comprehend how bubbles operate, it is necessary to review these theories. Otherwise, the concept that herd mentality, measured by consumer confidence, can predict bubbles will be overly relied upon. As Phillip Carret points out:

Prices on the New York Stock Exchange are affected by French politics, German banking conditions, wars and rumors of wars in the Near East, the Chinese monkey market, the condition of the wheat crop in The Argentine, the temper of the Mexican congress as well as by a host of domestic influences. The successful speculator must carefully weigh the effect of all these influences, set down the pros and cons and arrive at a sound conclusion as to the side on which the balance lies. When he has done all this he has made only a beginning. If he concludes that the balance favors an upward movement, he must still decide which stocks he is to buy for maximum profit.

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