



Risk and uncertainty in efficient capital markets

or why is the Nasdaq so risky?

By Charles Corrado

The terms “new economy” and “old economy” have become part of our everyday vocabulary.

New economy describes the high-tech, high-growth world of computers and the internet, where good luck with a good idea creates overnight wealth. In the new economy, people skills are subordinate to technical skills and nerds feel right at home.

By contrast, in the old economy who you know can be as important as what you know and surfing the net on company time can be hazardous to your career.

Separate stockmarkets represent the new and old economies. For the old economy, there's the New York Stock Exchange, or NYSE. For the new economy, there's the National Association of Securities Dealers and Automated Quotations, or Nasdaq. ▶

Is the Nasdaq driven by bouts of irrational exuberance followed by post-exuberance hangovers?

Only five years ago, in my investments classes, I would routinely describe the Nasdaq as the trading arena for typically newer, smaller companies and note only a few exceptions to this general pattern.

How quaint that description seems today! While the Nasdaq is still a major trading arena for new and small companies, it is better known for titans including Intel, Microsoft and Oracle, among others.

For a decade now, old-economy investors have been kept smiling by a bull market that has rewarded them with an average annual return of 18 per cent.

In recent years, however, new-economy investors have had all they can do to keep from gloating. Following a 37 per cent gain in 1998, in 1999 the Nasdaq index climbed 86 per cent – an unprecedented performance for a major stockmarket index.

Despite this stellar performance, Nasdaq investors are a justifiably nervous lot. In 2000, the Nasdaq index reached an all-time high of 5000 in early March only to plummet to 3000 in late May. Do the math and realise that this is a more than 40 per cent drop in the span of a few months.

By contrast, the Standard & Poor's 500 index of predominately old-economy stocks was down only about 10 per cent during this period.

Why are the high-growth technology stocks that dominate the Nasdaq index so risky? The often-stated answer is the B-word, “bubble”. For several years, we have heard that the Nasdaq was a bubble bound to burst. Since United States Federal Reserve chairman Alan Greenspan's “irrational exuberance” remark, the litany has been incessant.

Is the Nasdaq driven by bouts of irrational exuberance followed by post-exuberance hangovers? Possibly, but I shall argue otherwise

and offer an alternative explanation for Nasdaq volatility that has nothing to do with bubbles or irrational exuberance. Instead, I shall suggest that the Nasdaq is volatile because it is efficient.

The basic idea is that stockmarket fluctuations, even the big ones, are symptomatic of an efficient capital market coping with uncertainty about the future.

RISK AND UNCERTAINTY

Risk can be categorised into two types. The first type involves comprehensible risks for which the nature of the uncertainty being faced is known. Specifically, these are risks for which you “know the odds”.

Knowing the odds means you can attach specific probabilities to specific outcomes. These we may call “casino odds” since casino odds are well known – at least to the casino operators. Casinos worry about attracting customers. They do not worry about losing money to customers.

The second type involves essentially non-comprehensible risks for which the nature of the uncertainty is not well understood.

These are risks for which the “odds” are not well known and specific probabilities cannot be assigned to specific outcomes. “Market odds” fall into this category, since the odds in financial markets are typically not well understood.

The distinction between these two risk categories is important.

The insurance industry provides a rich source of examples to illuminate the distinction between casino odds and market odds. Consider the centuries-old business of writing life insurance. Risk management in the life insurance industry advanced dramatically in the 18th century when mortality statistics were first collected on a large scale. With these statistics, actuaries came to know “mortality odds” with great accuracy.

While individual mortality cannot be predicted accurately, average mortality for a population can be predicted quite precisely. Consequently, life insurance underwriting is a low-risk business.

Like casino operators, life insurance companies worry about attracting customers, but do not worry about losing money to customers.

Not all insurance underwriting is such a low-risk enterprise. Consider the business of writing catastrophe insurance against such natural disasters as earthquakes, tsunami and typhoons. This is not a simple “casino-odds” business.

Several centuries of data are available to derive estimates of disaster frequencies, but global weather and tectonic patterns are not stable and the ability to accurately predict the number of large disasters in a particular period simply does not exist. Furthermore, earthquakes, tsunami and typhoons are low-frequency random events.

Actuaries know well that low-frequency random events are not evenly spaced through time, but tend to occur in clusters. This means that catastrophe insurance underwriters may not make significant pay-outs for years or even decades before a cluster of disasters might severely deplete insurance reserves.

EFFICIENT CAPITAL MARKETS

The concept of an “efficient capital market” has somewhat interesting origins. In the early 1950s, when academic researchers first gained access to electronic computers, statisticians looking for large data sets found a data bonanza in financial markets. Financial security transactions generate more data than any other human activity.

Armed with mountains of data, statisticians applied these early computers to the lengthy

calculations required to apply various statistical test procedures.

What they found in financial market prices at first astonished. A careful examination of the data using then state-of-the-art procedures suggested that prices in financial markets fluctuate randomly. At the time, this was a controversial discovery.

In an important article published in 1953, the famous statistician Maurice Kendall said: “There is no hope of being able to predict movements on the exchange without extraneous information.”

This finding astonished because the general expectation was to find predictable trend patterns. The first sentence in Kendall’s 1953 paper reads: “It has been customary to analyse economic time-series by extracting from it a long-term movement, or trend.”

Instead, these early tests could not reject the statistical null hypothesis of randomness.

Randomness has an unsettling effect on the human psyche. Remember that early in the last century, physicists were astonished to discover unpredictable randomness in sub-atomic particles. In an apparent expression of denial, Einstein remarked: “God does not play dice with the universe.” Turns out, as best we know, randomness does exist.

It was in this setting of scepticism and denial that the concept of an “efficient capital market” was born. In its purest form, an efficient capital market is defined as follows:

Definition: “An efficient capital market makes immediate and efficient use of all information available to it. Consequently, in an efficient capital market security prices reflect all currently available information.”

This definition inevitably leads to the conclusion that capital market prices fluctuate 

Financial security transactions generate more data than any other human activity

This concept of a competitively efficient capital market is a mainstay of modern financial thinking

randomly. To demonstrate this point, I introduce this syllogism:

Major premise: Capital market prices reflect all available information and, therefore, price changes reflect changes in available information.

Minor premise: Changes in available information are news and “news”, properly defined, arrives randomly. A (clarifying) corollary is that news that does not arrive randomly is not truly news. Properly defined, “news” arrives randomly.

Conclusion: In an efficient capital market, security prices fluctuate randomly in response to the continual assimilation of news.

There is a refinement to the concept of an efficient capital market in the form of a “competitively efficient market”:

Definition: A competitively efficient capital market is one in which security prices reflect all currently available information worth the cost of collection. That is, the market is efficient up to a level of competitive efficiency with respect to the costs of acquiring relevant information.

This concept of a competitively efficient capital market is a mainstay of modern financial thinking. It suggests an efficient capital market within limits set by the costs of acquiring information.

In this view, markets are always on the edge of efficiency and there is a rational economic reason to expend resources acquiring information. In this view, changes in security prices are still essentially random.

RISK AND UNCERTAINTY IN AN EFFICIENT CAPITAL MARKET

The discussion thus far suggests that in an efficient capital market risk is associated with the arrival of “news”. This is contrary to any suggestion that market efficiency is associated with market stability. Everything depends on the news. Financial markets are

ruthlessly efficient in setting prices in response to news and a continuous flow of good and bad news brings a continuous flow of risk.

Nevertheless, it is still legitimate to ask why the efficient assimilation of news into market prices leads to the high levels of risk observed in the stockmarket generally, but especially in the Nasdaq market.

If it is only news that moves markets, why are these markets so risky?

The answer lies in two related phenomena. First, news has tremendous leverage because market prices have more to do with the future than the present. Second, with regard to pricing the future, we run headlong into the problem of risks for which we don’t “know the odds”.

PRICING THE FUTURE

Financial analysts typically rely on “cashflow” to value a company. The essential canon of valuation is: *The value of a company is based on the value of its future cashflows.*

A common classroom exercise is to show that most of the value of a growing company is based on cashflows that will not be realised until years into the future. This is demonstrated by simply adding up future cashflows based on an expectation of future growth. The arithmetic is simple and the result is that expected cashflows over the next five years typically sum to only a fraction of a firm’s observed market value.

Consider the example of yahoo.com. In September 2000, Yahoo!’s trailing cashflow was reported at 36 cents a share and the median analyst’s estimate predicted a 30 per cent growth rate for the next five years. Summing cashflows over those five years while they grow at 30 per cent per year yields a grand sum of \$4.23 a share.

Compare this with Yahoo!’s then current stock price of about \$110 a share. We would

need cashflows growing at 30 per cent for 15 years to sum to just half of Yahoo!'s \$110 share price. Clearly, Yahoo! investors are valuing the very distant future.

Notice I said that Yahoo!'s median growth rate estimate was 30 per cent. Not 31 per cent or 29 per cent, but 30 per cent. Individual analysts typically round off their estimates, in this case suggesting that they accept inaccuracies of plus or minus 2.5 per cent. Further, given inaccuracies for five-year growth estimates suggest larger inaccuracies for more distant periods.

The simple fact is that analysts have no way of knowing the odds precisely. They cannot say there is a probability of x per cent for 30 per cent growth and a probability of y per cent for 31 per cent growth and so on in the way that insurance actuaries can for mortality odds.

How important are these inaccuracies? Well, actually quite important. To demonstrate, I make the following hypothetical assumptions to formulate a simple cashflow valuation model for Yahoo!

- Yahoo!'s share price is the present value of its expected future cashflows.
- Yahoo!'s cashflows are discounted using an interest rate of 12 per cent.
- Yahoo!'s current cashflow is 36 cents a share.
- Yahoo!'s current 30 per cent growth will gradually decline to five per cent.

Calibration with Yahoo!'s \$110 share price yields a rate of decline for growth of 1.8761 per cent per year (implying a half-life of about 37 years). For the mathematically inclined, this simple cashflow valuation model is represented by the following calculation:

$$\$110 = \$36 \times \sum_{t=0}^{1000} \frac{\left(1 + .05 + \frac{.3 - .05}{(1 + .018761)^t}\right)}{(1 + .12)^t}$$

Given this valuation model, I shall vary only the initial growth rate and observe the resulting

effects on share value. Altered growth rates, resulting share values and their corresponding per cent changes from \$110 are summarised in Table 1. These numerical examples suggest that even small changes in expected growth can yield large changes in market valuations.

TABLE 1

Growth rate	Share value		Growth rate	Share value	
25%	\$55.41	-50%	31%	\$126.49	+15%
27%	\$72.67	-34%	33%	\$167.68	+52%
29%	\$95.70	-13%	35%	\$222.85	+103%

Now consider the question “how much news is required for the market to alter its expectation for Yahoo!'s future growth from 30 per cent to, say, 25 per cent or 35 per cent, thereby halving or doubling, respectively, Yahoo!'s share price?”

Well, probably not much. Suppose an analyst notices that instead of growing cashflow from 36 cents to 47 cents a share as determined by a 30 per cent growth rate, Yahoo!'s cashflow for the coming year is projected to be just 45 cents a share. This represents only 25 per cent growth. If the market agreed on the analysis, Yahoo!'s share price could fall by 50 per cent. Ouch!¹

Which brings us back to our bubble analogy. Only a small prick in expected growth can deflate the Yahoo! bubble to half size. Conversely, only a small puff in expected growth can inflate the bubble to double size.

Since small changes in expected growth can yield large changes in market valuations, the traditional forces of greed and fear will drive active investors to constantly collect and analyse news about Yahoo! These active investors make the market for Yahoo! shares efficient and the news they collect makes an investment in Yahoo! shares risky.

In a market where investors are competitive collectors of news, but cannot know the odds (▶)

¹Nasdaq market watchers are aware that in the remaining months of 2000, analysts were tripping over each other revising downward expected growth rates for new economy companies. Yahoo! shares lost half their value, along with most other dot-com companies.

precisely, share prices will fluctuate randomly and frequently to extremes. That is why the Nasdaq is so risky.

CONCLUSION

There is a story told about the famous – some say infamous – Wall Street financier John Pierpoint Morgan, who built a financial empire in the United States in the early 20th century. The story relates how a newspaper reporter once asked Morgan what he thought the market would be doing in the coming months, whereupon Morgan replied: “The market will fluctuate.”

This is about the best forecast that anyone can ever make about the stockmarket – it will fluctuate.

This paper is based on Charles Corrado's inaugural address as a Professor in the University of Auckland Business School, delivered on September 11, 2000.



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