

Is the Stock Market a VUCA Environment?

Viktorija Dalko¹

Hult International Business School and Harvard University

Michael H. Wang

Research Institute of Comprehensive Economics

This conceptual article explores a fundamental question: Is the stock market a volatility, uncertainty, complexity, and ambiguity (VUCA) environment? Examination of key literature on the volatility of stock prices, the uncertainty caused by certain news events, the complexity of stock market instability, and the ambiguity introduced by new technologies supports the claim that the stock market is a VUCA environment.

INTRODUCTION

Public companies simultaneously operate on two frontiers. One is competition in the goods, services, technology, and labor markets, and the other is competition in capital markets. The latter is manifested in stock price fluctuations. Market ecology is important to the decision-making process on many fronts, including the capital-raising opportunities for public corporations. It has been noted that, instead of raising equity, US corporations have rather been repurchasing stocks. The cause is most often cited as a too-low stock price (e.g., Ikenberry, Lakonishok, & Vermaelen, 1995; Brav, Graham, Harvey, & Michaely, 2005; Lazonick, 2012). Abundant literature is devoted to the impact that corporate managers expect to achieve through the share buyback (e.g., Jensen & Meckling, 1976; Batt & Appelbaum, 2013; Lazonick, 2014). Little research has been done on why the stock price is so low to begin with so that it prompts a stock buyback (Vuolteenaho, 2013). On the one hand, it has been studied that businesses face a volatility, uncertainty, complexity, ambiguity (VUCA) product and service market environment (Kirk, 2013; Bennett & Lemoine, 2014). On the other hand, research has focused less on how businesses' capital market environment is seen through the eyes of the business leaders. Could the stock market also be considered a VUCA environment for public companies? This is the question we aim to explore in this article.

Our study builds on the awareness of corporate managers of the VUCA environments in the real economy and helps broaden the application of the same conceptual toolbox of VUCA to the stock market. The issue of how to adapt to the VUCA-filled equity market is a significant problem for corporate managers.

WHAT IS A VUCA ENVIRONMENT?

The term VUCA was coined by Robert E. Murphy around 1996 to describe military training environments (Whiteman, 1998). Researchers now use the concept to describe business environments and explore solutions in response in the fields of leadership and management (e.g., Kirk, 2013; Bennett & Lemoine, 2014). To the best of our knowledge, no previous study has applied the VUCA concept systematically to the stock market. The present article makes a first attempt to analyze some of the characteristics of the modern stock market from the perspective of VUCA.

This paper relies on the framework laid out by Bennett and Lemoine (2014). The authors describe the four aspects in VUCA as follows:

Volatility: Refers to unstable change. The magnitude of change is unpredictable, and change is frequent.

Uncertainty: Describes a situation exhibiting a lack of knowledge whether an event will cause substantial change, although cause and effect are understood.

Complexity: Characterized by the numerous parts and the interconnection between them.

Ambiguity: More challenging than uncertainty, since cause and effect are not known. Frequently ambiguity is attached to new products or technologies. Their “newness” creates ambiguity.

Building on the above descriptions, this article attempts to examine whether the stock market is a VUCA environment. We will review the key literature relating to each of the four aspects of VUCA. The literature on stock price volatility and uncertainty to stock price movement caused by price-sensitive information is abundant in the financial economic arena. Research on complexity in the stock market is more concentrated in unorthodox fields such as econophysics, and the least studied concept is ambiguity.

VOLATILITY IN THE STOCK MARKET

No financial professionals doubt the price volatility in the stock market. Speculators take advantage of it, and long-term investors hope for profitable investments while ignoring short-term volatility. Public companies have little control over the price volatility of their stocks in the secondary market.

Many prominent economists have posed the following question: Why are the prices of stocks and other financial assets so volatile? Nobel Laureate Robert Shiller is among the earliest economists to raise this question (LeRoy & Porter, 1981; Shiller, 1981). Using statistical methods, numerous researchers have attempted to identify factors that explain the volatility of US stocks between 1962 and 2006 (e.g., Campbell, Lettau, Malkiel, & Xu, 2001; Wei & Zhang, 2006; Bartram, Brown, & Stulz, 2012). In the 21st century, prices of stocks and other financial contracts are still very volatile (LeRoy, 2013; Adam, Marcet, & Nicolini, 2016).

This article focuses on one phenomenon of interest. When more individual investors are trading a stock, its price is more volatile (larger price movements on either an intraday or daily basis) than when more institutional investors hold the stock. This was particularly true during the second half of the 1990s. Many empirical studies have found that increased short-term trading by retail investors causes excess volatility in the stock market (e.g., Brauer, 1993; Pontiff, 1997; Brown, 1999; Ahn, Cai, Hamao, & Melvin, 2014). A theoretical model by DeLong Shleifer, Summers, & Waldmann (1990) showed that trading by retail traders generates excess volatility in equity prices.

Some breaking news events move the market substantially, while some do not. Cutler, Poterba, and Summers (1989) listed seven news events, out of 49 major news events between 1941 and 1987, that moved the Standard & Poor (S&P) Index by more than 3.2% in absolute terms. Those seven news events were as follows: “Eisenhower suffers heart attack” (-6.62%), “North Korea invades South Korea” (-5.38%), “Truman defeats Dewey” (-4.61%), “Japanese bomb Pearl Harbor” (-4.37%), “Orderly transfer of power to Johnson” (3.98%), “US declares war against Japan” (-3.23%), and “Soviet letter stresses peace (over Cuban missile crisis)” (3.22%). Fair (2002) conducted a similar survey regarding the trading days between 1987 and 1999. He identified sixty-nine events that led to a one-to-five-minute S&P 500 futures’ price change greater than or equal to 0.75% in absolute value. Occasionally, a non-event news

piece leads to unexpected price fluctuations, such as the EntreMed story. EntreMed had the potential to develop new cancer-curing drugs, as reported by an academic journal in 1997. Huberman and Regev (2001) found that, although the same information was available to the general public several months before, the summary of the same information in a Sunday *New York Times* article on such a development caused EntreMed's stock price to rise from \$12.063 at the Friday close to open at \$85 (a 605% jump), and close near \$52 (a 331% rise) on Monday.

Illegal rumors can cause imminent large price changes rapidly. In the notorious Emulex Hoax (SEC, 2001), the rumormonger made up a negative news release by the public company Emulex and e-mailed it to *Internet Wire, Inc.*, a news agency, on August 24, 2000. Several news organizations published the fake press release the next day. During the 16-minute period following the publication of the fake press release, 2.3 million shares of Emulex stock were traded, and the price plummeted almost \$61.00 or 58.63%, from \$103.94 to \$43.00. Following a trading halt by Nasdaq, Emulex resumed trading later that day, after the hoax was discovered, and the price rebounded to close at \$105.75. Another legal case involved shorting the stock of Alliance Data Systems (ADS) (SEC, 2008). The rumormonger used Instant Messenger to spread a false statement and caused a 17% decline in the share price of the rumored ADS stock within 30 minutes.

Based on these events, public firm executives must designate a professional to watch the stock price every trading hour. If any sudden and dramatic movement takes place to the price without the release of any macroeconomic news, breaking news, or corporate announcements, then the firm must determine as soon as possible what the causality is. Such a professional must keep a statement at hand always and release it publicly when necessary within a short time period. This would help to prevent unreasonable price drops or restore investors' confidence in the stock.

Some volatile price changes take place without the release of any fundamental news. One possible explanation is trade-based manipulation. According to Aggarwal and Wu (2006), about half of the 142 manipulation cases brought by the Securities and Exchange Commission (SEC) between 1990 and 2001 included some form of trade-based market manipulation. Mei, Wu, and Zhou (2004) presented empirical evidence from the SEC prosecution of 159 "pump-and-dump" manipulation cases between 1980 and 2002. In their studies, market manipulation in any form, trade-based or not, increases stock volatility. This may have posed a serious problem to certain public firms. The executives must take care of their firms' stock price behavior in addition to the real business issues. One ultimate question they must consider is this: is their stock being manipulated? Many CEOs or CFOs do not think price volatility to their stock has anything to do with manipulation (Private conversation, 2013). Only a very experienced trader can see through the price volatility and identify patterns of manipulation (Specogna, 2003).

In short, price volatility is an ever-present phenomenon in the stock market. Some researchers consider the volatility to be normal, while other researchers consider it excessive. Researchers have attributed volatility to multiple reasons. Breaking news and business news, particularly depending on their presentation style, can move stock prices. Rumors in any form, once they reach mass media or large investors, can cause fast price changes. Market manipulation and a large proportion of retail investors in one stock can also lead to large price swings. Executives of public companies cannot take price volatility too lightly, because when their stock price is greatly suppressed, a large army of short-sellers starts a "bear raid." Their short trades can cause bankruptcy or lead to a takeover target. This has happened numerous times in the history of financial markets. Recent well-known examples include Enron (Laing, 2002) and Lehman Brothers (Goldstein, Ozdenoren, & Yuan, 2013).

UNCERTAINTY IN THE STOCK MARKET

Two elements are crucial to investors when making trading decisions in the stock market. One is price-sensitive information, and the other is observation of trading by others. This article focuses on the uncertainty caused by price-sensitive public information. Within the realm of public information, breaking news and business news are of particular interest in this study.

Breaking news events include large and sudden happenings related to epidemics, breakout of war, political developments, and natural disasters. Breaking news may cause uncertainty in the financial market. Frequently the investing public overreacts to such news. Drakos (2004) recorded a market-wide drop in stock prices on September 11, 2001 after the terrorist attack before the market opened. Among all stocks, the airline sector declined the most; the top four US airliners stocks all dropped more than 50% that day. The outbreak of the severe acute respiratory syndrome (SARS) in 2003 created global panic. SARS turned out to be a short-lived epidemic with a relatively small health impact. However, the epidemic generated such widespread global panic and spawned a disproportionate economic impact, thus showing the uncertainty it caused and the overreaction of millions of people (Smith, 2006). Particularly, it triggered substantial losses in the stock markets of the affected regions. Taiwan was one of the areas hit hardest by SARS. Taiwanese hotel stocks experienced a 29 percent share price decline within a month of the SARS outbreak (Chen, Jang, & Kim, 2007).

If the business news is related to a public company, it has price-moving potential for the company and for related corporations' stocks. The news becomes public through the dissemination of a reputable media outlet that enjoys a large audience or readership. The bankruptcy filing of Lehman Brothers on September 15, 2008, caused imminent market-wide panic. This led to a global financial crisis, as multiple stock exchanges with 50–94% drops in 2008 were triggered or precipitated by Lehman Brothers' unexpected bankruptcy (Robertson, 2008). In other words, significant unexpected business news events can bring sudden and serious uncertainty regarding the magnitude of price change to the financial market as well (Klein, Dalko, & Wang, 2012).

A substantial part of business news comes from public companies (Klein et al., 2012). Earnings compose the most important corporate information announced by public companies to stock market investors (D'Avolio, Gildor, & Shleifer, 2001; Shanthikumar, 2009). However, the accounting and finance literature has accumulated undeniable evidence that earnings are frequently manipulated. This is particularly true during market meltdown time (see Klein et al. (2012) for literature review). There are several incentives behind earnings manipulation, one of the main incentives is for corporate insider trading (Dechow, Sloan, & Sweeney, 1996). Since insider-trading law is ineffective in detection and prosecution worldwide, corporate insider trading is persistent, and so is earnings manipulation (Dalko & Wang, 2016)

Manipulated earnings result in uncertainty, occasionally ambiguity, to investors. Consecutive earnings manipulation may lead to legal penalty that in turn triggers market penalty. The extreme case results in large financial loss of shareholders. Enron, for example, presented a complete case of corporate insider trading assisted by consecutive earnings manipulation (Healy & Palepu, 2003).

In brief, uncertainty of the magnitude of price fluctuation is an inherent feature of the stock market. This article selected two lines of causality of uncertainty – breaking news and business news – for demonstration purposes. Rational corporate managers may have realized the significant consequences of insider trading assisted by a string of earnings manipulation. It is not only unethical or illegal, but may also cause the firm to go bankrupt or to be taken over. This is the largest uncertainty a publicly traded firm in the stock market faces.

COMPLEXITY IN THE STOCK MARKET

Complexity theory takes a system-oriented approach. In this article, two lines of literature that apply complexity in finance, econophysics and agent-based models (ABMs), are selected for discussion.

The field of econophysics was formed in the 1990s by physicists who applied theories and methods of statistical physics to solve problems in economics. Early work in this field was accomplished by physicist H. Eugene Stanley and his colleagues. One of their contributions is the characterization of the “fat tails” of asset price movements (Mandelbrot, 1963), particularly in the stock market, by using extremely large data sets comprising hundreds of millions of data points (Gabaix, 2009). From this perspective, financial crises are no longer outliers, and their frequency and magnitude are predictable.

Fat tails are linked to financial instability in several ways. For instance, high leverage of investors can lead to increased fat tails of returns. It is important to recall that the stock market crash in 1929 of the New York Stock Exchange was mainly due to margin calls of highly leveraged positions (Thurner, Farmer, & Geanakoplos, 2012).

ABMs present a way to model the financial economy as a complex system. They take a “bottom-up” approach instead of making predictions through a given theory *a priori* (Farmer & Foley, 2009; Gallegati & Kirman, 2012). The three aspects central to ABMs are agents, emergence, and complexity. In financial markets, the term “agents” refers to numerous market participants that have diverse, dynamic, and interdependent behavior, including herding. Emergence implies that a system can exhibit a substantial systemic risk (or even systemic collapse), while each of the constituents’ attempts to control his or her own risk. Complexity suggests that, because ABMs are built on modeling individual agents’ behavior and because the agents are interacting, the outcome of modeling becomes systemic. To that end, agent-based modeling can be viewed as a way to reconcile the two opposing philosophical perspectives of methodological individualism and holism (Gallegati & Kirman, 2012).

ABMs are frequently used in studying bubbles, systemic risk, and crisis in financial markets. The ABMs of the financial market built by LeBaron (2006) provide a plausible explanation for bubbles and crashes. The ABM built by Thurner et al. (2012) shows how attempts to control risk at a local level can actually generate risks at a systemic level. This illustrates what emergence means in the stock market. ABMs have been used to test systemic risk implications of financial reform and show how dynamically changing risk limits can lead to booms and busts in prices (Thurner et al., 2012; Aymanns & Farmer, 2015). ABMs can replicate stylized empirical behaviors in financial markets that lead to instability, such as positive feedback. The ABM created by Battiston, Farmer, Flache, Garlaschelli, Haldane, Heesterbeek, ... and Scheffer (2016) shows that positive feedback systems are characterized by persistent deviations of prices from equilibrium and emergence of speculation-driven bubbles and crashes. The emergence is strongly amplified by the positive feedback behavior of investors who herd together in trend-following.

In short, complexity models are increasingly applied to study the instability phenomena in the stock market and other financial markets. However, the actual use of complexity models and results remains at an early stage. Recent efforts are focused on monitoring and managing highly interconnected financial systems that are expected to help anticipate and manage future crises (Battiston et al., 2016). Forecasting the coming stock market crisis is a very challenging issue for corporate managers. However, it is a worthy task, since financial crises are obviously contributing factors to low stock prices for certain public firms.

AMBIGUITY IN THE STOCK MARKET

Most investors are guided by their perception as they make their investment decisions (Dalko, 2016). New technologies create an uncertain future, and therefore investors’ expectations can be very widely varied relative to those of well-established firms. Subsequently, the valuation of stocks of new technologies becomes ambiguous, as it is not clear if such technology will be viable or not. The media, therefore, often play a critical role in attempting to reduce ambiguity during such times. Frequently, new technological innovations lead to bull markets, mixed with speculative bubbles. Economic history has recorded multiple speculative bubbles that were hallmarked with the term New Era and accompanied significant technological innovations. The railroads in the 19th century, the auto and aviation industries in the early and middle part of the 20th century, and the personal computers in the late 20th century brought new technological innovations to the world and also bull markets (Bhattacharya, Demers, & Joos, 2010). The term New Era was also used frequently during the stock market uptrend times of 1901, the 1920s, 1950s, and 1960s. The New Era thinking was clearly evident in the midst of the dot-com bubble (Shiller, 2000).

The dot-com bubble in the 1990s provides an example of the impact of the ambiguity of a new technology (in this case, the Internet) on the stock markets in the world. The year 1995 is unique to the dot-com bubble. That year, Bill Gates (1995) declared that the surging popularity of the Internet was the most important single development in the computer industry since the IBM PC was introduced. When the

Internet technology was commercialized, particularly after the initial public offering (IPO) of Netscape Communications on August 9, 1995, business media started information frenzies (DeLong & Magin, 2006). Business commentator Maynard Patton called the day of Netscape's IPO "Day One of the Internet Bubble" (DeLong & Magin, 2006).

Clark, Thrift, and Tickell (2004) suggested that mass media played a reinforcing role during a speculative bubble, especially during the 1990s. The events that marked the beginning of the dot-com bubble in the media are perhaps the *Business Week's* articles on "New Economy" in 1995. The term New Economy was not used pervasively between 1985 and 1994. However, 1995 saw an increase in its appearance in print media (325 times), particularly in *Business Week*. From 1998 to 2000, the growth became dramatic; i.e., it was mentioned 1,048, 3,215, and 22,848 times, each year respectively, at regular intervals during that time span (Madrack, 2001). Media hype had an influence on equity analysts as well. More and more analysts turned away from the traditional method of valuation of stocks based on earnings according to the unprecedented reasoning that Internet firms would initially offer their services for free in order to capture the market share and start generating revenue later.

A representative episode under this perspective was the famous Amazon call made by then-unknown analyst Henry Blodget. In October 1998, he boldly raised the target price of Amazon, and then traded at \$240 to \$400 within a year, regardless of the fact that the company had negative earnings. Amazingly, the stock price of Amazon rose above \$400 in less than three weeks after the call (Mann, 2004). Blodget became known on Wall Street because of the call and was hired by Merrill Lynch as a star analyst. Media used the case in frenzy. *The Wall Street Journal* mentioned him nearly 100 times during the three years following his famous Amazon call in 1998. *The New York Times* cited him about 60 times and *The Washington Post* more than 50. In 1999 alone, Blodget appeared on TV nearly 80 times (Gasparino, 2005). Subsequently, during the years around 2000, analysts on Wall Street could practically recommend any stock related to the Internet and see it soon trade at astronomical prices (Scianni, 2003).

The dot-com bubble occurred mainly due to the ambiguous nature of the new technology, particularly the Internet. Numerous IPOs of Internet start-ups, most of them with negative earnings, and their soaring prices fueled the rapid growth in the Internet sector (Scherbina, 2013). Barber and Odean (2001) identified several market conditions that are conducive to the formation of speculative bubbles, one of which is significant uncertainty (actually ambiguity) regarding firm valuation.² This ambiguity is directly reflected in accounting practice. Nobel Laureate economists Joseph Stiglitz and Paul Krugman both criticized poor accounting practice as a contributor to the irrational exuberance in the 1990s' dot-com mania (Krugman, 2004; Stiglitz, 2004).

Several researchers build models to explain the causality of bubbles in the stock market. The common causality they have captured is a new technology. To be more precise, it is the ambiguity of valuing new technology stocks. Hong, Scheinkman, and Xiong (2008) presented a theory for how bubbles may arise in new technologies. According to their theory, a set of investment advisors exaggerates the extent of their optimism over the revolutionary effect of a new technology, other advisors follow suit, and then a pricing bubble arises. Abreu and Brunnermeier (2003) attributed bubble development to the high growth rate of a new technology asset's price. Hirshleifer, Hsu, and Li (2013) asserted the belief that information about the prospects of new technologies is especially hard to process. Thus, the ambiguous perception about Internet motivated numerous retail investors in large crowds to purchase Internet stocks. After observing the rapid climb of new stock prices for months, some institutional investors joined the herd. The internet-heavy NASDAQ Composite rose from 775 in January 1995 to 2,506 in January 1999, and that figure more than doubled from this point to its peak of 5,048 on March 10, 2000 (Scherbina, 2013).

To summarize, new technologies bring valuation difficulties of their stocks. These difficulties are based on the ambiguity of their future profitability. However, once institutional investors have settled the pricing task of these new technologies, related public firms will undergo stock price adjustment from overpricing to the conventional pricing range. The risk is that many of such firms adjust too far downward as most of them get delisted from stock exchanges. The dot-com bubble and burst should illustrate to corporate managers the double-edged effect of ambiguity of new technologies.

THE STOCK MARKET IS A VUCA ENVIRONMENT

The stock market is mainly about trading, and trading decisions are greatly influenced by price-sensitive information. Modern information and communications technology have enhanced the persuasive power of mass media and the rising social media. According to Prospect Theory, which states that people pay much more attention to their loss or potential loss than their gain of the same magnitude when facing uncertainty (Kahneman & Tversky, 1979), news-reading investors display a loss aversion attitude. Business journalists capture this pattern and thus generate more negative news pieces than positive ones. In the end, some negative coverage of public companies may cause overreaction of investors by overly selling, which pushes down stock prices disproportionately (Soroka, 2006). If public firms encounter allegations of securities fraud, the market penalty is very severe: their stock prices are greatly suppressed after a series of negative news articles appears on mass media. The stock price suppression comes from not only the real economy side such as declining consumer demand but also from the stock market such as reductions in institutional ownership and deterioration of the contractual relation with their lenders (Haslem, Hutton, & Hoffmann, 2015). This causes certain stock prices to fall below the level that would be warranted by the actual and anticipated performance of the firm.

After examination of the literature in each of the four aspects of VUCA separately, we conclude that the stock market is a VUCA environment.

CONCLUSION AND FUTURE RESEARCH

The stock market used to be called the inherent “free market” by neoclassical economists. That was probably an ideal that did not exist in reality; at least not since the twentieth century. The actual stock market prominently features price volatility, informational uncertainty, complexity in rising instability, and ambiguity in the valuation of the stocks of new technologies. This article examines key literature and typical events in the lines of the volatility of stock prices caused by breaking news or business news, dominance of retail investors’ trading, market manipulation and rumors, trading decision-making under the uncertainty of breaking news and business news, and the ambiguity in the valuation of the stocks of new technologies. The article also examines the key literature of the econophysics and agent-based models that are applied to study instability, key complexity in stock markets. Albeit this study is an initial exploration, the authors have achieved conviction that the stock market is a VUCA environment. Definition of each aspect of VUCA helps to distinguish those concepts in the stock market, since risk in financial markets is traditionally mixed with volatility, uncertainty, ambiguity, and perhaps complexity.

This study is among the first attempts to apply the VUCA concept to the stock market. More work should be undertaken to better understand the VUCA concept and its uniqueness in today’s stock markets. Research questions can be raised; for example, can each aspect of VUCA in the stock market be quantified? How do public firms respond to the contemporary VUCA environment that is dominated by high-frequency trading, which threatens the fundamental capital-raising functionality of the stock market? Are there useful lessons learned and techniques developed previously to deal with VUCA in goods and services markets, and can management apply those in the capital markets as well?

ENDNOTES

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2. The term uncertainty used by Barber and Odean (2001) is equivalent to ambiguity according to the terminology of Bennett and Lemoine (2014).

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