Stock market performance of computer software firms across multiple periods

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ABSTRACT

Stock market volatility has been omnipresent in the information technology sector. This manuscript compares the stock performance of computer software companies across six different twenty-month periods between the years 1996-2006. The focus periods include the browser era, the Y2K era, the post-Y2K era, the post-9/11 era, the outsourcing era and the mobile/wireless era. The lowest stock market returns are in the post-Y2K and post-9/11 eras for five of the six software firms in the research cohort. The highest stock market returns for the six software firms are in four different periods. The software firms in the study show a strong tendency to experience high industry correlation in a bear market but little correlation during a bull market. The results imply that the software industry has characteristics that are consistent with being a blockbuster instead of a commodity.

Keywords: Abnormal Stock Returns, Blockbuster, Computer Software, Industry Analysis, Information Technology, Stock Market

INTRODUCTION

The information technology sector has transformed the economy and changed the basis of competition (Sampler, 1998). Information technology boosts the efficiency of the decision-making process and is perceived by many executives as an integral part of their business strategy (Molloy and Schwenk, 1995; Bartholomew, 1998). Investors have struggled to comprehend the potential and the limitations of information technology companies as the industry has continued to evolve over time. Not surprisingly, the volatility of stock prices for information technology firms has been extreme as many companies struggle to survive a couple of years after reaching a peak stock valuation. On March 10, 2000 the NASDAQ composite peaked at an intra-day high of 5,132 and declining to half of its value within a year before finding a bear market bottom on October 10, 2002 with an intra-day low of 1,108. The excessive rise and fall of information technology companies offers a unique opportunity to evaluate industry nuances associated with bear and bull markets.

The purpose of this research is to compare the stock market performance of multiple software companies across six information technology eras. The six period classifications are the browser era, Y2K era, post-Y2K era, post-9/11 era, outsourcing era, and mobile/wireless era. Electronic Arts Inc. (ERTS), Hewlett-Packard Company (HPQ), International Business Machines Inc. (IBM), Sun Microsystems Inc. (JAVA), Microsoft Corporation (MSFT), and Oracle Corporation (ORCL) are the six software companies included in the study. The organization of this manuscript is into five sections. The first section offers a discussion on the literature related to the financial performance of information technology companies. The next section offers background information relating to the six information technology eras applied to this study. The third section discusses the software industry and the six specific companies that are the focus of this study. The fourth section presents data and methodology. The fifth section puts forth results from the application of a nonparametric technique in order to compare stock market returns across different information technology eras for the six companies. The final section offers concluding comments.

REVIEW OF THE LITERATURE

Academic research identifying structural economic changes that influence stock prices mostly focus on major crashes in the history of financial markets (Higgins & Osler, 1997; Allen & Gale, 2000; Cocca, 2005). Although a relatively new topic in the information technology sector, there are numerous finance theories that focus on the development of speculative bubbles and stock market volatility (Camerer, 1989; Bulow & Klemperer, 1994; Allen & Gale, 2000). Stock market volatility is explained by various approaches, which differ in essence according to assumptions made with regard to market efficiency (Sornette & Malevergne, 2001). Stock market performance of information technology companies reveals the sector has greater volatility than most other economic sectors (Demers & Lev, 2001; Ofek & Richardson, 2003; Kamssu, Reithel, & Ziegelmayer, 2003). Terry, Macy, and Abdullat (2010) find a correlation of stock prices for vertically integrated technology companies in a down market but bull markets are not highly correlated within the industry.

Cocca (2005) puts forth one of the few studies exploring potential reasons for the volatility of information technology companies with respect to stock market performance. The study uses a broad media database to analyze the informational and media environment

surrounding the market highs for technology stocks and explores potential trigger events that could cause an Internet bubble to burst. Two key informational event triggers are public awareness of the human genome research results and the publication of a study by Barron's magazine about Internet companies' burn rates. Cocca (2005) concludes diffusion data of the informational events show a long-term impact of the Barron's study on media, financial analyst, and investor focus.

Researchers are becoming more and more interested in studies relating IT investment and firm performance (Im, Dow, & Grover, 2001). The studies have produced a wide range of performance results that are negative or not conclusive (Tam, 1998), mixed (Avison, Eardley, & Powell, 1998; Bleiweiss, 1998; Ranganathan & Samarah, 2001), or positive a positive and significant relationship between IT investment and firm financial performance (Im, Dow, & Grover, 2001). Kamssu, Reithel, & Ziegelmayer (2003) explore the impact of information technology and stock returns. They conclude that Internet-dependent firms have lower excess returns than non-Internet firms do in a booming economy and that Internet stocks trade at relatively higher prices than non-Internet stocks. The explosion of Internet technology and behavior of investors and decision makers toward firms that use the Internet suggest that Internet technology must have an impact on firms' market performance.

Stock performance helps investors gauge how well their managers are handling their money. Several studies have proposed different methods to assess stock performance. Armitage & Jog (1996), Rogerson, (1997), and Clinton & Chen (1998) have used economic value as a measure of performance. The economic value added is obtained by comparing profits with the cost of capital involved in obtaining these profits (Stephens & Bartunek, 1997). Johnson & Pazderka (1993) and Sundaram, John, and Kose (1996) have employed stock market performance estimates to measure firm performance. Fama & French (1995), Loughran (1997), Zaher (1997) and Ranganathan & Samarah (2001) employ the stock excess returns based on the Capital Asset Pricing Model (CAPM) to measure stock performance. Historically, the stock values of information technology firms bear very little relationship to classical business performance measures (Savitz, 1998), which creates a need for non-traditional proxies and estimation methods.

The statistical methodology incorporated in this study employs a nonparametric approach to comparing the stock market performance of firms across a decade of six different development stages for the information technology industry. The study uses multiple years of data based on the diffusion model hypothesis that the spread of information needs time and stock price momentum reflects gradual diffusion of firm-specific information (Hong & Zhu, 2006). There is no research focusing on stock market volatility of software companies.

TECHNOLOGY ERAS

Between 1996 and 2006, several major events in the field of information technology made a lasting impact on many businesses and consumers. Six implicit periods are identified for the purposes of this study. Although somewhat arbitrary, the six periods are placed in twenty-month segments in an effort to capture stock market returns in a broad representative timeframe. The six period classifications are the browser era, Y2K era, post-Y2K era, post-9/11 era, outsourcing era, and mobile/wireless era.

The browser era is defined in the study as the 20-month period of August 1996 through March 1998. The World Wide Web was but a few years old when Mosaic, often considered the

first browser, was introduced. The web was massive and complicated. Prior to Mosaic, access to the Internet was largely limited to text, with any graphics displayed in separate windows. Users needed to possess certain technical knowledge and skills to exploit available capabilities and access both the Internet and the web. Mosaic eventually became Netscape. The success of Netscape gained the attention of Microsoft, which developed the Explorer browser. A cluster of related and supporting technologies came together to make the browser a significant innovation breakthrough. The browser era developed with the assistance of computer servers, bandwidth affordability and availability, content providers, and communication links. The browser interface made it easier for users to connect to the web and created a significant critical mass of users (Cocca, 2005). The use of browsers to connect to the Internet pressured software developers and content providers to adhere to certain accepted specifications and standards. These standards and specifications enhanced the interoperability of web-related products and services. For years, enterprises struggled to find reliable, cost-effective ways to integrate and automate critical processes between different application packages. The web-enabled applications and technology provided the enterprises with the ability to integrate different systems and application types regardless of their platform, operating system, programming language or locations. In essence, the browser was the key that unlocked the World Wide Web to a massive number of users. Netscape was the most used browser to access the web. It allowed millions of users to navigate the web and was the vehicle that linked people and information. The catalyst marked the boom in the Internet. The browser made it possible for millions of users to access the web daily, to send messages and to perform business transactions that would not have been possible without the browser. The browser has changed the way society communicates, created new businesses and contributed to the demise of other businesses.

The Y2K era in this study is the 20-month period of April 1998 through November 1999. In the early days of software development and hardware design, it was common practice to use standard two-digit shorthand to indicate the year. This practice infiltrated many software applications and hardware design schemas. In the early nineties, this became known as the Y2K problem. The Y2K problem implied that some software and hardware would not perform as expected after December 31, 1999. While many were relieved that the catastrophic consequence of Y2K did not materialize, it is clear that this era had profound impact on the amount of expenditures in the field of information technology. The commercialization of the Internet and the need to overhaul information technology infrastructure in preparation to address the potential Y2K problem was a significant driving force. The Department of Commerce estimated that there was approximately $100 billion spent to address the Y2K problem in the United States (Manion & Evan, 2000). The significance of Y2K is more than the expenditure amount, it also provided opportunities to shift to new computing platforms, implementing new approaches to software applications development and highlighted the relevant role of information technology to the overall enterprise's business strategy.

The post-Y2K era in this study is the 20-month period of December 1999 through July 2001. The 2001 year had been a bust with the dot-com implosion and the downturn of the economy. The pre-Y2K buildup resulted in the post-Y2K bust for many information technology companies. Many companies cut back on information technology expenditures during this era because of the significant expenditures in the preceding era. Despite the bursting of the dot-com bubble, significant advances information technology advances continued during this era. The importance of critical infrastructure, the need for compliance with security regulations, the

importance of business continuations plans, and data mining/warehousing were four major themes that emerged during this time (Terry, Macy, & Abdullat, 2010).

This study defines the post-9/11 era as the 20-month period of August 2001 through March 2003. The event of September 11 accentuated the importance and the vulnerability of information technology in the event of catastrophic attack. It necessitated the need to develop plans to identify its critical infrastructure that are required to maintain minimum operation of the economy and government. The security of critical infrastructure became a vital concern. The perceived increase in risk from growing reliance on technology to support operations and from expanding market bases including growth in the global sector. Security of critical infrastructure and other resources went through extensive change to mitigate the risks. Federal regulations tightened security regulations to include many aspects of business processes and functions. Information technology was targeted as the means to meet the security concern. The sense of urgency to meet security demands and concerns by the federal government made it easier to fund many of the new research and development activities by businesses. Moreover, many businesses recognized the value of computer security as a large, emerging market. During this time, the importance of data centers redundancy of data and the need for diversity of geographic concentration of information technology resources gained in relevance and significance (Terry, Macy, & Abdullat, 2010). In addition, network infrastructure influenced businesses in very profound manner that required continued increase in computing power. Barriers that existed between firms for most of the 20th century gave way to accommodate the need for partnership-based opportunities afforded through e-business. The need for interoperability and flexibility increased during this era to exploit new business opportunities. This created a demand for new for new system architectures to mitigate the shortcomings of grid computing and client server technologies. The continuous decline in the storage cost of data, the increase of computing power, and the availability of broadband bandwidth reduced the incentive for firms to discard any data (Hong & Zhu, 2006). The availability of stored digital data and information presented firms and government agencies with a major challenge to identify ways to make some senses of the huge amount of data. The government's heightened concern with security was instrumental in funding new developments in data mining and contributed to the increase use of business-intelligence software to mine huge amount of stored data.

The outsourcing era is defined in the study as the 20-month period of April 2003 through November 2004. In this era, companies were looking for different measures to cut costs and to improve the balance sheet. Outsourcing and off shoring became prominent business strategies to reduce operational cost, to enhance services, and to improve financial performance. In addition to the economic and market conditions, three Laws influenced this period: Moore's (growing power of computer chips), Metcalfe's (growing network usefulness) and Gilder's (growing communications bandwidth). These laws transformed processes, products and services (Terry, Macy, & Abdullat, 2010). Combining the economic conditions and the changes in information technology made it possible to reduce cost but to continue performing certain functions of the business at the same or higher level. Businesses quickly realized the cost advantage of developing and maintaining their software applications in India, China and Eastern Europe. In looking back at that era, it is clear that notwithstanding the challenging economic conditions at the time, it marked the beginning of accepting outsourcing as a cost-reduction strategy (Hong & Zhu, 2006). The outsourcing phenomena affected many areas of information technology including software development and programming, technical support, calling centers and customer services.

The mobile/wireless era is the 20-month period of December 2004 to August 2006. The term mobile computing is the use of portable computing devices either in transit or from a remote location. Wireless technology had been around for many years but the industry-transformed society during this era. The mobile computing environment is composed of small devises that permit users to have access to information almost anywhere at any time (Cocca, 2005). The increased access by users to the Internet, the innovation of wireless technology, and the high number of cellular phone services contributed to the growth of mobile computing. Moreover, the dependency and the reliance on laptops and hand-held devises to perform computing functions increased the demand for mobile and wireless products and services.

THE SOFTWARE INDUSTRY

This section offers a description of the software industry and specific software companies in the research cohort. Hoover's Company Profiles, Value Line, Business & Company Resource Center, and Mergent Online are resources used to put forth the industry and company profiles. The software industry is differentiated from other industries in the information technology sector by the high level of technical expertise required of its employees. Software buyers are willing to spend on the latest version but only if the upgrades are too enticing to ignore. This situation makes the industry both capital and labor intensive. The level of research and development needed to create the new products requires a large, knowledgeable and expensive labor force using costly technology to create the innovations. Additionally, the employees must be current on all of the new technology, both hardware and software, developed by other firms (Terry, Macy, & Abdullat, 2010).

While research and development is a driving force for new product creation, each firm must market the new products to demonstrate to buyers why they should upgrade. This is unlike other information technology industries such as semiconductors. Semiconductor buyers are concerned with capability and energy usage. As long as the new microprocessor is faster, smaller, and uses less energy, buyers will upgrade (Terry, Macy, & Abdullat, 2010). Because software products are more complicated, there is a greater need by each firm to establish the value of the upgrade versus existing products and competitor products. Thus, marketing the product is just as important as creating the product.

There are four main types of software buyers. Business buyers generally seek database operating systems and applications. The purpose of the software is to help businesses control large amounts of information such as finance and marketing information and then mine that information to increase sales and profits. On the other hand, consumers are concerned with ease of use and compatibility with other products. Because many family members might be sharing one computer, the software must be flexible enough to handle the different needs from managing household budgets to gaming. Information technology managers and software developer each seek specialized software. IT managers need software for organizing and maintaining the IT structure on which the business is run while software developers depend on existing software to speed creation by altering what is available to meet specific needs. Additionally, smaller firms produce niche software for businesses and consumers that work with the existing main software packages. Electronic Arts gaming products can be run on Microsoft and Oracle systems, as an example (Hoover's, 2010).

Blockbuster products are the hallmark of the software industry. If a company truly creates something new, it will be a blockbuster and all sales remit to that firm. Additionally,

because of the nuances of software, less-sophisticated users are reluctant to switch programs. Consumers may not love Microsoft products but once a person learns the Office application programs, competitor programs require a large fixed cost on the part of a consumer to learn the new program. Thus, blockbusters have a longer shelf life in the software industry versus other blockbuster industries. This generates an environment of highly competitive firms seeking to be the first to the marketplace (Terry, Macy, & Abdullat, 2010). Each firm needs to both create the blockbuster but also market it to buyers. The high switching cost generates even higher value to the first mover.

While blockbusters are important, firms don't want to cannibalize themselves with new versions of software coming to market too quickly. It is a delicate balance of providing a new version of the software when sales of the existing software begin to slow but before buyers move to competitor products.

The double emphasis on innovation and marketing creates an environment prone to mergers and acquisitions. If another company creates a new software product, other companies can either produce their own versions or acquire the product from the original company. Strategic alliances are common in this industry as are marketing agreements where one company creates a product but another company markets it.

This study examines six key software developers, each with their own niche within the overall industry. International Business Machines (IBM), Microsoft (MSFT), and Oracle (ORCL) are the three major developers. Oracle focuses on database systems for businesses while Microsoft focuses on operating systems and application packages for consumers. IBM concentrates on business solutions such as communications and enterprise software but directly competes with Oracle and Microsoft in several sub-areas. Hewlett-Packard (HPQ) focuses on imaging software, while Sun Microsystems (JAVA) concentrates on network solutions. Electronic Arts (ERTS) is the leading developer of entertainment software (Hoover's, 2010).

Microsoft is perhaps the best known of all of the software companies. Since being started by Bill Gates and Paul Allen in 1975, the firm has grown to be the largest software company in the world with annual sales over $60 billion. The Windows operating system has a market share that exceeds two-thirds of all computers (Hoover's, 2010). Microsoft's best performing era was the browser period, or first period of this study. This coincides with the proliferation of personal computers with many using Windows and Microsoft Office. Microsoft earnings doubled during this period, and the firm accumulated a large amount of cash (Business & Company Resource Center, 2010). Microsoft used the cash for acquisitions and investments such as the Expedia online travel website (Hoover's 2010). It was added to the Dow Jones Industrial Index in November 1999 (Mergent Online, 2010).

By the Y2K era, Microsoft was accused of monopolistic business activities such as Sun Microsystem's accusation that Microsoft created an incompatible version of JAVA. While Microsoft continued to look for ways to grow externally, antitrust allegations ended many of these moves (Hoover's, 2010). Leading up to the Y2K event, many consumers upgraded their operating systems and application packages. Thus, by 2000, sales growth slowed to less than 20% per year. Earnings still grew during this time period but also at a slower rate falling from over 20% to under 5% annually. Investors responded by decreasing the P/E they were willing to pay by 40%, which caused the stock price to become stagnant (Value Line, 2010).

Even after the technology burst in 2000 and the recession of 2001, Microsoft's dominance of market share maintained itself, and it was one of the few firms able to maintain positive earnings growth during both events (Value Line, 2010). In 2001 Microsoft reached an

agreement with the U.S. Justice Department on the antitrust issues which provided closure for the firm and investors (Hoover's, 2010). By 2003, Microsoft's cash holdings were so large that the firm paid its first dividend. This action marked that Microsoft had changed from a growth firm to a value firm. Earnings growth began to increase from the lows in the post-Y2K era to over 10% annually in the outsourcing era. Microsoft also began to use its large cash holdings to increase the dividend and to repurchase shares, all to increase the value of its stock. Part of the move to increase stock price was offset by the declining P/E ratio, which decreased by more than 50% between 2000 and 2005 (Value Line, 2010). During the outsourcing and mobile eras, Microsoft reorganized its internal business decision-making process to speed innovations. It continued to acquire businesses, most notably, collaboration software creator Groove Networks, security software Sybari Software, email security developer FrontBridge Technologies and file synchronization provider FolderShare (Hoover's, 2010). These acquisitions allowed Microsoft to continue to modernize its core products of Windows and Office while keeping competitors at bay.

International Business Machines Corporation is a multinational computer technology and information technology consulting corporation headquartered in Armonk, New York. The company is one of the few information technology companies with a continuous history dating back to the 19th century (Hoover's, 2010). IBM manufactures and sells computer hardware and software, and offers infrastructure services, hosting services, and consulting services in areas ranging from mainframe computers to nanotechnology (Value Line, 2010). The important events for IBM during the 120-month period of this study include a significant increase in the software group from one brand to five, an increase in the business advisory capabilities by acquiring part of Pricewaterhouse Coopers, and the creation of more U.S. patents than any other company (Hoover's, 2010). IBM's focus has been on businesses and not households. After struggling in the early 1990s, IBM moved its focus to operating systems and network management (Business & Company Resource Center, 2010). Businesses knew what they wanted the computers to do but they did not know how to set up the system to share and store information. IBM acquired both Lotus Development and Trivoli in 1995, which provided the needed basic application software to go with IBM's existing operating systems (Hoover's, 2010). IBM's earnings and profit margins grew during the browser and Y2K eras as it met this demand (Value Line, 2010).

Recognizing the growing importance of the Internet and the need for business consulting, IBM altered it business model by selling some of its hardware businesses and focusing more on application integration and database management (Hoover's, 2010). While all of the firms struggled during and after the technology bubble, IBM was able to maintain its net profit margin and stock price by effectively managing the number of shares outstanding through a stock buyback program (Value Line, 2010). While IBM had always been a major player in business consulting, the outsourcing era hurt IBM's margins as cheaper firms in India absorbed some of its business. IBM responded like it had many time before by acquiring some of these firms including Daksh eServices (Hoover's, 2010). As the decade continued and the market moved to mobile devices, IBM continued its high-end consulting which contributed to steady sales growth (Mergent Online, 2010). However, the stock market did not reward IBM for its steady control of this segment and its P/E fell by 25% leading to a stagnant price (Value Line, 2010).

Of the big three software developers, Oracle is the youngest and smallest. Started in 1977 by four computer programmers who created a database system based on the IBM mainframe (Hoover's Online, 2010). Led by Larry Ellison, the company altered the database to

run on many different companies' computers, therefore, freeing it from IBM-only computers. Ellison was an aggressive marketer and by 1988 one-third of the U.S governments' database software was made by Oracle (Hoover's Online, 2010). By 1992, Oracle was the largest database software developer in the world in terms of sales (Business & Company Resource Center, 2010). During the browser era, Oracle expanded its reach as businesses began to computerize and mine data. The high cost of learning new systems aided Oracle during the browser and Y2K eras. Programmers who learned Oracle systems would choose those systems at each new job, thus, spreading the programs and market share for Oracle (Hoover's Online, 2010).

During the post-Y2K era, Oracle was able to maintain healthy growth rates in sales and earnings, albeit the growth rates were slowing (Value Line, 2010). The ability to do this was again related to its dominance the database market. When firms did upgrade, they chose to stick with Oracle instead of a new system (Hoover's Online, 2010). However, by the post-9/11 era, Oracle could no longer live off past products. Sales declined by over 8% and earnings declined by over 15% in 2002 (Value Line, 2010). Oracle's software was sold as a product with a service contract in order to monetize the software value over several periods (Mergent Online, 2010). By 2002, IBM began to compete stronger with Oracle as did other competitors whose products had improved, and businesses were reluctant to sign new, long-term contracts with Oracle (Hoover's Online, 2010). Oracle responded with an acquisition spree. It bought PeopleSoft in a hostile takeover and purchased Retek after a bidding war with SAP (Hoover's Online, 2010). These acquisitions provided Oracle with the ability to recharge its products and solidify its dominance in the database software industry. Earnings rebounded during the outsourcing era and stock investors rewarded the firm by increasing the P/E ratio (Value Line, 2010). The outsourcing era also saw Oracle's market share outside of the U.S. grow with foreign sales exceeding half of all sales (Mergent Online, 2010). During the mobile era, Oracle continued its aggressive acquisition strategy and was able to maintain earnings growth greater than 20% annually. The stock price did not grow as quickly because investors lowered the P/E ratio on the stock to bring the P/E in line with other technology firms (Value Line, 2010).

Hewlett-Packard Company is a technology corporation headquartered in Palo Alto, California. Hewlett-Packard specializes in developing and manufacturing software and hardware for printing and imaging. Hewlett-Packard markets its products to households, small to medium size businesses and enterprises both directly, via online distribution, consumer-electronics and office-supply retailers, software partners and major technology vendors (Hoover's Online, 2010). The important events for Hewlett-Packard during the 120-month period of this study include the $8 billion spinoff creating Agilent, the hiring of Carly Fiorina as the first female CEO of a company in the Dow Jones Industrial Average, merger with Compaq, and the outsourcing of enterprise support to lower cost workers in other countries (Mergent Online, 2010). While HPQ operates in all areas of information technology, HPQ is almost synonymous with printers. While not a glamorous part of the technology industry, printers and the corresponding imaging software are a necessary component, which created a steady increase in earnings and net profit margin over the first two eras. Additionally, steady income in the form of ink purchases helped to provide earnings (Value Line, 2010). In the post-9/11 era, HPQ lowered price in order to maintain steady sales and market share (Hoover's Online, 2010). Its net profit margin fell by more than 50% (Value Line, 2010). It was during this same period that HPQ acquired Compaq, which evolved into a contentious proxy fight (Hoover's Online, 2010). HPQ's stock price declined. After the departure of Fiorina in early 2005, the new leadership of Mark Hurd

refocused the firm on imaging (Mergent Online, 2010). Printing had been a declining activity as the Internet was used more and more for document sharing. However, the move to the consumer in the wireless/handheld era created a need for easier imaging products for all types of cell phones. HPQ responded with docking products and the ability to print quality pictures from a home printer (Hoover's Online, 2010). Earnings and net profit margin increased resulting in the stock price doubling in 2005-06 (Business & Company Resource Center, 2010).

Sun Microsystems is a multinational vendor of computers, computer components, computer software, and information technology services. The company is headquartered in Santa Clara, California. Products include computer servers and workstations based on its own processors as well as Advanced Micro Devices and Intel's processors; storage systems; and a suite of software products including the Solaris Operating System, developer tools, Web infrastructure software, and identity management applications. Other technologies of note include the Java platform and NFS (Value Line, 2010). Sun Microsystems is a proponent of open systems in general and UNIX in particular. On April 20, 2009, Sun and Oracle Corporation announced that they entered into a definitive agreement under which Oracle will acquire Sun for $7.4 billion. Sun shareholders approved the acquisition on July 16, 2009 (Hoover's Online, 2010). During the dot-com bubble, Sun experienced dramatic growth in revenue, profits, share price, and expenses (Business & Company Resource Center, 2010). Some part of this was due to genuine expansion of demand for web-serving cycles, but another part was fueled by venture capital-funded startups building out large, expensive Sun-centric server presences in the expectation of high traffic levels (Mergent Online, 2010). In response to this business growth, Sun expanded aggressively in all areas: head-count, infrastructure, and office space. Sun's earnings per share grew at a rate of 31.5% per year from 1996 to 2000 (Hoover's Online, 2010). The bursting of the bubble in 2001 was the start of a period of poor business performance for Sun. Sales dropped as the growth of online business failed to meet predictions. Earnings per share turned negative in 2002 and stayed negative or close to zero through 2006 (Value Line, 2010). As online businesses closed and their assets were auctioned, a large amount of used high-end Sun hardware was available very cheaply (Mergent Online, 2010). In 2005, Sun announced the deployment of its first software as a service product. One problem for Sun's stock price since the tech burst was that so many investors had suffered major losses in the stock (Hoover's Online, 2010). Sun was considered one of the four horsemen of the Internet. Its P/E ratio rose from 15.9 in 1996 to over 80 by 2001. The stock price declined over 90% from 2000 to 2002 (Value Line, 2010). During the outsourcing and wireless eras, Sun has had to compete by lowering price and forming alliances. Its products that were a first-mover for Internet business became easily copied or provided at a lower price in subsequent years (Hoover's Online, 2010). While it created the JAVA language and originally encouraged use by other firms to created demand for other Sun products, it was not able to maintain control over the language and create an income flow from it (Mergent Online, 2010). Oracle's hope with the acquisition is to offer integrated hardware-software systems for businesses (Hoover's Online, 2010).

Electronic Arts is synonymous with gaming, whether it is *Madden NFL* or *Medal of Honor*. Trip Hawkins, an Apple employee, founded Electronic Arts in 1982 (Hoover's Online, 2010). ERTS started by designing games for Sega's Genesis video game systems (Mergent Online, 2010). Throughout the 1980s and early 1990s, ERTS expanded internationally making games for all types of consoles. By the browser era, 40% of the firm's sales were from outside of the U.S. (Value Line, 2010). ERTS started their relationship with Japanese firms early, which enabled ERTS to quickly produce games for the Sony Playstation console, which was released in

the mid-1990s (Hoover's Online, 2010). In addition, in the browser era, Electronic Arts bought Maxis, the publisher of *SimCity* (Mergent Online, 2010). This early move into family-friendly gaming helped ERTS solidify its spot at the top of entertainment software. Sales and earnings growth rates exceeded 25% in most years during the browser and Y2K eras (Value Line, 2010).

When the technology bubble burst, ERTS's earnings turned negative. However, investors were not overly worried and kept the stock price up during the post-Y2K era (Value Line, 2010). ERTS is one of the few technology stocks to see its price rise during the recession. Part of the reason for investor confidence is that ERTS products were not overly expensive and during the recession families looked for cheaper entertainment such as video games (Business & Company Resource Center, 2010). The post-9/11 era saw ERTS try to grow its online gaming with subscriptions to its online games such as *The Sims Online* (Hoover's Online, 2010). It hoped to generate a steady cash flow from its products instead of a one-time purchase. The experiment was not successful and ERTS turned its focus back to its core games of sports and war along with games associated with movies such as *Harry Potter* (Hoover's Online, 2010). While gamers could easily switch to new games, ERTS had developed a following among its users. The graphics improved each year, as did the ancillary features to the games. Additionally, the new music in the editions was almost as important (Value Line, 2010). By producing games for children, ERTS was able to convert users early and then provide new games for them as the aged (Hoover's Online, 2010). Investors rewarded ERTS for its steady control of market share by increasing its P/E ratio to coincide with the sales and earnings growth (Business & Company Resource Center, 2010). During the mobile/wireless era, new consoles were released, most notably the Wii. While ERTS had products for the Wii, its core games associated with the NFL, other sports, and warfare did not fare was well with the new consoles (Hoover's Online, 2010). Additionally, consumers focused on smart phones, which did not have the capability or screen size for the comprehensive games ERTS produced (Mergent Online, 2010). Competitors also moved in on ERTS's customers. Take-Two created a line of lower-priced sports games (Hoover's Online, 2010). Electronic Arts' earnings decreased by over 80% during this period (Value Line, 2010). ERTS responded by acquiring exclusive right to the ESPN trademark by the end of the mobile era (Hoover's Online, 2010). Of the six major software companies examined, Electronic Arts had the largest 120-month total return. While all the P/E ratios fell over the 120-month period, ERTS's ratio remained the highest, which helped to negative any fluctuations in its earnings (Value Line, 2010).

Overall, the software market is highly competitive with each firm trying to gain and hold market share. Each firm realizes that once a customer is lost, it could be years before the customer returns especially if the customer bought new hardware to go with the new software. The reliance on blockbuster products causes each firm to look to acquire rivals or anyone with a good idea or product, even if it requires a hostile bid. Investors recognized the value that the larger firms have in controlling sales and rewarded the firms with higher P/E ratios. When P/E ratios did fall after the technology bubble burst, the rate of decrease of the P/E ratios lagged the earnings growth rates until a firm lost market share.

DATA AND METHODOLOGY

Is there a difference in the stock market performance of software companies in the different period classifications? In this section, we compare the stock market returns of software companies in six different twenty-month periods between the years 1996 through 2006. Six

different information technology firms specializing in computer software are the focus of this study. The primary data source is the Yahoo! finance website, which offers daily and monthly closing stock prices across multiple years. The six period classifications are the browser era, Y2K era, post-Y2K era, post-9/11 era, outsourcing era, and mobile/wireless era. The statistical methodology incorporates a nonparametric approach to comparing the stock market performance of a company in the six different periods. The Kruskal-Wallis test offers the most powerful test statistic in a completely randomized design without assuming a normal distribution. A traditional event study methodology is not applicable to this specific research design because the research periods require a long time horizon instead of the narrow window associated with an event study. In addition, a nonparametric approach is more efficient given the limitation of defining all six periods as in a strict twenty-month periods given some eras might be somewhat longer or shorter than the twenty-months.

The Kruskal-Wallis test is sensitive to differences among means in the *k* populations and is extremely useful when the alternative hypothesis is that the *k* populations do not have identical means. The null hypothesis is that the *k* company stock returns in the different periods come from an identical distribution function. For a complete description of the Kruskal-Wallis test, see Conover (1980). The specific equations used in the calculations are as follows:

(1) $N = \sum_i n_i$ with i = 1 to k
(2) $R_i = \sum_j R(X_{ij})$ with j = 1 to n_i
(3) $R_j = \sum_i O_{ij} R_i$ with i = 1 to c
(4) $S^2 = [1/(N-1)] [\sum_i t_i R_i^2 - N(N+1)^2/4]$ with i = 1 to c
(5) $T = (1/S^2) [\sum_i (R_i^2/n_i) - N(N+1)^2/4]$ with i =1 to k
(6) $| (R_i/n_i) - (R_j/n_j) | > t_{1-a/2} [S^2(N-1-T)/(N-k)]^{1/2} [(1/n_i) + (1/n_j)]^{1/2}$

where *R* is the variable rank and *N* is the total number of observations. The first three equations find average ranks. Equation (4) calculates the sample variance, while equation (5) represents the test statistic. If, and only if, the decision is to reject the null hypothesis, equation (6) determines multiple comparisons of stock market returns across the various periods.

RESULTS

Table 1 offers summary statistics for the six software companies in the research cohort. Oracle is the most volatile company in the research sample with the largest mean, standard deviation, sample variance, and maximum monthly return. Electronic Arts has the largest median monthly return and Sun Microsystems is the sample representative with the minimum monthly return of greatest magnitude. Monthly returns for the companies range from a minimum of -0.3498 for Sun Microsystems to a maximum of 0.6525 for Oracle. The most notable observation is the relatively large 120-month return of 561% for Electronic Arts. All six companies have a positive 120-month return although Sun Microsystems clearly earned a return well below average at 47% compared to a range of 142% to 561% for the other five companies.

The nonparametric empirical approach yields six T-values of 26.44 (p-value = .0001) or higher, indicating a significant difference in stock market returns across the six period classifications for all companies in the study. Table 2 presents a summary of the average rank value of stock market returns for each company across the six periods defined in this study. Assuming an alpha level of .05, the empirical results from equation 6 indicate all companies

have four or more time-periods with stock market returns that are statistically different. The most interesting observation from Table 2 is the low relative return earned in the post-9/11 (period 4) era. Four of the six companies achieve their lowest return period in the post-9/11 era and all six companies earn relatively low returns in the era. The results imply companies in the same industry all tend to face financial challenges during the declining phase of a stock market bubble. Although the consistent negative return in the bubble bursting eras might seem obvious, it is important to note all the companies in the study survived the stock market bubbles of the post-Y2K and post-9/11 eras. The fact that even survivors consistently struggled and not a single firm prospered is noteworthy given several firms earned high overall returns during the 120-months of the study. In fact, four companies (Electronic Arts, International Business Machines, Microsoft, and Oracle) earned 120-month returns higher than 200% but, with the exception of Microsoft, followed the tide of achieving their relative low return period in the post-911 era. One of the limitations of the study is a potential survivor firm bias, where companies that did not survive the stock market bubble burst of the post-Y2K or post-9/11 eras are not part of the study. This limitation is somewhat mitigated by the observation that companies that did not survive almost certainly hit low periods in the post-Y2K or post-9/11 eras, which is consistent with our empirical results.

The high return period for software companies is more diverse than the low return period. Four of the six companies achieve their high return period in different eras. International Business Machines, Microsoft, and Oracle achieve their high return period in the browser era. Sun Microsystems achieves their high return period in the Y2K era. The high return period for Electronic Arts is the outsourcing era. The high return period for Hewlett-Packard is the mobile/wireless era. The variation in the high return periods across the six companies provides evidence the software industry produces blockbusters. Items that are blockbusters tend to have one product or innovation that captures the attention of investors. The product does not have to be the most profitable item but investors normally consider the innovation to have strong potential for success. Industries characterized as containing blockbusters normally have low correlation with respect to price and stock market returns because product innovation is sporadic across the industry.

CONCLUDING COMMENTS

The purpose of this research is to compare the stock market performance of six software companies across six information technology eras. The six period classifications are the browser era, Y2K era, post-Y2K era, post-9/11 era, outsourcing era, and mobile/wireless era. The statistical methodology incorporates a nonparametric Kruskal-Wallis test to compare the stock market performance of the companies in the research cohort. The primary data source is the Yahoo! finance website.

The results of this study imply a high correlation of stock market prices for software companies during bear markets but a low degree of correlation with respect to firms achieving their peak return period. Specifically, four of the six companies achieve their peak return period in different eras. The variation in the high return periods across the six companies provides evidence the software industry produces blockbusters.

One of the limitations of the study is a potential survivor firm bias, where companies that did not survive the stock market bubble burst of the post-Y2K or post-9/11 eras are not part of the study. This limitation is somewhat mitigated by the observation that companies that did not

survive almost certainly hit low periods in the post-Y2K or post-9/11 eras. A second limitation of the study is the application of stock market returns across a very broad timeframe encompassing 120-months. Traditional finance event studies usually focus on daily data for a very short window of time in order to minimize the potential contamination of other events. This study requires the use of a larger than normal research window in order to compare the six different period classifications. Thus, the results should be interpreted with caution given the potential for correlation with other events that occurred in any given focus era. A third limitation is the tendency for software companies to integrate into other aspects of the computer industry, which can include hardware, data services, and consulting services. This product integration limits the ability to isolate stock returns driven by software operations relative to other aspects of the product portfolio of a company. One avenue for future research is to examine consistency of the empirical results across various eras by employing multiple short-run event studies.

REFERENCES

Allen, F. & Gale, D. (2000). Financial contagion. *Journal of Political Economy*, 108(1), 1-33.

Armitage, H. & Jog, V. (1996). Economic value creation: What every management accountant should know. *CMA—The Management Accounting Magazine*, 70(8), 21-24.

Avison, D. & Eardley, W. (1998). Suggestions for capturing corporate vision in strategic information systems. *Omega*, 26(4), 443-459.

Bartholomew, D. (1998). How to lead? *Industry Week*, 247(2), 27-30.

Bleiweiss, W. (1998). Measuring what counts. *Telephony*, 235(14), 50-52.

Bulow, J. & Klemperer, P. (1994). Rational frenzies and crashes. *Journal of Political Economy*, 102(1), 1-23.

Business & Company Resource Center (2010). *Company Financials* on Electronic Arts, Hewlett-Packard Compaq, IBM, Microsoft, Oracle, and Sun Microsystems. New York: Gale Cengage Learning. Retrieved March 12, 2010.

Camerer, C. (1989). Bubbles and Fads in Asset Markets: A Review of Theory and Evidence. *Journal of Economic Surveys*, 3(1), 3-38.

Clinton, B. & Chen, S. (1998). Do new performance measures measure up? *Management Accounting*, 80(4), 38-42.

Cocca, T. (April 2005). What made the Internet bubble burst? A butterfly flapping its wings or how little things can make a big difference. Available at SSRN: http://ssrn.com/abstract=758346.

Conover, W. (1980). *Practical Nonparametric Statistics*. New York: John Wiley & Sons Publishing.

Demers, E. & Lev, B. (2001). A rude awakening: Internet shakeout in 2000. *Review of Accounting Studies*, *6*(2), 331.359.

Fama, E & French, K (1995). Size and book-to-market factors in earnings and returns. *Journal of Finance*, 50(1), 131-155.

Higgins, M. & Osler, C. (1997). Asset market hangovers and economic growth: The OECD during 1984-1993. *Oxford Review of Economic Policy*, 13(3), 110-134.

Hong, W. & Zhu, K. (2006). Migrating to Internet-based e-commerce: Factors affecting e-commerce adoption and migration at the firm level. *Information & Management*, 43(1), 204-221.

Hoover's, Inc. (2010). Company records on Electronic Arts, Hewlett-Packard Compaq, IBM, Microsoft, Oracle, and Sun Microsystems. *Hoover's Company Records*. Austin, Texas: Hoover's Company Reports. Retrieved March 12, 2010.

Im, K., Dow, K. & Grover, V. (2001). A reexamination of IT investment and the market value of the firm—An event study methodology. *Information Systems Research*, 12(1), 103-117.

Johnson, L. & Pazderka, B. (1993). Firm value and investment in R&D. *Managerial and Decision Economics*, 14(1), 15-24.

Kamssu, A., Reithel, B., & Ziegelmayer, J. (2003). Information technology and financial performance: The impact of being an Internet-dependent firm on stock returns. *Information Systems Frontiers*, 5(3), 279-288.

Loughran, T. (1997). Book-to-market across firm size, exchange, and seasonality: Is there an effect? *Journal of Financial and Quantitative Analysis*, *32*(3), 249-268.

Manion, M. & Evan, W. (2000). The Y2K problem and professional responsibility: A retrospective analysis. *Technology and Society*, 22(3), 361-387.

Mergent Online (2010). Company profiles on Electronic Arts, Hewlett-Packard Compaq, IBM, Microsoft, Oracle, and Sun Microsystems. Retrieved March 11, 2010.

Molloy, S. & Schwenk, C. (1995). The effects of information technology on strategic decision making. *Journal of Management Studies*, 32(3), 283-311.

Ofek, E. & Richardson, M. (2003). Dotcom mania: The rise and fall of Internet stock prices. *The Journal of Finance*, 58(3), 1113-1138.

Ranganathan, C. & Samarah, I. (2001). Enterprise resource planning systems and firm value: An event study analysis. *22nd International Conference on Information Systems*, 157-158.

Rogerson, W. (1997). Intertemporal cost allocation and managerial investment incentives: A theory explaining the use of economic value added as a performance measure. *Journal of Political Economy*, 105(4), 770-795.

Sampler, J. (1998). Redefining industry structure for the information age. *Strategic Management Journal*, 19(4), 343-355.

Savitz, E. (April 20, 1998). A momentary lapse for Internet stocks, but mostly they defy gravity. *Barron's*, Chicopee.

Sornette, D. & Malevergne, Y. (2001). From rational bubbles to crashes. *Physica*, 299, 40-59.

Stephens, K., & Bartunek, R. (1997). What is economic value added? A practitioner's view. *Business Credit*, 99(4), 39-42.

Sundaram, A., John, T. & Kose, J. (1996). An empirical analysis of strategic competition and firm value: The case of R&D competition. *Journal of Financial Economics*, 40(3), 459-486.

Tam, K. (March, 1998). The impact of information technology investments on firm performance and evaluation: Evidence from newly industrialized economies. *Information Systems Research*, 9(1), 85-98.

Terry, N., Macy, A, & Abdullat, A. (2010). Stock market volatility: A comparison of vertically integrated technology companies. *The Journal of the American Academy of Business, Cambridge*, 15(2), 242-249.

Value Line (2010). Company stock reports on Electronic Arts, Hewlett-Packard Compaq, IBM, Microsoft, Oracle, and Sun Microsystems. *Value Line Investment Surveys*. New York: Value Line, Inc. Retrieved March 12, 2010.

Zaher, T. (1997). The cross-section of expected stock return: Application of the Fama-French methodology to the utilities industry. *Journal of Energy Finance and Development*, 2(2), 229-238.

Table 1: Summary Statistics for Software Firms Average Monthly Returns

Firm	Mean	Median	Standard Deviation	Sample Variance	Minimum	Maximum	120-month Return
ERTS	0.0238	0.0237	0.1256	0.0158	-0.2880	0.3324	561%
HPQ	0.0148	0.0041	0.1228	0.0151	-0.3201	0.3538	142%
IBM	0.0137	0.0025	0.0959	0.0092	-0.2264	0.3538	205%
JAVA	0.0161	0.0014	0.1601	0.0256	-0.3498	0.4493	47%
MSFT	0.0177	0.0110	0.1156	0.0134	-0.3435	0.4073	287%
ORCL	0.0241	0.0177	0.1637	0.0268	-0.3475	0.6525	300%

Notes: The sample period is the 120-months between August 1996 and August 2006. Total return for ten-year period is 102.6% for the Dow Jones Industrial Average and 91.3% for the NASDAQ Composite Index.

Table 2: Software Firms (Average Rank Order Value of Returns)

Firm	T-values (p-value)	Period 1 8/96 - 3/98	Period 2 4/98 - 11/99	Period 3 12/99 - 7/01	Period 4 8/01 - 3/03	Period 5 4/03- 11/04	Period 6 12/04 - 8/06
ERTS	35.23 (.001)	62.6**	64.2**	60.4**	47.3*	105.2***	23.3 -
HPQ	26.44 (.001)	83.9***	51.3**	38.1*	21.5 -	80.0***	85.9***
IBM	27.87 (.001)	99.4***	95.1***	51.5*	25.9 -	64.3**	29.0 -
JAVA	32.84 (.001)	79.6**	98.9***	49.0*	22.0 -	80.3**	28.3 -
MSFT	43.83 (.001)	103.7***	91.6**	11.3 -	48.9*	56.5*	51.1*
ORCL	36.69 (.001)	97.3***	74.5**	49.1*	16.7 -	70.7**	53.8*

Notes: Table 2 shows average rank order value of stock market returns derived from a Kruskal-Wallis nonparametric methodology. The first column is a listing of the ticker symbols for the four software companies included in the study. The second column is the value of the equation (5) test statistic and p-value for each company, which determines if there is a statistical difference in stock market returns across the six periods. Columns three through eight present the average rank value of the stock market returns for the six periods of the study. Asterisk(*) and negative signs (-) signify difference in average rank values as follows:

(1) *** Indicates period with highest statistically significant return derived from equation 6.
(2) ** Indicates period with second highest statistically significant return derived from equation 6.
(3) * Indicates period with third highest statistically significant return derived from equation 6.
(4) - Indicates period with lowest statistically significant return derived from equation 6.
(5) Some periods do not have a return that is statistically significant from an alternative period.