An Empirical Analysis of Idiosyncratic Volatility and Extreme Returns in the Japanese Stock Market

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Abstract

Traditional finance theory assumes that systematic risks cannot be diversified in the market and need to be priced, while idiosyncratic risks should be diversified away in a rational investor's portfolio and should not be compensated by risk premiums. However, due to various reasons such as incomplete information or market failures, investors in reality often do not hold perfectly diversified portfolios and thus idiosyncratic volatility is priced. Investors who hold stocks with higher idiosyncratic volatility expect a higher return. This study examines idiosyncratic risk behaviour from different perspectives.

The objective of this research is to determine the effects of idiosyncratic volatility and extreme returns on the Japanese stock market. This research will determine whether there is a trend in the Japanese stock market using the t-dan test introduced by Bunzel and Vogelsang (2005). If the trend exists, we test on the factors that lead the trend behaviour. This study also examines if idiosyncratic volatility and extreme returns are priced in the Japanese stock market. The Fama and French three factor model, cross-sectional Fama Macbeth (1973) regression and double sorting stocks into portfolios based on variables of interest will be employed to test this effect.

The study results identified four major findings on idiosyncratic volatility and extreme returns in the Japanese stock market. First, the result showed a negative and robust trend in idiosyncratic and market volatility in the Japanese stock market between 1980 and 2007. Second, the research findings confirm that volatilities, whether equal weighted, value weighted idiosyncratic volatility, market volatility or maximum daily returns are unable to forecast one month ahead excess market returns. However, the research results confirm with Brockman and Yan's (2006) finding, who found no evidence of forecasting ability during their research sample from January 1926 to June 1962 in the US stock market. Third, the result showed a negative relationship between idiosyncratic volatility and expected stock return and the reverse between maximum daily return and expected stock return. Both the idiosyncratic volatility and extreme return finding is consistent with Ang, Hodrick, Xing and Zhang (2006), Brockman and Yan (2006) and Bali et al.'s (2010) findings for the U.S market. Finally, the result showed a highly significant inverse relation between idiosyncratic volatility, maximum daily return and cross-sectional returns.

Key Words: Idiosyncratic volatility, extreme returns, cross-sectional returns, asset pricing, Japan

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Table of Contents

List of Tables

List of Figures

List of Equations

CHAPTER 1

Introduction

1.0 Research Background

In the past decade, developed equity markets have experienced significant growth. These equity markets play an important role in the international investment market. As stock prices face irregular fluctuations, high levels of volatility will yield abnormal returns to the investors. Returns are abnormal when they exceed what an investor would normally expect to earn from accepting a certain level of risk. In order to ensure that capital investors are willing to hold risky assets, companies have to compensate them with higher or abnormal returns. When financial market volatility increases, investors may request a higher risk premium as compensation for taking excessive risks. This is because investors are unsure about the future returns from the risky assets. For example, a high risk premium and high uncertainty will lead to a decrease in foreign direct investment. In such environment, both domestic and foreign investors will ask for a higher average rate of return on capital demanded to comply with a higher risk premium.

In the CAPM (Capital Asset Pricing Model) framework the risk of an individual stock is divided into two parts; systematic and idiosyncratic (http://www.investopedia.com/risk/risk2.asp). Systematic risk or non-diversifiable risk refers to risk factors common to all stocks while idiosyncratic risk (also known as diversifiable risk) refers to risk due to firm specific events. Moreover, the volatility of an individual stock's return is determined by the aforementioned. CAPM suggests that idiosyncratic risk can be costlessly eliminated by holding a fully diversified portfolio; therefore, there should be no compensation for bearing idiosyncratic risk. In other words, idiosyncratic risk should not be a determinant of a firm's expected returns.

However, this argument is based on the assumption that investors are able to hold fully diversified portfolios. Investors commonly diversify the systematic risk regarding volatility in their portfolios and neglect the idiosyncratic volatility which will affect their portfolios returns (Cochrane, 2005). Investors normally hold huge amounts of individual stocks where systematic volatility and idiosyncratic volatility will equally affect the portfolios. Therefore, both components of volatility are fairly important to those investors (Cochrane, 2001). In other words, investors have to hold large amounts of stocks in order to fully diversify their portfolios. However, this will lead to higher transaction costs. In these situations, idiosyncratic risk plays a role in affecting the future returns. For example, Levy (1998), Merton (1987) and Malkiel and Xu (2001) extend the CAPM by putting constraints on portfolio construction and manage to capture systematic and unsystematic risk of the security. Thus, the study of idiosyncratic volatility should be considered equally important to systematic volatility.

A lot of empirical research has been conducted on idiosyncratic volatility on stock returns, but few focus on the Japanese stock market. However, the empirical evidence on the relationship between idiosyncratic risk and returns are mixed. Ang, Hodrick,Xing, and Zhang (2006), Jiang, Xu, and Yao (2007) and Brockman and Yan (2008) found negative relationship evidence for the US stock market. Similarly Ang, Hodrick, Xing and Zhang (2009) confirm in their recent study that negative relationships also occur in 22 other markets in addition to the US market. However, Malkiel and Xu (2006), Speigel and Wang (2005) and Fu (2009) found positive relationships between idiosyncratic volatility and expected returns. On the other hand, Fama and Macbeth (1973) found no relationship between idiosyncratic risk and expected returns, consistent with the prediction of CAPM.

The stagnation problem has plagued and complicated the Japanese economy for decades. Japan, severely affected by the bubble economies, was once well known for its developed and industrialized economy. The economic bubble has caused Japan to operate far below its potential productive capacity. In the late 1980s, Japan experienced a huge surge in real estate and stock prices. The apartment prices doubled and tripled in only a few years. By 1990, the value of Japan's real estate had grown to five times the value of the entire US real estate market. However, following the boom period, Japan's economy fell dramatically, entering into a decade long deflationary slump. This stage is known as the lost decade which resulted from the economic bubble (Fischer, 2010).

Japan is still struggling to revive its economy due to the 2008 global financial crisis and the 8.9 magnitude earthquake that struck off the coast of Japan on March 11, 2011. When the nation struggled with a rescue effort, it also faced a nuclear emergency and leakage of radioactive gas at the Fukushima Daiichi Nuclear Power Station. On March 11, 2011, the Nikkei 225 index tumbled 1.7 percent to a five week low. In addition, other stock markets also rattled due to this incident where the Hong Kong's Hang Seng index dropped 1.8 percent and the South Korea's Kospi slid 1.3 percent. The Bank of Japan released the Gross Domestic Product figures in May and it showed that Japan's economy shrank at an annual rate of 3.7 percent in the first quarter of 2011. This brought the country into a recession, as the crises affected production and consumers' spending. Economists then predicted that the Japanese economy would shrink again. (http://topics.nytimes.com/top/news/international/countries/japan/index.html).

There are many debates on the health of the Japanese economy but most of them have focused on falls in asset values, consumer demand and non-performing loans (Hamao et al., 2003). However, our research has a very unique perspective compared to the previous studies where we concentrate on testing whether idiosyncratic risk occurs and is also priced in the Japanese stock market. Campbell, Lettau, Malkiel and Xu (2001) pointed out an important structure feature of the US stock market volatility which later drew the attention of the researchers. The authors argued that the behaviour of the US stock market volatility is not at the market level as a whole but also involves the industry and firm levels. Malkiel and Xu's (2003) results are consistent with Campbell et al. (2001) who provided evidence of a positive deterministic trend in firm level volatility from 1962 to 1997. However, what determines the positive deterministic trend has not been well explained or documented. Campbell et al. (2001) suggests a few reasons in order to explain the positive trend on idiosyncratic risk and expected returns. Similarly, Wei and Chang's (2004) results showed that decreasing corporate earnings drive positive trends.

There are some controversies in the research findings on idiosyncratic volatility. A number of researchers found a positive relationship between idiosyncratic risk and expected returns in the US stock markets (Malkiel and Xu, 2002; Spiegel and Wang, 2005; Brandt, Brav, Graham and Kumar, 2008). Ang et al.'s (2004) study shows aggregate volatility risk is a priced factor in the cross section of stock returns, with a negative price of volatility risk. They also find that stocks with high idiosyncratic volatility have lower expected returns. The authors did not explain their findings robustly and called it a substantive puzzle. Ang et al.'s (2004) findings drew many criticisms from researchers globally. For example, Malkiel and Xu (2004) criticized that Ang et al.'s (2004) sample size is small. Bali and Cakici (2008) suggested that Ang et al.

(2004) should add size, price and liquidity in their sample to test whether size, price and liquidity play a role in determining the existence and the significance of a relationship between idiosyncratic risks and cross-sectional expected returns. Fu (2009) suggested that Ang et al. should have considered auto-correlation to measure idiosyncratic volatility because the author finds that a positive relation arises when conditional idiosyncratic volatility is estimated from the EGARCH models. Similarly, Saryal (2009) found evidence that noise around announcement days will lead to a negative relationship. Therefore, our study will contribute to the literature whereby we investigate the interaction between idiosyncratic risk and expected returns in the Japanese stock market using additional variables such as size, book to market, momentum and maximum return.

1.1 What is Idiosyncratic Risk?

Idiosyncratic risk is a risk which affects only one stock or security. Idiosyncratic risk is also known as unsystematic risk. In normal circumstances, idiosyncratic risk can be diversified away using a portfolio that does not rely too much on any given investment product. This is to ensure that when an idiosyncratic risk affects a security, it does not affect the whole portfolio. In other words, the scenario of risk diversification is synonymous to the saying "don't put all your eggs in one basket."

There are a number of causes that can lead to the devaluation of a single security without affecting the whole portfolio. For example, a company may experience a strike which affects the productivity and this is followed by a fall in stock price as consumers and investors raise their concerns. Moreover, if a company faces a decline in earnings, subject to a large law suit or similar event will cause the company value to decline due to less confidence by the investors. All these risks will affect the stock price at any time.

Even though idiosyncratic risk is small, it still affects stocks associated with a particular company with a varying length of time. Idiosyncratic risk can be difficult and close to impossible to predict even for skilled investors who watch the market closely. Therefore, in order to avoid idiosyncratic risk, most investors would rather diversify their portfolios by selecting specific securities so that they can manage the idiosyncratic risk and try to reduce the effect on their returns. When investors try to figure out which stock to buy, they will consider how the idiosyncratic risk might affect their returns. For example, buying large quantities of stocks and bonds in both a listed company and its subsidiary is not a wise choice. This is because bad news concerning the parent company could have an impact on the subsidiary company.

Diversification can help an investor to manage risk and to reduce the volatility of his or her portfolio. A good diversification strategy is diversifying between different asset classes. Different classes of assets such as bonds and stocks will not react in the same way to adverse events. Therefore, a combination of asset classes will reduce an investor's portfolio's sensitivity to market swings. Generally, the bond and equity markets move in opposite directions, so, if an investor's portfolio is diversified across both areas, unpleasant movements in one will be offset by positive results in the other. In other words, it is evident that diversifying a portfolio is the only way to protect the capital invested from unnecessary risks (www.azsecc.com/why-its-important-to-diversify-investment.html).

1.2 Research on Idiosyncratic Volatility and Extreme Returns

Research on idiosyncratic volatility is motivated by several reasons. First, idiosyncratic volatility is obviously of interest to the investors that have not diversified their portfolios and are perhaps holding only a single stock. According to Goetzmann and Kumar (2004), their results showed that more than 25% of retail investors hold only one stock in their portfolio, over half of the investor portfolios contain no more than three stocks and less than 10% of the investor portfolios contain no more than 10 stocks. Therefore, investors will be exposed to a higher risk. According to Malkiel and Xu (2004), institutional investors too rarely hold an indexed portfolio. It is critical to have a diversified portfolio especially when one stock or bond is performing poorly, as then they still have other stocks in their diversified portfolio as a backup.

Secondly, a better understanding of the nature of idiosyncratic risk is valuable to investors since recent research has shown that investors tend to hold under-diversified portfolios and that idiosyncratic risk appears to be priced. Levy (1978), Merton (1987) and Malkiel and Xu (2004) suggest that idiosyncratic risk is priced because many investors hold poorly diversified portfolios. This means that those “efficient” investors are also unable to hold market portfolios. This is because the undiversified investors and the “efficient” investors make up the whole market. The inability to hold the market portfolio will force investors to pay attention to the total risk and not just the market risk.

Thirdly, idiosyncratic volatility is an important component of total volatility, which is needed to value options and other derivatives. This is because in option pricing and other financial applications that use volatility as a parameter, idiosyncratic volatility is relevant due to its large influence on total volatility. Since we know that volatility is not constant, understanding the determinants of the variation in volatility may help us to create better option pricing models.

Fourthly, Barberis and Huang’s (2001) results showed that idiosyncratic volatility should be positively related to the expected stock returns. They use a model that includes investors who are loss averse over the fluctuations of their stock portfolio and another model in which they are loss averse over the fluctuations of individual stocks that they own. Both models can shed light on empirical phenomena but the authors find the loss averse over the fluctuations of individual stocks are more successful than the model that includes loss averse over the fluctuations of investor's stock portfolio. The typical individual stock has a high mean and is excessively volatile while the large value premium in the cross-section can be captured by the multifactor model. Kahneman and Tversky (1979) first tested on loss aversion and found that people are more sensitive to losses than gains. In addition, evidence suggests that the degree of loss aversion depends on previous gains and losses. Narrow framing explains that when people evaluate changes in their wealth, they often appear to pay attention to narrowly defined gains and losses such as price appreciation of a stock they own rather than the change in their total wealth. Moreover, Barberis and Huang (2001) conclude that investors' loss aversion over individual stock fluctuations leads the expected premium to depend on past performance. Their model also predicts that total risk is positively correlated with expected returns which signify that idiosyncratic risk should be priced.

Fifthly, according to Bali et al. (2010), there is evidence that investors have a preference for lottery-like assets. For example assets that have low probability of a large payoff, such as in horse track betting and lottery tickets, where the expected return per dollar wagered tends to increase monotonically with the probability of the horse winning and the popularity of lottery games although there is a tendency for negative expected returns (Thaler and Ziemba, 1988). In addition, Garrett and Sobel (1999) showed that the participants were interested in the degree of skewness in the payoffs but there are also alternative explanations. Patel and Subramanyam (1978) argued that the participants show more interest to the degree of skewness in the payoffs due to the sluggish goods market. Motivated by these three studies, we also examine the role of extreme positive returns in the cross-sectional pricing of stocks.

1.3 Idiosyncratic Volatility Puzzle

The issue of pricing idiosyncratic risk in the cross-section of security returns has been one of the more popular topics for research for almost 40 years. Douglas (1969) and Lintner (1965) were the first who found that the variance of the residuals from the market model was highly significant in explaining the cross-section of stock returns. However, recent studies found conflicting results on the relevance of idiosyncratic volatility. Lehmann (1990), Goyal and Santa-Clara (2002), Malkiel and Xu (2003), Spiegel and Wang (2005), Eiling (2006), Huang et al. (2007) and Fu (2009) present evidence of a positive relationship between idiosyncratic volatility and future returns. Ang et al. (2006), Guo and Savickas (2006) and Bali, Cakici & Whitelaw (2010) found a significant negative relationship between idiosyncratic volatility and stock returns. Finally, Bali et al. (2005) and Bali and Cakici (2008) found that there is no significant relation between firm specific risk and future returns. Similarly, Ang et al. (2008) tested the same models using international data and control all the firm related characteristics. However, Ang et al. (2008) surprisingly found a significant negative relationship between idiosyncratic volatility and stock returns in international market and called it a "puzzle". This is because their research results showed low idiosyncratic volatility firms earning higher future returns than firms with high idiosyncratic volatility. The "Puzzle" that Ang et al.'s (2008) pointed out in their research has created attention to researchers globally. Some researchers have been trying to find ways to explain Ang et al.'s (2008) "puzzle" while others such as Fu (2009) challenged Ang et al.'s (2008) research by arguing that idiosyncratic volatilities are time-varying and therefore a one month lagged value is not a good proxy for the expected value. The author suggested the EGARCH model should be used instead to estimate the expected idiosyncratic volatilities as they are positively related to the expected returns.

1.4 Overview of the Japanese Stock Market

Japan is one of the world's largest economies and one of the most important financial hubs in Asia. The Tokyo Stock Exchange (TSE) is the main stock exchange of the Japanese stock market. It is the world's third largest with a market capitalization of US$3.8 trillion as of December 2010 (www.tse.or.jp). The TSE trades through two primary indexes which are Nikkei 225 and the TOPIX. Currently, there are four stock exchanges operating in other Japanese cities including Osaka, Nagoya, Fukuoka and Sapporo.

Japan's stock market went through restructuring when the Hiroshima and the Niigata exchanges were both merged into the TSE while the Kyoto exchange was merged into the Osaka Securities Exchange on 1st March 2000. On April 30th, 2000 TSE faced one of its more significant developments as the trading floor closed for the last time. The old trading floor has been changed to electronic trading. On May 9, 2000 the TSE Arrows complex provided a new era with a trading floor where the traders can exchange information and have face-to-face contact in addition to electronic trading.

The incorporation of technological solutions to the exchange has not gone through very smoothly. For example on November 1st, 2005 bugs in the computer system disrupted Fujitsu's transactional system which led to only 90 minutes of trading throughout the entire day. In addition, the TSE system also has its weak points where it is not sensitive to the input and allows mistakes made by employees at UBS Warburg and Mizuho (each selling c600, 000 shares at one yen a piece rather than 1 share at c600, 000 yen) resulting in extensive losses for both companies in excess of hundreds of millions of yen. (http://imber-articles.blogspot.co.nz/2012_02_01_archive.html)

The TSE has grown tremendously and is seeking for new opportunities to collaborate with other exchanges around the world. The TSE and its partner London Stock Exchange (LSE) have signed a memorandum of article to jointly investigate products and services which may benefit both parties. Recently, the LSE has been helping TSE with the establishment of an Alternative Investment Market (AIM). They also invest in 5% share purchase in the Singapore Stock Exchange (SGX).

After the March 11, 2011 earthquake and tsunami hit Japan, the immediate aftermath can be noticed where on March 15th; the Japanese stock markets closed 10% down while the Bank of Japan pumped a massive 15 trillion yen into the money markets to stabilize the market and to calm the investors. The impact to the economy was the worst in the north of the country where the major manufacturing industries, contributing 8% of Japan's GDP, are located. Corporate giants such as Sony, Toyota, and Nippon were forced to temporarily close down their factories due to the disaster and various logistical difficulties. Moreover, some multinationals even moved their staff abroad due to the nuclear threat. There is still much debate about the total cost of the earthquake and whether the disaster has significantly damaged the market. However, the government of Japan should focus on the rebuilding process rather than estimating the total cost of the damages (http://www.tradingeconomics.com/japan/stock-market/).

1.5 Research Problem Statement

There is ample literature focused on the idiosyncratic volatility of stock returns especially in the developed markets. However, most of the literature is based on the US stock market and limited on the Japanese stock market. The Japanese stock market plays an important role in the world equity market. The Tokyo stock exchange is the world's third largest stock exchange after the New York stock exchange and Shanghai and Shen Zhen stock exchanges. As of 31

December 2010, the Tokyo Stock Exchange has a market capitalization of $3.8 trillion. (www.wikiinvest.com/wiki/Tokyo_Stock_Exchange)

In the 1970s, Japan became the second largest economy in the world and it played a vital role in the world economy. However, Japan faced a short period of economic downturn in early 1970s and managed to overcome that with significant growth in economy and political stability from 1975 to 1989. However, Japan again faced economic, financial and political instability in the 1990s. The economy got worse and slipped into stagnation until 2005. Even though Japan's economy started to recover at that time, the economic and political problems still persist. For the past three decades, the overall real economic growth has decreased from an average of 10% in the 1990s. This is because of asset price bubbles and inefficient investments during the late 1980s when firms required a period of time to reduce excess debt, capital and labour. In late 2008, the US sub-prime crisis and the effects of the global credit crunch led to a decrease in the global demand for Japan's exports which pushed Japan into further recession (Cargill and Sakamoto, 2008). In spite of this, the Japanese stock market has been rising and falling dramatically, risk averse investors generally required compensation to their investments. The diversifiable risk is known as the idiosyncratic risk (a major focus of this research). Since idiosyncratic risk is diversifiable, we test whether there is any relationship between idiosyncratic risk and investors expected returns.

1.6 Research Objectives

First, this study examines whether there is a time trend in the average idiosyncratic volatility in the Japanese stock market. If a trend exists, a further investigation on the nature of that trend will be carried out. If a trend does not exist, the study will identify the factors and the reasons for the non-existence.

Second, this study tests whether the average idiosyncratic volatility and maximum daily return predict expected excess market returns on the Japanese stock market. Third, this study determines whether there is any relationship between idiosyncratic volatility, maximum daily return and expected stock returns in the Japanese stock market.

The Tokyo Stock Exchange faced a major crash in 1989 and has tumbled ever since. The Japanese economy has suffered from many negative effects caused by the crash. The economic bubble began in 1985 and Nikkei stock index reached around 40,000 in 1989. According to Zielenziger (2001), the Japan stock indexes had declined to the 1985 levels on March 13, 2001. The Nikkei index fell 3.6 percent or 456.53 points and closed at 12,171.37. On the same day, the US stock indexes dropped by 1.6 percent where they reached to the 1998 levels. However, the Nikkei index fell to 8636.33 on March 26, 2009 (http://finance.yahoo.com/intlindices?e=asia). Thus it is evident that the Japanese economy was in severe distress and therefore this study investigates how idiosyncratic risk affects market volatility in the Japanese stock market.

1.7 Research Hypotheses

The research hypotheses include the following:

Hypothesis 1: Japanese stock market exhibits a significant upward trend in idiosyncratic volatility.

Hypothesis 2: An increase in the number of firms in the Japanese stock market leads to an upward trend in idiosyncratic volatility.

Hypothesis 3a: There is a positive cross-sectional relationship between idiosyncratic volatility and excess returns.

Hypothesis 3b: Stock portfolios containing smaller size stocks (lower market value) provide higher average returns than stock portfolios containing larger size stocks (higher market value).

Hypothesis 3c: Stock portfolios with higher book-to-market (BTM) ratio provide a higher average return than stock portfolios with lower BTM ratios.

Hypothesis 3d: Idiosyncratic risk is positively correlated with momentum returns.

Hypothesis 3e: Stock portfolios with extreme returns provide a higher average return than stock portfolios with normal returns.

1.8 Research Motivation

The literature review shows that the stock market volatility has drawn the attention of the researchers in the late 1990s. For example, Malkiel and Xu (1997) revealed that there is a positive relationship between idiosyncratic volatility and expected stock returns. However, Ang et al. (2006) puzzled the researchers by claiming that there is a negative relationship between idiosyncratic volatility and expected returns. The authors' results contradict the existing theoretical predictions on the relationship between idiosyncratic volatility and expected stock returns and therefore they became a puzzle. The main difference between Malkiel and Xu (2002) and Ang et al. (2006) studies is that Malkiel and Xu estimated portfolio idiosyncratic volatilities by assigning estimates to individual stocks within each portfolio while Ang et al. (2006) estimated idiosyncratic volatility using individual stocks daily returns directly. Further, Spiegel and Wang (2005) argue that their research results show high idiosyncratic volatility stocks earning lower returns and they conclude that further research should investigate what factors cause stocks with high idiosyncratic volatility to have low risk and low expected returns. From the above-mentioned literature, it is clear that idiosyncratic volatility plays an important role in the stock market. There is also a lack of evidence on testing the relationship between the idiosyncratic volatility and the expected return on the Japanese stock market.

The first research objective describes the time series behaviour of idiosyncratic volatility in the Japanese stock market. Brandt et al.'s (2005) results showed that there is an upward trend in the US stock markets' volatility since 2002. Furthermore, Campbell et al. (2001) found that the level of idiosyncratic volatility has increased from 1962 to 1997. Chang and Dong (2006) conducted research on the Japanese stock market using data from 1975 to 2003. Their results show that the idiosyncratic volatility is positively correlated with institutional herding and firm earnings. This study examines whether there is an idiosyncratic volatility trend in the Japanese stock market. If there is a trend, the next question is whether the trend is upward or downward. T-dan test developed by Bunzel and Vogelsang (2005) is employed to test whether there is an idiosyncratic volatility trend in our sample size.

The second research objective is to explain the time series behaviour of idiosyncratic volatility in the Japanese stock market. Malkiel and Xu (2003) found there is an association between institutional ownership and the volatility of individual stocks and a positive relationship between idiosyncratic volatility and the expected earnings growth which explains the time series behaviour of idiosyncratic volatility in the stock market. Wei and Zhang (2006) found a mixture of an upward and a downward trend in ROE. However, the evidence shows only an upward trend in ROE which does affect the average volatility trend. Fink, Grullon and Weston's (2006) results were consistent with Wei and Zhang (2006) where they argued that the positive trend of idiosyncratic risk can be explained if there is a higher than average percentage of new firms traded in the capital markets. This is because the age of the firm that issued public equity has decreased from 40 years in the 1960s to less than 5 years in the late 1990s. However, Hamao et al.'s (2003) study on the Japanese stock market suggests that corporate restructuring is a factor that leads to the sharp fall in the firm level volatility. This study determines what factors lead to the time series behaviour of idiosyncratic volatility in the Japanese stock market. We use the Goyal and Santa Clara (2003) method to measure the idiosyncratic risk for estimating the market return model.

The last research objective tests whether idiosyncratic volatility and maximum daily return are priced in the Japanese stock market. Merton (1987) suggests that if idiosyncratic risk cannot be diversified due to transaction costs then the investors would require a positive risk premium. However, Ang et al. (2006) found a negative relationship between idiosyncratic volatility and stock returns in the US stocks from 1963 to 2000. Fu (2009) employed US stocks from 1963 to 2006 and found a positive relationship between idiosyncratic volatility and stock returns. Fu's results contradict Ang et al.'s (2006) study. Ang et al. (2009) confirm their US findings using the lagged method and test on another 22 developed markets. They found a negative relationship between idiosyncratic volatility and stock returns for those 22 developed markets which became a puzzle in the world of finance. Our study employs the lagged method from Ang et al. (2006) to measure the idiosyncratic volatility. Momentum, book to market, size and extreme return are used to test whether they explain the cross sectional variation of the expected returns on the Japanese stock market.

1.9 Significance of the Study

Angelidis (2008) found evidence that liquidity and idiosyncratic risk were the priced factors in the cross-section of expected stock returns and that market capitalization significantly affects investor behaviour and liquidity. On the other hand, policy makers can concentrate their efforts on attaining economic and financial stability by reducing volatility and minimizing investor uncertainty. Researchers have debated extensively the significance of idiosyncratic risk in determining asset returns. While many argue that idiosyncratic risk is irrelevant because it is diversifiable, some have found evidence that idiosyncratic volatility and expected stock returns are positively (negatively) related. However, current empirical evidence is mixed in general equity markets.

The Japanese economic bubble first appears and started to form in the early 1970s and the stock markets continued to grow and reached its peak at the end of 1989. However, the Nikkei Stock Index had lost a third of the peak value in mid year 1991. Following the stock market meltdown, real estate prices especially for houses started to drop. Since then Japan has experienced eighteen years of economic stagnation. For example, Chang and Dong (2006) and Hamao et al. (2003) have investigated the existence and the importance of idiosyncratic volatility in the Japanese stock market, but the effects of idiosyncratic volatility on Japanese stock market have not been widely explored. Hamao et al. (2003) studied the Japanese stock market and suggested that corporate restructuring led to the sharp fall in the firm level volatility during the years from 1990 to 1996, i.e.: during the post crash era. Chang and Dong (2006) found evidence showing that institutional herding and firm earnings are positively correlated with idiosyncratic volatility in the Japanese stock market. In addition, most of the research has been conducted based on Campbell et al. (2001) methodology describing a time series of market, industry and firm level volatility.

This study uses the Ang et al. (2004) approach to analyze the Japanese stock market from 1980 to 2007. This will help investors, analysts and also policy makers to have a better understanding of the behaviour of the Japanese stock market. Investors that have not diversified their portfolios will be more concerned about the risk they are exposed to. Our study will also have a major contribution to the literature because no study has researched the idiosyncratic volatility and extreme returns on the Japanese stock market using Ang et al.'s (2004) and Bali et al.'s (2009) approaches. We will compare our results with Ang et al.'s (2004) results on the US market. This will help investors to better understand the role of idiosyncratic volatility in the

Japanese stock market. International investors can improve their portfolio's performance by considering the importance and behaviour of idiosyncratic risk.

1.10 Outline of the Research

The thesis is organised as follows. Chapter One presents the background, the problem statement, and the objectives of the research. Chapter Two presents an overview of the relevant literature on market risks, including idiosyncratic risk. Chapter Three discusses the Japanese economy and the stock market. Chapter Four discusses the research methodology and data collection. The analysis of the data and empirical results are presented in Chapter Five. Chapter Six summarises the major findings and implications, followed by the limitation of the research and recommendations for future research.

CHAPTER 2

Japanese Stock Market, Financial System and Economy

2.0 Background

The securities system was first introduced in Japan in the 1870s' when the public bond negotiation began. The Tokyo Stock Exchange was established as the Tokyo Kabushiki Torihikijo on May 15, 1878. The trading formally began on June 1, 1878 when the exchange started to issue government bonds to former samurais. The Japanese stock markets were restructured in 1943 following World War II. The eleven individual stock exchanges in Japan, which included the Tokyo Stock Exchange, were merged to form the Japan Securities Exchange which was partially managed by the government. The floor trading was suspended in 1945 from August to December due to the war (www.tse.or.jp/english/history.html).

In 1947, the Japan Securities Exchange was dismissed with a large number of shares being reallocated to public investors due to the termination of the "Zaibatsu" conglomerates (www.tse.or.jp/english/history.html).The Stocks became popular with the securities privatization. The three stock exchanges, namely Tokyo, Osaka and Nagoya, were established in April 1, 1949 and trading began on May 16, 1949. The Tokyo Stock Exchange was reopened under the guidance of the American authorities and with the development of the new Securities Exchange Act. During the reopening of the stock exchange, 12 U-shaped trading posts were placed and the transaction prices were written on the blackboard using chalk. In July 1949, six more exchanges which included Kyoto, (merged into Osaka Securities Exchange in March 2001), Kobe (dissolved in October 1967), Hiroshima (merged into Tokyo Stock Exchange in March 2000), Fukuoka, Niigata (merged with Tokyo Stock Exchange in March 2000) and Sapporo were created in April 1950. Currently, Japan has five stock exchanges including Tokyo, Osaka, Nagoya, Fukuoka, Sapporo and Jasdaq (www.tse.or.jp/english/history.html).

The Tokyo Stock Price Index (TOPIX) was introduced by the Tokyo Stock Exchange in 1969. Since 1987, the TOPIX is calculated every minute, while the Tokyo Stock Exchange no longer uses the trading floor. The trading floor was closed in 1999 and replaced by a fully electronic system (www.tse.or.jp/english/history.html). On May 9, 2000 the Tokyo Stock Exchange introduced a new facility called "Arrows", and restructured itself as a stock company in 2001. In 2003, the Tokyo Stock Exchange commenced its operations at the Japan Securities Clearing Corporation. The Tokyo Stock Exchange Group was established as incorporation on 1st of August 2007. On October 17th the same year, the Tokyo Stock Exchange regulation was established and commenced the operations of the regulations on the 1st November 2007 (www.tse.or.jp/english/history.html).

As of December 2010, the Tokyo Stock Exchange listed 2292 domestic companies, and 31 foreign companies with a total market capitalization of USD 3.8 trillion. The operating hours are from 9.00 to 11.00am and from 12.30 to 3.00pm. There are 89 domestic and 19 foreign securities firms who participate in the Tokyo Stock Exchange trading. The average daily turnover is USD 19.2 billion over 245 trading days in year 2010. (www.wikiinvest.com/wiki/Tokyo_Stock_Exchange)

2.1 Japanese Stock Market

Japan is one of the world's largest economies and most important financial hubs. The Tokyo Stock Exchange (TSE) is the major stock exchange of the Japanese stock market. It is the world's third largest by market capitalization. The TSE trades through two primary indexes which were Nikkei 225 and the TOPIX. Currently, there are four stock exchanges operating in other Japanese cities including Osaka, Nagoya, Fukuoka and Sapporo. (http://www.tradingeconomics.com/japan/stock-market)

At the end of the 1980s, Japanese corporations were flourishing and the total market capitalization of the companies listed on the TSE was rapidly rising. Between 1983 and 1990, TSE was the largest exchange in the world with 60 percent of the entire world's stock exchange market capitalization (www.tse.or.jp). In December 29, 1989, the Nikkei reached its peak with an intraday value of 38,957.44. However, the growth was not sustainable through the economic crisis during the 1990s and the Nikkei intraday price fell. By March 10, 2009 the Nikkei 225 intraday value fell to 7,054.98, and this is 81.9% below the 1989 peak (http://m.sooperarticles.com/finance-articles/stocks-articles/history-japanese-stock-market-368868.html). This shows us that the Japanese economy was much worse off in 2009 compared to 1989.

Japan's stock market went through a re-organisation in the 21st century. For example, on 1st of March, 2000 the Hiroshima and the Niigata exchanges were both merged into TSE while the Kyoto exchange was merged into the Osaka Securities Exchange on March 1, 2000. The Tokyo Stock Exchange closed its trading floor in the year 2000 and replaced it with an "Arrow" system which is electronically operated. This move was done to improve the efficiency and increase the competitiveness of the Tokyo Stock Exchange (http://m.sooperarticles.com/finance-articles/stocks-articles/history-japanese-stock-market-368868.html). Table 2.1 shows the historical development of the Tokyo Stock Exchange.

Table 2.1: Historical Development of the Tokyo Stock Exchange

Date	Events
May 15, 1878	Tokyo Stock Exchange Co., Ltd established.
June 30, 1943	Japan Securities Exchange, a quasi-governmental organization, formed through the merger of all existing stock exchanges in Japan.
April 16, 1947	Japan Securities Exchange dissolved.
April 1, 1949	The Tokyo Stock Exchange, in its present form is founded (opened on May 16).
June 1, 1951	Margin transactions introduced.
April 2, 1956	Bond trading starts.
October 2, 1961	Second section for stocks opens.
October 1, 1966	Government bonds listed for the first time after World War II.
October 2, 1967	New auction process put into practice with abolition of "Baikai" trades (off-Exchange trades by members reported as Exchange contracts)
April 1, 1968	Licensing system for securities companies introduced in place of registration system.
July 1, 1969	TOPIX (Tokyo Stock Price Index) inaugurated (Jan. 4, 1968=100)
May 11, 1970	Trading in convertible bonds commences.
October 15, 1970	The TSE joins International Federation of Stock Exchanges (FIBV)
July 19, 1971	Book Entry Clearing System for stocks introduced.
April 2, 1973	Yen-based foreign bonds listed for the first time.
December 18, 1973	Foreign Stock Section opens.
September 24, 1974	Market Information System (MIS) put into operation.
January 23, 1982	Computer-assisted Order Routing & Execution System (CORES) introduced.
May 20, 1982	East Asian and Oceania Stock Exchanges Federation (EAOSEF) established.
May 13, 1985	Trading in new market building starts.
October 19, 1985	Trading in 10 year Japanese government bond futures starts.
September 3, 1988	Trading in stock index futures based on TOPIX begins.
October 20, 1989	Trading in stock index options based on TOPIX commences.
December 1, 1989	Trading in U.S. T-Bond futures starts.
May 11, 1990	Trading in options on Japanese government bond futures begins.
November 26, 1990	Floor Order Routing and execution System (FORES) introduced.
October 9, 1991	Central Depository & Clearing System begins operation.
July 18, 1997	Trading in equity options starts.
November 14, 1997	Off-hours trading commence.
February 6, 1998	Bond Trading Floor closes.

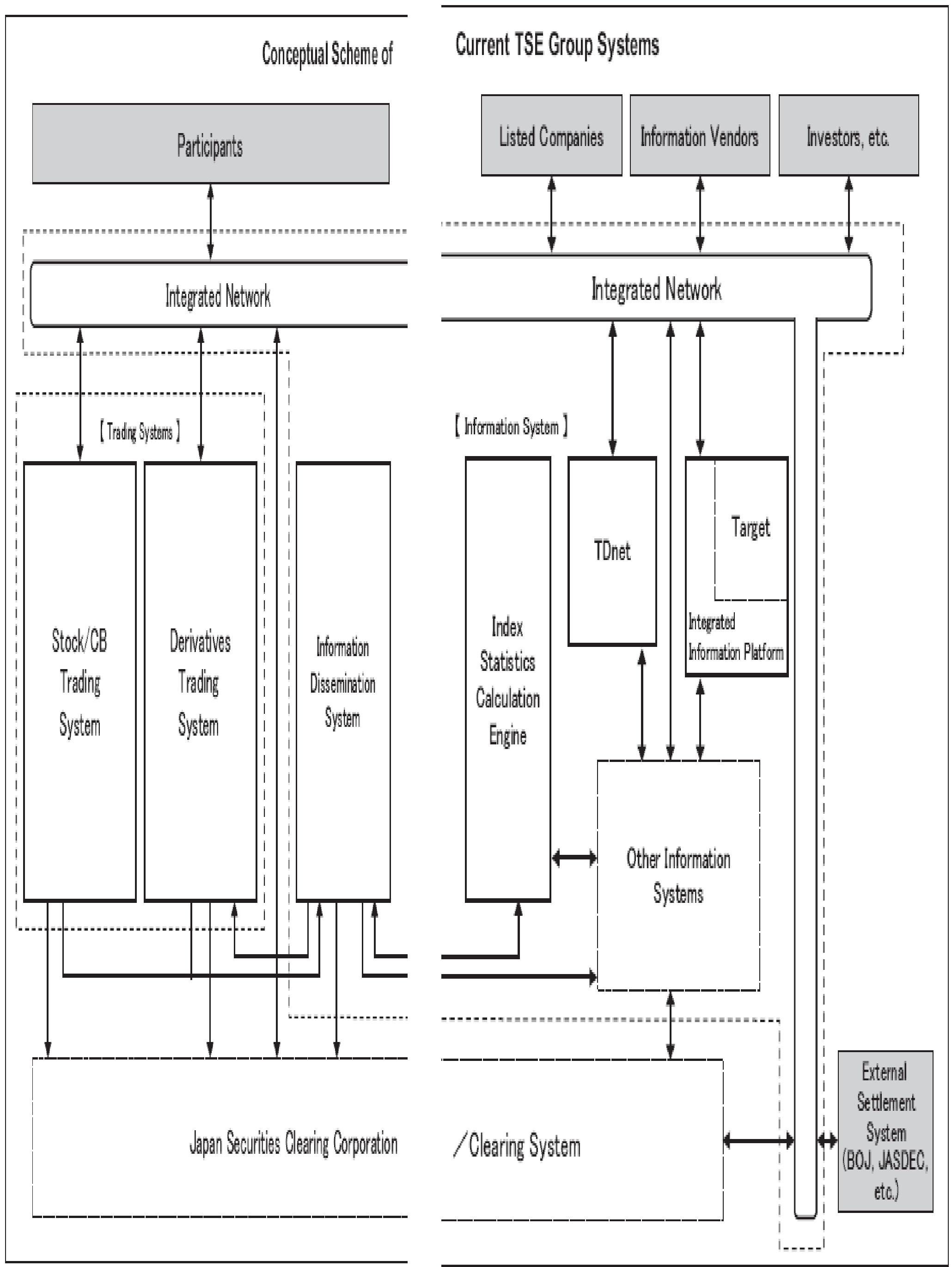
June 29, 1998	ToSTNeT-1, an electronic trading system for off-hours trading, begins operation (ToSTNeT-2 begins operation on Aug.7, 1998)
July 1, 1998	TDnet, an electronic system for listed companies' corporate disclosure, begins operation.
December 1, 1998	Restrictions on off-exchange trading for listed securities abolished; Registration system for securities companies introduced in place of licensing system.
April 30, 1999	Stock Trading Floor closes.
October 1, 1999	Brokerage commissions fully liberalized and become negotiable. Fixed number of members abolished.
November 11, 1999	Mothers (Market of the high-growth and emerging stocks), a new market section for emerging companies, established (First two issues listed on Dec.22)
March 1, 2000	Hiroshima Stock Exchange and Niigata Stock Exchange merged.
May 9, 2000	TSE Arrows (a multifunction information centre) opens.
July 17, 2000	New computerized order-routing and execution system is extended to cover all listed stocks.
November 1, 2000	Mother allows listing of foreign companies.
July 13, 2001	Trading in ETF (Exchange Traded Funds) starts.
September 10, 2001	Trading in REIT (Real Estate Investment Trusts) starts.
November 1, 2001	Tokyo Stock Exchange, Inc. demutualized and converted to a stock company.
March 1, 2002	Revisions to the Regulation for Short Selling.
June 4, 2002	The TSE and NYSE agree to share information on market surveillance.
July 1, 2002	Japan Securities Clearing Corporation, Inc., Japan's new unified clearing and settlement system, founded.
January 14, 2003	Japan Securities Clearing Corporation (JSCC) designated as securities clearing organization for cash transactions on the TSE.
September 16, 2003	Calculation and publication of TOPIX 1000, Tokyo Stock Exchange Mothers Index, and Tokyo Stock Exchange REIT Index on a real-time basis begins.
February 2, 2004	Clearing organization for futures and options transactions changed from the TSE to Japan Securities Clearing Corporation.
April 21, 2004	Opening of TSE Academy
October 12, 2004	World Federation of Exchanges (WFE) General Assembly and Annual Meeting held in Tokyo.
February 7, 2005	Stocks of Listed Foreign Companies (excluding Mothers listed issue) allocated to the 1st Section.
March 15, 2005	Establishment of the corporate philosophy of the Tokyo Stock Exchange.
July 4, 2005	Opening of the TSE Information Station.
October 31, 2005	Commencement of transition of TOPIX index to a floating share base (first stage of free-float weight implementation).
February 28, 2006	Second stage of free-float weight implementation.
June 30, 2006	Third stage of free-float weight implementation.
September 7, 2006	Establishment of informal meeting on listing system maintenance.

October 3, 2006	Change of TOPIX 1000 FLOAT Customized Index to TOPIX 1000 CSR.
January 31, 2007	The TSE and NYSE Group enter into a strategic alliance.
February 23, 2007	The TSE and the London Stock Exchange make a cooperative agreement to improve the international presence of both exchanges.
March 12, 2007	Introduction of off-auction block trading in options.
August 1, 2007	Tokyo Stock Exchange Group established.
November 1, 2007	Tokyo Stock Exchange Regulation established.
December 3, 2007	Formulation of the S&P/TOPIX150 Shariah Index.
January 15, 2008	The New Derivatives Trading System introduced.

Source: Tokyo Stock Exchange webpage

The Tokyo Stock Exchange used a system called ‘Arrowhead’. The new system handled all the trading of cash equities such as stocks and convertible bonds. The features of the system include a response period of 10 milliseconds or less and a back-up of trading orders and executions in a three-node back-up memory (www.tse.or.jp/english/rules/equities/arrowhead/). Figure 2.1 shows how the participants, the listed companies, the information vendors and investors send and receive information through an integrated network. The integrated network transfers all the information to the trading and information systems using the ‘Arrowhead’. The trading and information systems will then transfer the data to the Japan Securities Clearing Corporation where it will go through an external settlement system such as those of the Bank of Japan and the JASDEC (www.tse.or.jp/english/rules/equities/arrowhead/).

Figure 2.1: Tokyo Stock Exchange System



Source: (http://m.sooperarticles.com/finance-articles/stocks-articles/history-japanese-stock-market-368868.html)

Table 2.2: Names of the System and Related Products

	Name	Products related to the systems
Trading systems	Stock trading system	All stocks, preferred shares, real estate investment trusts etc.
	CB trading system	Convertible bonds, bonds with warrants, exchangeable bonds, foreign convertible bonds.
	Derivatives trading system	-TOPIX Futures, TOPIX options, Equity Options, JGB (Japanese Government Bonds) Futures. -Stocks and domestic convertible bonds, futures and options etc. on ToSTNET trading.
Information system	Information dissemination system	All TSE products, major products of five other exchanges (**)
Clearing system	Clearing system	All TSE products

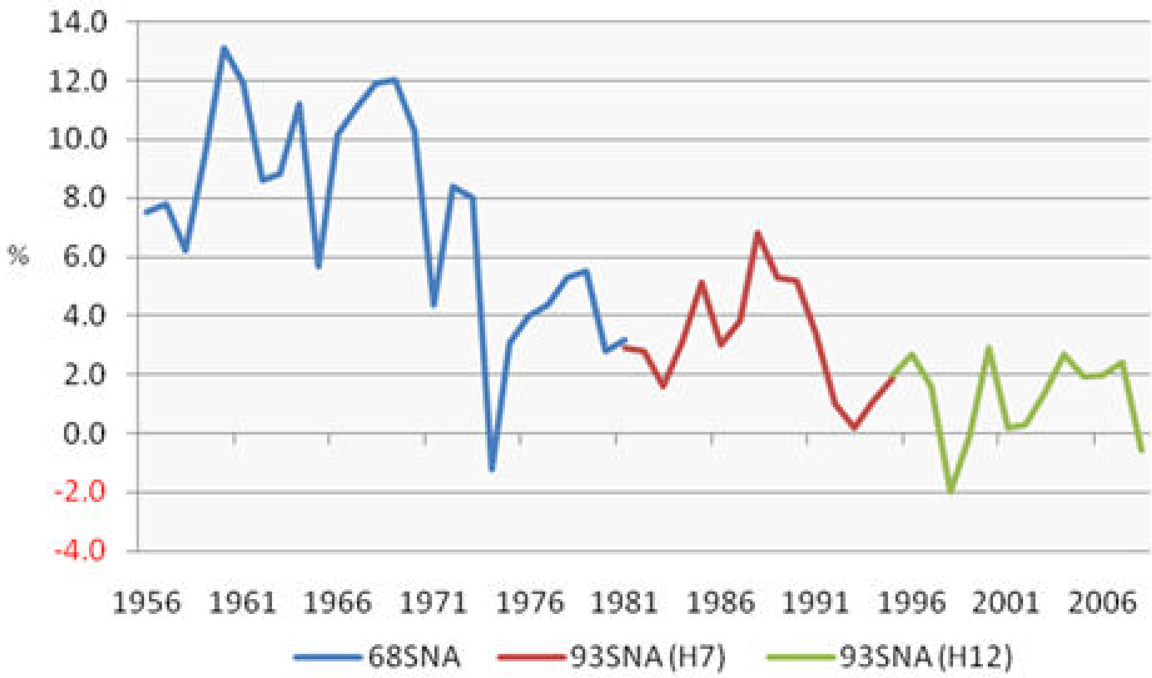
(**) "Five other exchanges" includes Osaka, Nagoya, Fukuoka, Sapporo and Jasdaq.

2.2 The Japanese Economy

A comprehensive account of the Japanese economic history is beyond the scope of this research; therefore, only a brief summary of the events taking place during our sample period from 1980 to 2007 as background information will be discussed.

The Japanese economy was growing remarkably with an average annual GDP growth of about 10 percent from the 1950s until the 1970s (www.nationasencyclopedia.com/economies/Asia-and-the-Pacific/Japan). Japan became the world's largest economy by the 1970s with one of the world's highest standards of living for its population. However, Japan's economic and political stability went through a series of fluctuations during the 1980s to 2007. In the early 1970s, the Japanese economy faced a short period of economic distress, but it managed to achieve significant economic and financial growth and political stability from 1975 to 1989. However, Japan faced economic distress again in the 1990s. Even though the economy showed signs of recovery in the mid 2000s, the economy stayed on the path of decline and stagnation until 2005. This is clearly showed in Figure 2.2 with the percent changes of real GDP growth rate from the preceding year in Japan from 1956 to 2008.

Figure 2.2: Real GDP Growth Rate in Japan (1956-2006)
(Percent change from preceding year)



(source: Cabinet Office, Government of Japan)

Note:

68SNA: real GDP growth rate from 1956

93SNA (H7): real GDP growth rate from 1981 to 1995 (H7 means 1995)

93SNA (H12): real GDP growth rate from 1995 to 2006 (H12 means 2000)

In October 2007, Japan's longest post-war period of economic expansion ended after 69 months. The Japanese financial sector was not heavily exposed to sub-prime mortgages or their derivative instruments and it weathered the initial effect of the global credit crunch by a meltdown in the U.S. market for subprime mortgage loans (Cargill, 2008).However, a sharp downturn in business investment and in the global demand for Japan's exports in late 2008 pushed Japan further into a recession. The 10-year privatization of Japan Post, updated its functioned not only as the national postal delivery system but also through its banking and insurance facilities, as Japan's largest financial institution, began in October 2007. The privatization will push Japan to more efficiently allocate capital and account for risk. In this case, the Japanese government will be forced to become more prudent. Since the postal service would no longer be required to purchase government securities, Japanese Government Bonds would have to be sold to private investors. Japan Post would deal with chronic budget deficits and it will need to perceive a risk-reward ratio that effectively balances the ability of Japanese Government Bond's to provide stability, liquidity, diversification and Yen exposure with the interest rate provided. The Japan Post privatization has marked a major milestone in the process of structural reform with privatizing Japan's postal savings system that is the largest financial institution in the world with deposits totalling approximately $3.3 trillion (www.asianresearch.org/articles/html).

After the March 11, 2011 earthquake, Japan's economy has continuously faced a downward pressure on the production and the exports have declined sharply. Domestic private demand also weakened due to the natural disaster. However, the economy has been showing some signs of recovery over time with the supply side starting to grow and households and business starting to improve. When productions begin increasing, exports are also expected to go up to reflect the improvement in overseas economic conditions. Business fixed investment, housing investment and public investment will increase gradually due to growing demand for restoring capital stock. On the other hand, when production recovers, private consumption will also recover gradually due to improvement in household sentiment (Bank of Japan Monthly Report of Recent Economic and Financial Developments, 2011).

As of June 2011, the three month rate of change in domestic corporate goods prices is rising due to an increase in the international commodity prices. The change in consumer prices increase over time. After the earthquake, the domestic corporate goods prices are expected to slow down for some time. The weighted average of the overnight call rate has been below the 0.1 percent level, and interest rates remain unchanged while the value of the Yen against the U.S dollar has risen compared to May 2011. The overnight call rate has remained at an extremely low level and the declining trend in firm's funding costs has continued. As for the credit supply, firms have continued to see financial institutions on an improving trend. When it comes to credit demand, firms have recently showed signs of increasing their demand for working capital. In general, the financial conditions have recovered slowly and weakness has been observed in the financial positions of some small firms (Bank of Japan Monthly Report of Recent Economic and Financial Developments, 2011).

2.3 The Rebound Economy (1980-1985)

Most of the countries in the world were puzzled with the Japanese economy because Japan seemed to achieve economic and political stability where Japan's national wealth stood at 1,363 trillion yen, 5.6 times GDP at the end of 1980. It then increased, reaching 3,531 trillion yen, 8.0 times GDP, at the end of 1990, due to the increasing land and stock prices (http://www.stat.go.jp/english/data/handbook/c03cont.htm).

In 1979, another oil shock broke out following the doubling of oil prices by the oil exporting countries. The response of most of the countries to the oil shock was to inflate the economy by using central bank policies to off-set the adverse effects of the higher oil prices on the real GDP. For example, the European Central Bank is planning to raise interest rates in response to the current higher oil prices in a bid to keep inflation under control. By doing so, European consumers and companies will be negatively impacted by both the higher cost of fuel and the higher cost of borrowing (Cargill, 2008).

Japan's central bank policy was based on a long-run trade-off between inflation and traditional Philips curves. Central banks throughout the world tried to offset the recessionary pressures of the oil shock and maintain employment rates but their efforts failed due to the high inflation rates. Thus most central banks have to intervene to deflate the economy which led to an economic downturn. Some of these countries went into "stagflation" for example Hong Kong, Ireland and United States. In contrast, Japan managed to avoid the stagflation (Cargill, 2008). Even though the oil shock incident did not affect the Japanese economy as severely as the first oil shock, the Japanese economy did experience a sharp drop. Since then, Japan has come up with some measures to cut down oil imports, making them the world's most energy efficient nation. In the 1960s, the importing of energy made up 3% of the country's GNP but the country managed to cut that down to 1.6% by 1984. The second oil shock affects the Japanese economy by altering the growth rate. The growth rate of the economy dropped from 5.3% in 1979 to 3.7% in 1980, but returned to above 5% by 1984 (Lincoln, 1988).

Since 1984, the Japanese economy grew rapidly, allowing Japan to overtake the US per-capita income in 1987. There was an increase in purchasing foreign assets and foreign direct investment following the economic growth in the 1980s, with the total Japanese overseas investment amounting to US$227.2 billion between April 1986 and March 1991. The purchase of foreign assets includes companies, real estate, government bonds and shares and the US government budget deficit was partly financed by Japanese money (Smith, 1998).

In 1985, Japan became the world's largest creditor nation; the Japanese banks were the largest in the world and they appeared to be sound and stable. However, political problems occurred between Japan and the US during the 1980s. Their relations declined sharply because many Americans thought that the Japanese were benefiting at their expense where Japanese were using the money earned from trading to buy up American property, companies, movie studios, including the giant high-tech companies (Smith, 1998).

Exports were one of the most important factors that helped the Japanese economy to recover from the second oil crisis. Japan's export trade includes automobiles, which increased by 50% from 1979 to 1980, and the electronic components which competed with the key US industries. During the post-war period, the US was Japan's most important trading partner, but since 1959, trade conflicts have existed between the two countries over certain products. The US resolved some of the problems with fixed prices or quotas for Japanese exports. It was difficult for American companies to compete with Japanese companies in Southeast Asia, especially in the semiconductor industry where in 1986, Japan produced 40% of the world supply (Fransman, 1995).

Japan's exports have prospered because of several factors, including the undervaluation of the yen which made Japanese exports competitive, while the US dollar was overvalued due to the Reagan administration's fiscal policy (Mundell, 2000). Japanese goods were in great demand in the US, and the Japanese collaborated to increase the value of the yen while reducing the value of the US dollar. American politicians declared that Japan's economic structures showed that the US businesses were not operating at a level playing field in Japan. The US Senate called Japan an "unfair trading partner" in March 1985, which pressured Japan to make some structural changes in its economy. Criticism and threats continued but the conflicts did not cause any major problems. The Japanese government is very sensitive to foreign criticism, and since then they have begun to deregulate its financial systems, allowing foreign financial institutions to compete with local insurance companies, securities firms and banks (Smith, 1998).

2.4 The "Bubble Economy" (1985-1990)

Japanese politics and economy reached a peak in 1985 when it seemed that Japan was immune to the financial crisis that caused major problems to the rest of the world. Japan's GNP grew between 2.6% to 6.2% each year between 1985 and 1990 (Cargill, 2008). In October 1987, the world's stock markets crashed. In the days between October 14 and October 19, 1987, the major stock market indexes in the United States dropped 30 percent or more. On October 19, 1987, the Dow Jones Industrial Average dropped 508 points, losing 22.6% of its value. The S&P 500 dropped 20.4%, falling from 282.7 to 225.06. This was the greatest loss Wall Street had ever suffered on a single day (www.hnn.us/articles/895.html). Even though Japan's stock exchange was affected by the world stock markets crash, Japan's stock exchange recovered fairly quickly compared to other major exchanges. This is because Japanese companies were financed by the domestic economy to sustain economic growth. Interest rates consequently became extremely low and banks were liquid which led them to finance customers purchasing real estate, land, shares, bonds, etc. As a result, real estate prices became extremely high while share prices increased by 120% between October 1987 and December 1989 (Cargill, 2008). This situation created a "bubble economy", where companies, corporations and individuals inflated their current holding assets to borrow more money from the banks in order to buy more assets. Banks financing helped real estate prices to double from 1986 to 1990 and most people spent recklessly and on credit (Cargill, 2008).

Moreover, a land boom began in Japan together with the deregulation of banks and real estate boom. Land was used as collateral for loans. A huge amount of land in Japan was bought and sold by the investors with higher prices which caused severe inflation. The deregulation policy reduced the interest rates down to only 2% and people started to take loans one after another. In 1990, the Japanese government announced that the interest rates were to be raised. Investors started to panic and speculating started. They stopped buying land and eventually the prices went down. On the other hand, domestic capital investment, heavy consumer spending and the bubble economy managed to sustain high levels of economic growth, a situation that is not sustainable. It turned Japan into an "accident waiting to happen", where any shock to the system would create economic and financial distress. The collapse of the asset prices in 1990 to 1991 was the result of the bubble economy (Cargill, 2008).

The burst of the "bubble economy" started in May 1989 when the Bank of Japan increased the discount rate to overcome the inflation and asset price inflation. In December 1989, the new president of the Bank of Japan increased interest rates to 4.25 percent from 3.25 percent (www.nytimes.com/1989/japan-raises-interest-rates.html). Meanwhile the Japanese stock market revealed that stocks and shares were overvalued by 400% of the market value. In the first half of the 1990s, the Tokyo Stock Exchange lost 48% of its share value while the real estate prices plummeted due to the announcement made by the Japan government to increase the interest rates (www.nytimes.com/1989/japan-raises-interest-rates.html). The financial institutions were left with mountains of debt secured by real estate and shares that had plummeted in value, with most of the debt being categorized as non-performing loans. According to the Japanese Ministry of Finance in January 1998, the debts or non-performing loans totalled around US$361 billion leading to Japan's economy falling again to the post-war recession levels. By the end of the

1990s the Japanese banking system was insolvent where assets were valued at market prices. However, the government made extraordinary efforts to prevent failures of large corporations. Those bad loans were replaced with new loans even when they had little chance of repayment (Smith, 1998).

Japan's bubble economy collapsed at the start of the 1990s. The Government and the Bank of Japan (BOJ) caused the collapse by trying to cool down the bubble. In 1989, the Bank of Japan changed to a tight-money policy and, in 1990, raised the official discount rate to 6%. In 1990, the Ministry of Finance requested that banks restrict their financing of property assets and the Government introduced a new system of land taxation (including a land holding tax) in the hope of destroying the "land myth". The Nikkei Stock Index and the price of land fell from their highs in December 1989 and autumn 1990, respectively (Smith, 1998).

After the bubble, the Japanese economy entered a long period of stagnation. The economy picked up several times during the 1990s, but a full recovery never happened. Financial institutions ended up with very large levels of non-performing loans as a result of the collapse in the share prices and the land values (Smith, 1998). Corporations suffered from the "three excesses": excess capital investment, excess employment, and excessive debt. Moreover, the Japanese economy had fallen into a deflationary spiral, a vicious circle where falling corporate profits lead to declining capital investment, falling employment, falling wages, stagnating consumption and to further declines in corporate profits (Smith, 1998).

Government negligence and the failure of the government economic policy to write off the non-performing loans were the major causes for the prolonged economic stagnation. Japan's economic performance in the 1990s can be referred to as a "lost decade" in terms of lost financial and economic development. Since the economic problems have continued into the new millennium, it might be appropriate to refer to Japanese economic stagnation over the 1990-2005 period as a "lost decade and half" (Kobayashi and Inaba, 2006).

2.5 The Depressed Era (1990-2001)

The recession started in 1990 with the collapse of asset prices, share prices and disinflation. Most Japanese were affected by the decline in share prices and asset values as the large population was facing the problem of financing the credit spending. The credit revolution started in 1985 when consumers borrowed from banks to buy land and real estate, with credit card spending on consumer goods. The debts grew from 9 trillion Japanese Yen in 1979 to 67 trillion Japanese Yen in 1991 (Wood, 1991). The bursting of the bubble led to a reduction in consumer spending and to an increase in savings. For example, in 1992, the net household savings rate increased from 13.9% to 16.5% and consumer spending decreased from 3.5% to 2.5%. In 1992, growth slowed to 1.3%, and in 1993 the GNP decreased by 0.2%. This downturn caused the wage rate to decline from 8.3% in 1990 to 3.2% in 1992 (Siddiqui, 2009).

From late in1997 to early 1998, Japan was on the verge of collapsing. Asset values and stock prices started falling in 1995 and deflation continued until 2007 (Hull, 2008). The unemployment rate doubled to around 5 percent, last seen back in the pre-1990 period. There are various reasons for this deflation in Japan. First is the fall in asset prices, as there was a large price bubble in both the equities and the real estate in Japan in the 1980s. Secondly, the bank lent to the companies that became insolvent and individuals who invested in the real estate. When the real estate values dropped, banks would try to get back the loans, but due to the reduced real estate values, the companies were unable to pay off their loans. Banks would delay the decision to collect the loans hoping that the asset prices would increase, and some banks even loaned more to these companies to service their previous debt (Kobayashi and Inaba, 2006). This process is known as "unrealized loss" and it proved to be a deflationary force in the economy.

Thirdly, the "insolvent" banks with a large percentage of "non-performing" loans were unable to lend more money until they increased their cash reserves to cover the existing "non-performing" loans. For example, the banks ran out of funds and therefore they increased their cash reserves to lend to the customers (Cargill, 2008). If there is a huge amount of "non-performing" loans, fewer funds will be available for lending to boost economic growth. Since most of the banks in Japan were insolvent banks, the Japanese preferred to buy gold or treasury bonds instead of putting money into their bank accounts. In addition, most of the Japanese prefer owning real estate as a form of savings, and the financial and economic downturn coincided with some political instability.

An important political reform took place in the summer of 1993, when the Liberal Democratic Party (LDP), which ruled Japan for 38 years, lost the election and Japan came to a period of political uncertainty where strong government action was needed to overcome the recession (Cargill, 2008). The economy showed signs of recovery in 1996; however, the economy growth decreased by 1.4% between April and September 1997. After the election, the ruling power was in the hands of the Koizumi administration (2001-2006). Koizumi significantly reduced the power of the faction by depriving their power of cabinet post assignment and policy making control (Cargill, 2008).

2.6 The Koizumi Era (April 2001 – September 2006)

With the pressure of a recession, the Japanese public wanted a change by the end of 2000, which presented a good opportunity for Koizumi. He was elected as Prime Minister of Japan in April 2001 and his term ended in September 2006. Japan overcame significant political and economic changes during the Koizumi administration, which was characterised by Koizumi's unconventional ruling approach. First, Koizumi set out to replace the "old" LDP which was unresponsive to the public outcry. Secondly, he came up with the slogans "There will be no economic recovery without structural reform" and "Structural reform without sanctuary", which reflected his approach as more aggressive than his predecessors (Cargill, 2008). He wanted to overcome the huge non-performing loans problem in the banking system and bring about more privatization and deregulation in order to increase efficiency in the Japanese economy. Thirdly, he privatized the Postal Savings System (PSS) and restructured the Fiscal Investment and Loan Program (FILP) budget. The most significant part of Koizumi's work was his economic policy which was markedly different from the former prime ministers. In terms of economic policy, he focused on the supply side which he referred to as "structural reform" (Cargill, 2008).

The Koizumi administration thought that Japan's stagnation was caused by supply side inefficiencies; therefore, they asked firms to cut down on unnecessary employees and to promote the closure of inefficient firms. Koizumi also cut down fiscal spending since it is commonly believed that the public sector is supposed to be less efficient than the private sector. Even though the Hashimoto and Koizumi administration kept reducing the spending, the national debt continued to increase. Growth also became negative since Koizumi's structural reform, because tax revenue decreased more than the reduction in fiscal spending as shown in a Bank of Japan report where in year 2000, general government net debt is 59.9% as a percentage of GDP and 65.2% in year 2001 respectively (Hiroshi, 2008).

2.7 Beyond September 2006

Shinzo Abe replaced Koizumi as Prime Minister of Japan after the election in September 2006. He tried to maintain the reform effort introduced by Koizumi, but he attempted to differentiate his administration from that of the previous prime minister by introducing nationalism and patriotism (Cargill, 2008). Nevertheless, the Japanese are more concerned about financial and economic outcome. Abe's political skills and the scandals during his administration caused him to lose the September 2007 elections by a devastating margin, with Yasuo Fukuda being elected as Japan's new prime minister. Yasuo had to overcome a lot of obstacles during his administration, including various socioeconomic problems such as the unequal distribution of wealth. However, the recovery of Japan's economy started in 2005 with increasing small and medium enterprises (Cargill, 2008).

Second, Japan cannot be judged as fully recovered from fifteen years of a depressed economy as the recovery process is not consistent and permanent. The economy depended on the export sector and the real GDP was increasing marginally by 1 or 2 percent which was not enough to impress policy makers. Third, Koizumi's policy of deregulation and liberalization has gone too far and generates negative effects on the economy (Cargill, 2008).

Finally, the external challenges faced by Japan such as the rise of the Chinese economy, which poses a severe threat to the health, growth and performance of the economy. As of July 2009, China's official GDP growth was 7.1% which is remarkable during a period where the rest of the world is fighting a recession. Japan needs to pay attention to other emerging economies which bring competition; therefore, they need to improve the overall productivity and efficiency of their economy (Cargill, 2008). For example, Euler Hermes press reports that South Korea's technology exports now exceed those of Japan and South Korea recorded a strong rebound, with exports up by nearly 30% compared with 2007. The fall in Japanese exports is directly linked to the slump in the US market, which in the past four years has dropped from 17 million vehicles sold to 11.5 million (http://www.eulerhermes.com/economic-research/economic-news.aspx#l).

2.8 Japanese Financial System

In the 1980's, the Japanese financial system was widely known as a model to both the developed countries and the emerging economies. The strength of the Japanese financial system contributed to its reputation in international markets. Japan had one of the highest savings rates in the world and ultimately these funds were transformed into Japanese firms' investments. In the mid-1980s, Japan became the world's largest creditor by owning four of the world's biggest banks, the world's largest insurance company and advertising companies and by having the largest stock market. Japan's financial and banking industries grew at an abnormal rate for the remaining of the 1980s.

The beginning of the 1990s evidenced the end of Japan's high growth period. Important political reforms took place in the summer of 1993, when the Liberal Democratic Party (LDP), which ruled Japan for 38 years, lost the election and Japan came to a period of political uncertainty where strong government action was needed to overcome the recession. The reform took place due to the burst of the financial bubble that had affected the Japanese economy in the 1980s and the political ambitions to implement Japanese style Big Bang in the domestic financial markets. However, the reformation did not transform the financial system to be more efficient and distinct. The Nikkei index fell from its peak of ¥38,917 in December 1989 to ¥14,309 in August 1992 and the land prices in Japan metropolitan commercial areas declined from one-fifth to one-quarter of their peak level (Kuroda, 2003). The banks faced a huge amount of non-performing loans for which the securities and properties that served as collateral had become worthless. The reputation of the Japanese financial markets and institutions worsened dramatically in international markets. Therefore, reformation on deficiencies of Japan's securities markets and payment systems are needed due to the weaknesses in the Japanese financial system.

According to Herring and Chatusripitak (2001), financial infrastructure quality indicators showed that Japan in many respects is on a par with financial markets in the UK and US. The quality of the accounting standards is well above the average of Asian countries and there are few restrictions on the press so that an overall transparency can be achieved. However, Japan is not on the list of economies with respected and trusted regulatory frameworks in East Asia. Japan's markets are known as non-transparent as and less sophisticated than its competitors in the region. In general, most people view "Australian, Hong Kong and Singaporean markets as 'cleaner' and healthier than Japan."(De Brouwer, 2003).

The main elements of Japan's financial system were similar to the other major developed nations: a commercial banking system, which accepted deposits, extended loans to businesses, and dealt in foreign exchange; equities market which have securities companies that provided brokerage services, underwrote corporate and government securities, and dealt in securities markets; capital markets which deals with bonds, which offered the means to finance public and private debt and to sell residual corporate ownership; and money markets, which offered banks a source of liquidity and provided the Bank of Japan with a tool to implement monetary policy (De Brouwer, 2003). Table 2.2 shows the main events affecting the Japanese financial markets (see Appendix 1.1).

Following the Japanese banking crisis in 1990, the Bank of Japan emphasizes the inherent risk in the financial markets especially the idiosyncratic risk or systematic risk and the failures of the Japanese banking system. Systematic risk is the risk that the financial system will fail to function properly due to widespread distress. A failure of the financial system implies that capital will not be properly allocated and that viable potential projects will not be undertaken. Banks play a special role in the economy. Bank failures are widely perceived to have greater effects on the economy and therefore considered to be more significant than the failure of other types of business firms. Bank failures are known as more damaging than other failures because the domino effect may spread throughout the banking system, affecting both solvent and insolvent banks. During the banking crisis, banks curtail lending and hoard liquidity worried that there might be a contagious spread across the financial markets.

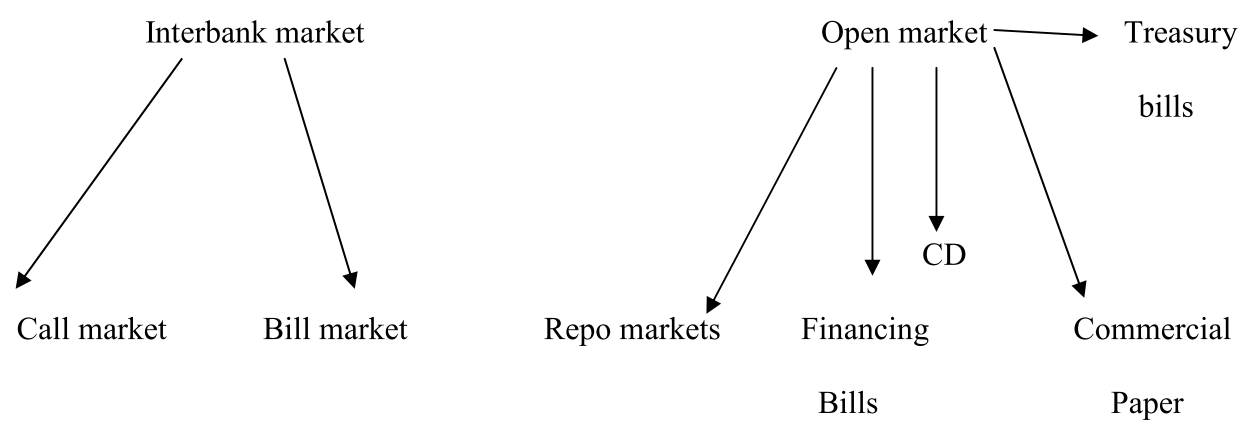
The banking industry has a symbiotic relationship with macroeconomic conditions of a country. For example, when a banking crisis occurs in Japan, the macroeconomic conditions are impacted such as unemployment rate increases and GDP will decrease. After the Japanese banking crisis, the Bank of Japan came out with new policies to stimulate the macro economy to get banks to lend. The three policy interventions include: first, Blanket Capital Infusions where 13 trillion yen were poured to recapitalized banks and 17 trillion yen was spent to protect depositors. Second the Risk-Based Capital Infusions where 75 trillion yen was injected by the Bank of Japan targeted to cover banks with non-performing loans. Third, Land revaluation where all Japanese banks can add 45 percent of their unrealized gains on land to Tier 2 capital accounting change (http://www.boj.or.jp/en/research/brp/fmr/index.htm/).

The objective of the policy interventions is to relax capital constraints in order to stimulate bank lending. However, policies such as the accounting rule changes and the blanket capital injections do not stimulate aggregate bank lending activity in the country. This is because accounting rule changes will only help reallocate credit from residential to non-residential real estate lending while public injections of capital must be large and target risk exposures in order to stimulate aggregate bank lending in the Japanese banking crisis. (http://www.boj.or.jp/en/research/brp/fmr/index.htm/)

2.8.1 Money Markets

Japan's financial market has limited the ability to bring significant contributions to its economic function. The shortfalls have occurred either in the elements themselves or in the way they are used, for example the money markets (Kuratani and Endo, 2000). In Japan, there are two types of money markets which include the interbank market and open market that can be accessed by both the financial institutions and the non-financial corporations. Figure 2.3 below shows the products involved in the interbank market and the open market. The interbank market consists of the call market and the bill-discount market whilst the open market consists of repos or bond purchase agreements, commercial paper (CP), negotiable certificates of deposit (CDs), financing bills (FBs) and Treasury bills (TBs)(Kuratani and Endo, 2000). Moreover, the Japanese foreign exchange market consists of a dollar call market and an offshore market.

Figure 2.3: Money Market



The interbank market was the most important domestic source of short-term funds for Japanese banks up to the late 1990s. In the 1990s, the interbank market accounted for more than 40 percent of the money market (including the dollar call market). According to the Japanese

Bankers Association (2001), the oldest market segment in the yen call market was established in 1902. The Yen call market maturities range from a half a day to several days. On the other hand, the bill market, with transactions usually lasting from one to three months, was introduced in 1971. Money market brokers (tanshigaisha) play its role as intermediaries in both call and bill market. The money market brokers were private non-banking organizations who obtained their licenses from the Ministry of Finance that put them in syndication position. They are empowered with borrowing privileges from the Bank of Japan and the central bank uses its influence on them to endeavour a far-reaching control over the Japanese money market (Baum and Hayakawa, 1994).

In normal circumstances, the money market operates as follows: The lender bank transfers deposit to a money market broker which will then receive a promissory note. The borrower bank gives the promissory note to the broker receiving the lender's deposit. A settlement will then take place on the bank's account kept with the Bank of Japan that functioned as a clearing house in the financial market (Baum and Hayakawa, 1994).

The open market was established in the late 1940s and the oldest segment was the gensaki market. In the open market, bonds were sold or bought under the agreement to buy or sell them back on a fixed date at a fixed price. Most of the players in the open market were financial institutions, public bodies, business firms and foreign investors since 1979. The main buyers were public institutions and non-financial companies, whilst securities firms were the main sellers. The maturity dates were up to one year to allow the long-term paper to convert into short-term debt. The gensaki market had been the only market free from central bank interventions and interest rate restrictions for several years. In March 2002, gensaki transactions were abolished and replaced by new repurchase agreements. Besides repurchase agreements, the third type of repo market known as cash-collateralized bond lending became the dominant repo market (Bank of Japan, 2002). However, the popularity of the repo markets as a whole was declining. In the year 2000, the outstanding repo amount was ¥22 trillion, but by the end of 2001, the outstanding amount had decreased drastically to ¥6 trillion.

In May 1979, certificates of deposit rapidly took over the gensaki market. In 1981, 1986 and 1987, financial bills, Treasury bills and commercial paper were established, respectively. In 1985, large-denomination time deposits, bearing market rates and money market certificates were introduced to the Japanese financial market (Kuroda, 2003). The commercial paper was first introduced in November 1987 and in December 1988 the range of available maturities was made wider. In the first half of the 1990s, the domestic securities companies, the non-banks and the insurance companies were allowed to issue commercial paper and these were followed by foreign securities companies in April 1996. Since the deregulation in 1998, the money market became important since banks were now able to issue commercial papers and corporations could directly approach the end-investors (Ogawa, 2003).

The regulation also applies to international activities of Japanese financial institutions and companies that traded yen in international markets such as Euromarkets. The euro yen markets are markets for financial products denominated in yen and traded outside Japan. The biggest euro yen market is based in London and other centres are New York, Hong Kong and Singapore (Ogawa, 2003). The trading instruments consist of euroyen deposits, certificates of deposit, commercial paper, loans and bonds. Even though these instruments are free from interest rate controls and legal reserve requirements, the Japanese banks hold the largest shares in those markets. Therefore, they are exposed to various types of government influence.

The Japanese foreign exchange market consists of the dollar call market and the Tokyo Offshore Market. The Tokyo Offshore Market was established in December 1986 to develop Tokyo as an international financial centre. The participants are authorized foreign banks mediating between non-residents. As compared to the euroyen market, the offshore market is open to foreigners only. However, the trading volume is low and even declining since the late 1990s. The main reasons for its low popularity among foreign investors were the non-existence of securities trading and the high taxes imposed on every transaction deal (Hall, 1993). On the other hand, the dollar call market was established in April 1972. The role of the dollar call market was to enable Japanese banks without access to the Euromarkets to take short-term positions in a foreign currency. In normal circumstances, the most active trading happens in short-term transactions with maturities of two to seven days (Wohlmannstetter, 1991). After the introduction of the dollar call market, trading volumes grew tremendously following the deregulation of capital transactions in December 1980 and soon exceeded the yen call market. However, the dollar market declined again after the establishment of the offshore market during the end of 1980s and thereafter.

Since the 1990s, the weight of the various types of money market has changed. Financing bills has taken over the importance of the yen call market. Financing bills are government securities with maturities of three months or less that are issued to cover temporary fiscal shortfalls. They were introduced to the market in 1973 via public auctions at a fixed interest rate below the official discount rate while treasury bills are zero-coupon short-term government bonds with maturities of up to one year (Wohlmannstetter, 1991). In 1999, the markets for Treasury bills and Financing bills became the core markets for the operations of the Bank of

Japan. The bill markets have to make their interest rates comparable or even more attractive to gain market share in the money markets.

The Bank of Japan has tried to cut down the interest rate over the years to stimulate the economy. From February 1999 to August 2000, the Bank had pursued a "zero-interest rate policy". In August 2000, the Bank switched their approach to "quantitative easing policy" to focus on bank liquidity. Therefore, the daily target for bank deposits with the central bank has increased to 5 trillion yen from the initial 4 trillion yen in March 2001. It exceeded 15 trillion yen in February 2003 and increased to 24 trillion by March 2003 (Tomita, 2003). The main objective to increase bank deposits was to equip banks with excess funds to push borrowing rates as low as possible. As a result, trading in the call market almost came to an end. Financial institutions parked their money in the overnight market with interest rate less than 0.001 percent a year (Tomita, 2003). In other words, the Bank of Japan policy was not successful. It has deteriorated the markets instead of boosting the economic condition. Interest rates no longer play a role as the signals of scarcity of short-term finance in the economy but as the indicators of the monetary systems. The liquidity created by the central bank did not flow into the economy, and the companies and the consumers are not willing to spend while banks still carry the burden of bad debts (Tomita, 2003). As for Japan, the signs of deflation became the first significant ones in international markets.

In mid-December 2002, the euroyen interest rates turned negative. Japanese banks began raising US dollars by converting yen through currency swaps by paying forward discount on the dollar to enable the counterparty from Europe and US to make profits from the interest rates (Tomita, 2003). The monetary policy used by the Japanese government does not serve the purpose to meet the economy's short-term financial needs, but make its way into foreign currency. The daily trading volumes in foreign exchange swaps increased dramatically over the years and surpassed the cash market. The development reflects the economic indicators in the Japanese economy since 1980s with a breakdown of the traditional relationship between real and financial transaction of the economy.

2.8.2 Equities Markets

Japan's financial system has long suffered from functional separation between the banking and the securities businesses. The law concerning the reform of the financial system in April 1993 abolished the separation and allowed the banks to set up their own subsidiaries regarding securities trading. In July 1993, two long-term credit banks, two trust banks and Norinchukin Bank established the first securities subsidiaries. The Bank of Tokyo followed the trend in October 1993 with the approval of Ministry of Finance (Kuroda, 2003). Following June 1998, the Big Bang and the Financial Reform Law was implemented. From December 1998, banks were allowed to engage in direct sales of securities investment trusts and over the counter derivatives. The remaining restrictions on securities subsidiaries were cancelled in October 1999. After the reforms and deregulations, the financial markets became more competitive but the equities trading did not increase remarkably. From 1990 to 1999, Japanese flow of funds accounts showed that the share of bank loans in financing the non-banking business was at 39 percent (Baba and Hisada, 2002).

According to the Tokyo Stock Exchange, as of December 2010, there are six stock exchanges in Japan. These are Fukuoka Stock Exchange, JASDAQ Securities Exchange, Nagoya Stock Exchange, Osaka Securities Exchange, Sapporo Securities Exchange and Tokyo Stock Exchange. Most of the trading is concentrated in Tokyo and to a smaller extent in Osaka. According to Schade (1990), Osaka stock exchange is the world's oldest futures exchange, originally the Dojima Rice Exchange which was established in the early 18th century under the

Tokugawa rule. Osaka was the country's main financial centre during the Meji era (Reszat, 1998). Moreover, Japan's oldest stock exchange is the Tokyo Stock Exchange (TSE), established in 1878. Each stock exchange has their unique financial products. Osaka Securities Exchange is popular for their Nikkei-225 futures trading whilst Tokyo Stock Exchange is famous for their 10 year government bond future. The Tokyo Stock Exchange is more active in forming alliances with other countries. It has a long established cooperation with the London Stock Exchange and the New York Stock Exchange (Reszat, 1998).

The competition between the Osaka and the Tokyo Stock Exchanges did not increase the efficiency. But it has led the market on a decline. Both exchanges have to overcome the issue of falling stock prices and increasing pressures from within and outside of Japan. One of the issues is technology. The banks and securities exchange set up trading platforms and offered all kinds of financial services online globally. In 1998, the electronic communication networks (ECNs) and private trading systems (PTS) were introduced after the restrictions on off-exchange trading for exchange-listed stocks were terminated. Those systems are highly cost-efficient where it matches the exchanges and client's order. In September 2001, the Tokyo Stock Exchange members decided to demutualise the bourse whilst the Osaka Securities Exchange planned to float in March 2004 (Reszat, 1998).

2.8.3 Bond Markets

The bond markets in Japan were started in the "welfare era" in the early 1970s with the Japanese government bonds (JGBs). The volume of JGBs grew dramatically with the worsening economic situation in the 1990s and in the early 2010; it almost reached ¥950 trillion (see Figure 2.2). Between August 1992 and October 2000, the government has released fourteen packages of emergency fiscal and economic measures with a total ¥132 trillion of spending, loans and tax cuts (Wright, 2002).

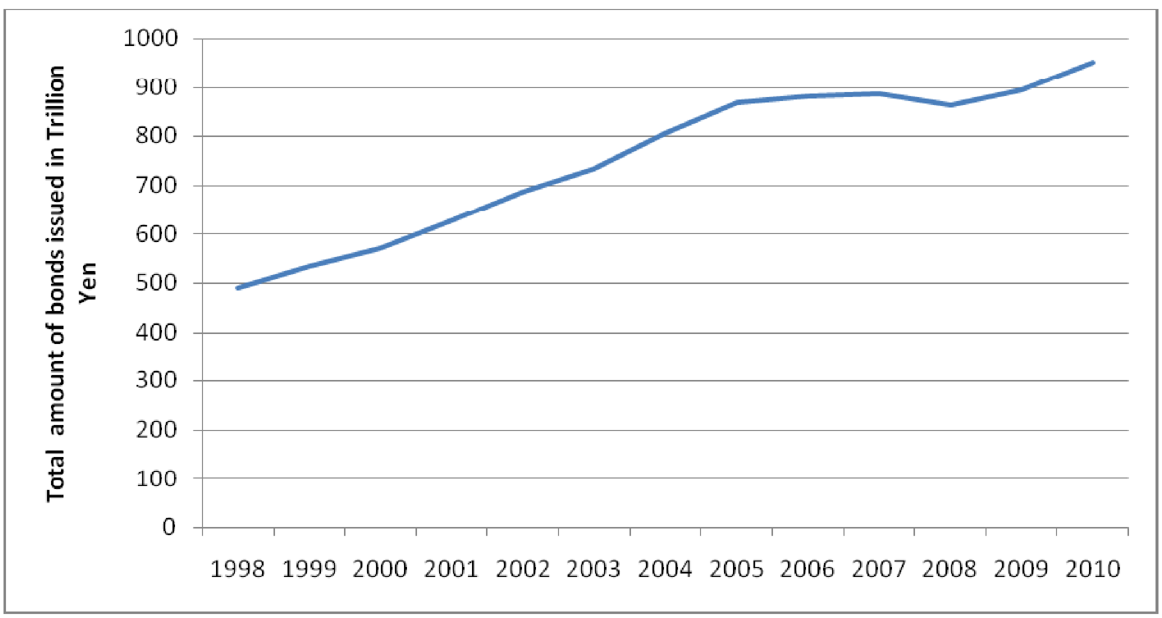
The huge amount of government borrowing in the market has outperformed the private sectors. On top of that, the bond issuance by private corporations was long restricted by regulation that was terminated in the 1980s (Flath, 2000). There are different types of corporate bonds in Japan which includes straight bonds, convertible bonds, warrant bonds, samurai bonds, shogun bonds and Daimoyo bonds. Straight bonds offer the holder a stream of interest payments. Convertible bonds exist since 1966 and may be exchanged for some specified number of shares of common stock of the issuing company. Warrants bond is a warrant with an option to purchase shares of the firm's stock. Samurai bonds are yen-denominated bonds issued in Japan by non-residents while Shogun bonds are foreign currency denominated bonds issued by non-residents in Japan. Daimoyo bonds are the non-resident Eurobonds issued in Japan and sold to investors in the Euromarkets. In addition, corporate bonds play a minor role in Japan (Japan Securities Research Institute, 2000).

In the middle of 2002, Japanese bonds had the lowest ranking of all major developed nations. This is because history shows Japanese government bonds may be cancelled and redemptions postponed. Taxes on bond holders may also be imposed. Liabilities other than those resulting from bond issuance maybe deferred or cancelled (Tomita, 2003). With the worsening of the international credit standing, the quality of Japanese government bonds as a benchmark has become weakened. In normal circumstances, long term government yields are used as an interest rate benchmark for the entire range of other fixed-income securities considered less credit worthy in an economy and the benchmark for pricing and quoting yields on other securities. They are the most common form of collateral in the financial markets (Study Group on Fixed

Income Markets, 2001). The advantage of long term government yields shows the government securities have been the most important type of instrument traded in the financial markets (Allen and Gale, 2001).

The market liquidity was low in Japan which showed the imperfections. On top of that, an extraordinarily large part of the marketable securities is held by the government and the Bank of Japan, making pricing based on supply and demand estimates exceptionally difficult (Inoue, 2003). In addition, the overall weakness of the corporate-bond sector in Japan led to low public interest in developing a market infrastructure. With market imperfections and an increasing possibility of default in the bond markets, Japanese government bonds are less able to fulfil their benchmark role and the markets have started to search for alternatives (Inoue, 2003).

Figure 2.4: Japan's Bond Market



Source: Japanese Securities Dealers Association

2.8.4 Derivatives

Japan's derivatives markets are quite active compared to other financial markets in the country. The derivatives exchange alone trades daily over $2,600 billion in Japan and even more significant in the world's stock exchanges (Inoue, 2003). As of June 2011, the amounts of outstanding derivatives transactions by major Japanese financial institutions were equivalent to US$ 55 trillion for the over the counter contracts and US$ 3.8 trillion for exchange traded contracts. The over the counter contracts have increased by 20.9 percent while the exchange-traded contracts have decreased by 13.3 percent compared to last survey as of 31st December 2010 (www.boj.or.jp/en/statistics/bis/yoshi/deriva.htm/). In general most derivatives are traded over the counter and on organized exchanges. However, in Japan, derivatives are traded separately within cash markets for banks and securities firms. Bond futures and stock price index futures are based on interest rate and currency futures. Both bond futures and stock price index futures are listed and traded on different exchanges. Bond futures trading in Japan started in October 1985 with long term government bond futures being traded at the Tokyo Stock Exchange. In 1988, the bond futures started to trade in Tokyo stock price index, the derivatives contract trades in Nikkei 225 and Tokyo International Financial Futures Exchange (TIFFE), where the euroyen and the US dollar short-term interest-rate futures are traded. The most successful contracts were the 10-year government bond contract and the Nikkei 225 (Inoue, 2003).

However, the Japanese derivatives markets are relatively weak. They are not well developed and are simpler compared to those in the Western financial markets. As a consequence, option trading plays a minor role while cash instruments are widely used for benchmarking and hedging purposes. The exchange-traded derivatives account for the smaller part of Japan's derivatives while the larger is traded over the counter as of December 2002. The interest rate swaps are highly traded over the counter, followed by foreign exchange swaps (Japan Securities Research Institute, 2000).

The interest rate swaps trading has grown remarkably over the years in Japan and also internationally. This is because interest rate swaps are used to replace government bonds and related derivatives as benchmarks. According to recent Bank of Japan statistics, the amounts of outstanding interest rate swaps was US$ 49.3 trillion as of June, 2011, an increase of 22.5 percent compared to December, 2010. The foreign exchange swaps totalled US$5.4trillion, the equity contracts US$208.1 billion and the commodity contracts US$32.6 billion. Interest rate swaps were the largest share, holding 73.5 percent of over-the-counter contracts. On the other hand, interest rate futures were dominant with 80.7 percent of exchange-traded contracts (www.boj.or.jp/en/statistics/bis/yoshi/deriva.htm/).

Compared to government bonds, the main advantage of swaps is that swap rates tend to move closely with the other credit products prices especially during the financial crisis. Moreover, swaps do not need any underlying assets and there are no limits to enter into swap contracts; reverse price movements due to demand and supply imbalances are unusual (Study Group on Fixed Income Markets, 2001). On the other hand, swaps spare capital does not use up large amounts of credit limits (Santillán et al. 2000). In Japan interest rate swaps are popular because they provide an attractive source of profits for Japanese financial institutions and help them to increase their revenues.

Bystrom (2005) examines the effectiveness of the credit default swap market in Japan. The author found that the credit default swap index can be used as a possible hedge against market wide Japanese credit risk. Nowman (2003) tested the financial market integration using stock returns and bond yield data from Japan and the U.S. The research results show evidence of market integration between Japan and the U.S. In Japan, unidirectional causality existed from stock to bond markets. This reflects the increased significance of the Japan Government Bond market in Japan.

2.9 Conclusions

Japan has long faced negative interest rates, premiums on government bonds, and a lack of benchmarks for constructing a reliable yield curve for yen instruments and other symptoms in their financial system. In addition, Japan's economic recovery is suppressed by the financial market inefficiencies. Japan's bank-based system has low market dependence; however, market failure did affect the financial system too. The weakness of the Japanese banks is one of the reasons why the financial markets are not working effectively. Currently, the weakness of the Japanese banks may be contributing to the weakness of the economy but more evidence is needed to assess this effect. According to Krugman (1998), Japanese banks have low or negative capital and they tend to be more willing to make risky loans than they should. However, the US experience confirms the zealousness for over lending by undercapitalized banks was the driving force of the savings and loan crisis in the 1980s. Therefore, Japanese banks should reduce rather than increase their lending because it worsens the savings-investment gap.

Japan will suffer from an excess of savings over profitable investments with interest rates near zero. This will give rise to a liquidity trap in Japan. Krugman (1998) defined the liquidity trap as a situation where monetary policy becomes ineffective because interest rates cannot be pushed below zero. The current situation in the Japanese economy is unfavourable towards the country's demographic trends where low fertility and population decline are expected. In addition, the short term real interest rate to match saving and investment may become negative. Currently, Japan's deposit rates are low and negative, because banks are not willing to pay depositors high rates when the expected returns on loans and other investments are low. However, individuals are willing to accept low nominal returns on deposits because they are paying for services that banks provide. Investors are willing to accept a negative nominal return on a risk-free asset because holding it in banks is cheaper and less risky than transporting and storing cash.

However, if prices were perfectly flexible, the Japanese economy would get the inflation needed, regardless of monetary policy. If current prices are not flexible and the public expects price stability in the long run, the economy cannot get the expected inflation needed due to the deflation in the Japanese economy. The government is trying to achieve inflation by reducing the current price level compared with the future. However, the future price level must be higher than the price level now. The monetary policy will become ineffective and the Japanese economy will slump against the short-run monetary expansion. To overcome this problem, sound policy implications such as fiscal policy would be needed to promote economic growth and welfare. Krugman (1998) argued that structural reforms that increased the long-run growth rate, such as deficit-financed government spending, might solve the problem. However, the simplest way to overcome the liquidity trap is to buy-back government debts by the central bank so as to inject cash or liquidity into the economy. In the 1990's, this was an option considered by the Japanese government during their deflationary recession.

Most people called the past twenty years as the lost decades of financial market reform in Japan. The Big Bang program has gotten results below people's expectations. First, the financial reforms did not manage to control the overwhelming role of government on all levels of financial market activity. Second, it relates to the way the reforms are realized. The main objective of the reforms is to formulate clear and binding general rules. However, the focus remains on market segmentation and separation, procedure in small steps, accompanying informal guidance and overregulation of details. Further, transparency, reliability and the foreseeable future of official decisions remain low and arbitrage which means the linkage between markets and instruments that guarantee an efficient capital allocation across markets still face a lot of problems. Financial liberalization in Japan has been a complex, time-consuming process, hampered by the need to create attention of various interest groups and this has not changed.

In general, the Big Bang program was used to fundamentally liberalize the Japanese financial system and create a free, fair, and global financial market. However, the stagnation of the stock market and the bad debt problems of the Japanese banks revealed that the financial reforms have not accomplished their desired goals. Financial markets are still underdeveloped with weakness in many financial institutions; the quality of financial services did not improve dramatically. Trading has not become much fairer or more transparent and traditional bank finance with all its deficiencies still dominates. A financial reform with a bigger impact is needed to change the old values and attitudes. In 1998, the Japanese Financial Supervisory Agency (FSA) got involved in the restructuring measures of the Japanese banks. Actions taken including mergers and takeovers of failed banks, raising capital privately, imposing stricter standards for loans, increasing provisions and write-offs and decreasing bank and corporate cross-holding of shares especially for keiretsu companies. As a result, Japanese banks' capital adequacy ratio improved (Krugman, 1998).

The Japanese economy had been stagnant since 1990, when the real Gross Domestic Product (GDP) grew at an average of just 1.2 percent (Hoshi and Kashyap, 2004). In 2003, the

Japanese banks have an estimated 21.5 trillion yen of non-performing loans (http://www.economist.com/node/9417036). According to Krugman (1998), there is a symbiotic relationship between the financial sector and the real economy in which each depends on the other. Back in the late 1980s in Japan, banks' poor credit policies led to riskier loans while government relied on loose monetary policy. These factors caused the collapse of the asset bubbles in the Japanese economy and many companies went into default which increased banks' non-performing loans and lead to the economic stagnation that began in the 1990s.

The Japanese economy remained stagnant since the 1990s and the government has made efforts to revive the economic growth throughout the 1990s but those efforts were unsuccessful. Subsequently, the global financial crisis and a collapse in domestic demand made the Japanese economy shrink by 5% in 2009 (http://www.bbc.co.uk.news/14336966). The Japanese economy was further disrupted again on March 11, 2011, where the country was hit by an 8.9 magnitude earthquake that violently shook buildings in Tokyo and triggered a 10 meter tsunami. The Bank of Japan immediately injected 15 trillion yen fund to buy assets such as corporate bonds and real estate investment trusts in the markets to stave off severe financial panic. After six months of the earthquake and tsunami, the Japanese economy has started to recover with factory output rising and household spending increased by 3.9 percent and 0.8 percent, respectively in June 2011 (http://www.bbc.co.uk/news/14336966). Japanese economists are looking forward to the classic V-shaped economy recovery in 2012. With a self sustaining recovery in production, an increase in government consumption and reconstruction demand on public works will likely lead to economic recovery.

CHAPTER 3

Literature Review

3.0 Introduction

Chapter Three includes a comprehensive theoretical and empirical literature review of the study. Section 3.1 discusses the investor behaviour. Section 3.2 explains whether investor biases affect asset prices. Section 3.3 reviews the volatility in the stock markets which includes research on idiosyncratic volatility and empirical evidence of volatility in the US market, Asian stock markets and Japanese stock market. Section 3.4 discusses the trend issues in the idiosyncratic volatility. Section 3.5 presents the determinants of idiosyncratic volatility pricing. Section 3.6 explains the maximum daily returns over the past one month (MAX) and expected stock returns. Section 3.7 provides a summary of the chapter.

3.1 Investor Behaviour

The portfolio theory suggests that every investor should participate in all security markets. However, many investors neglect major asset classes and investors' non-participation may be due to non-familiarity and bias effects. Generally, investors have a strong bias toward investing in stocks based in their home country and region. According to Huberman (1999), employees who invest heavily in their own firm's stock perceive to have low risk. Benartzi (2001) argues that the degree of employees who invest in their employer's stock does not predict the stock's future returns, suggesting that the investment is not based on superior insider information of their own firm. Hirshleifer's (2001) findings show that from experimental evidence, investors sometimes fail to form efficient portfolios and violate fund separation. Some studies of investor behaviour in natural and experimental markets showed disposition evidence that will affect a greater readiness to realize gains than losses. Some investors change their behaviour into herding and engage in momentum trading including contrarian trading.

Bloomfield, Libby and Nelson (1999) found male investors trade aggressively, which incurred high transactions costs without higher returns. Moreover, most investors do not place enough weight on the information and actions of others. Both findings are consistent with overconfidence. In addition, Longstaff, Santa-Clara and Schwartz (1999) and Rietz (1998) explain that investors seldom make errors such as failing to exercise in-the-money options at expiration and to exploit arbitrage opportunities. However, in retirement fund contribution decisions, evidence shows that people are strongly subject to status quo bias, where they diversify naively by dividing their contributions evenly among the options offered and naively assume past return performance.

3.2 Do Investor Biases Affect Asset Prices?

A lot of researches have been done to trace the evidence of whether errors made by individuals, institutional investors and analysts affect security prices. According to Daniel et al. (2001), they first examined the predictability of security returns followed by a discussion of the calibration of equity premiums and associated puzzles. Lastly, they discuss the efficiency of information aggregation by markets when investors make cognitive errors. When interpreting the evidence on the predictability of returns, positive doubt is recommended because the potential post-selection bias may create a significance illusion. In general, both psychological and purely rational theories of asset pricing generally showed that returns are predictable.

Daniel et al. (2001) discusses the most reasonable conditioning variables, whether past returns, variables containing current prices, accounting variables or analyst forecasts, are predictors of future returns. The authors cannot conclude about the sources of these patterns. However, they suggest that rational risk premia or psychological effects have been arbitraged away slowly. At times, it is argued that the psychological effects are the most important effect since empirical anomalies have faded away. Schwert's (2001) findings show that the value effect was not found in their recent 5 year sample period from 1996-2000 in the US market. Daniel et al. (2001) concluded that the process of picking off predictability patterns is itself irregular and prone to under- and overreactions. If investors are irrational, they may trade based on the misperception that they have identified anomalies that led to genuine mispricing. Daniel and Titman (1999) discussed it is difficult for arbitrageurs to predict what other arbitrageurs do, which can cause them to under-exploit or overexploit mispricing patterns. Existing psychology based models make some absolute assumptions which do not take into account the effects of anomalies such as the size effect in the late 1980s. Most of the explanations on the patterns of returns predictability are based on either risk premia or mispricing.

In conclusion, empirical papers have often discussed risk-based explanations in a more general way than psychological ones because the psychology based models are less developed. However, the psychological approach is consistent with the existence of factor risk premia because investors having psychological biases does not mean that they are risk takers. Moreover, the mispricing of factors can generate factor-related expected return patterns. The Fama (1970) study suggests that an asset pricing model can be used to measure whether risk can be compensated by a return premium. The risk factors include book to market, size, market dividend yield, default premium and others. The CAPM test will be discussed in the next section.

3.3 CAPM Test

The Capital Asset Pricing Model (CAPM) was developed by Sharpe (1964) and Lintner (1965). The CAPM assumes that all investors have the same investing behaviour. Therefore, by aggregating utilities, a securities market line can be defined and an optimal investment portfolio can be determined. The CAPM is associated with two types of returns: risk free return of the government bonds and beta times the return on the market portfolio. The model is specified as follows:

$$E(r_i) = r_f + \beta[E(r_m) - r_f] \tag{3.1}$$

where $E(r_i)$ is the expected return of the asset in question; r_f is the risk free return rate; r_m is the market risk; and β is the sensitivity of the particular share to movements in the market return. Formally, β is defined as:

$$\beta_i = \frac{Cov(r_i, r_m)}{\sigma_m^2} \tag{3.2}$$

where r_i is the return of the asset, r_m is the return of the market portfolio, and σ_m^2 is the variance of the market portfolio.

This form of the CAPM is a specific case of the more generalised form:

$$E(r_i) = \alpha_i + \beta[E(r_m) - r_f] + \varepsilon_i \tag{3.3}$$

The linear regression provides a method for estimating α_i which is the mispricing of the stock relative to the market, and β which is the stock sensitivity to the market risk factor and ε_i is the residual return. The market risk premium is the extra return an investor can expect over the riskless bonds, in exchange for bearing risk. The market risk is potential loss due to changes in market prices or values. The market does not reward systemic risk, as it can be diversified away.

Under normal circumstances, the portfolio managers seek to gain incremental returns with a positive alpha, but if the markets are efficient and the Sharpe-Litner version of the CAPM is the correct model, then alpha should be zero. Statistical inference to test the hypothesis $\alpha = 0$ is the basis of many empirical tests of the validity of the CAPM (Cochrane, 1999).

The success of the CAPM is well documented. Shares with high betas moved with the market while shares with low betas do not move higher than the market. A low beta stock moves less than the market when the market goes up and less than the market portfolio when the market goes down. Investors who invested in highly volatile instruments would expect high returns. Therefore, investors who are risk takers and who have invested in high risk instruments will be rewarded when the betas of the underlying instruments are high. For example, Cochrane (1999) tested 10 portfolios of shares traded on the NYSE sorted by size according to market capitalization. Included in the test sample were also an extra portfolio for corporate bonds and another for long term government bonds. The author found differences in excess returns and large spread between treasury bills and share portfolios. The portfolio average returns were plotted against their betas and the relationship would fall on the CAPM regression. One of the portfolios showed an extremely high return, higher than expected, and this portfolio included small firms. This can be explained where small firms are riskier and therefore they are expected to provide higher returns.

3.4 Multiple Factors

Since the early 1970s, asset pricing theorists have focused on the important factors and sources of price risk beyond the market portfolio performance. Compared to the CAPM, the multifactor models extend the CAPM theory using time-series multiple regressions to quantify an asset movement with multiple macro variables.

A major drawback of the traditional CAPM model is that it assumes that the investors depend only on their investments and will not be affected by any economic events. However, this is not the case in the real world. Cochrane (1999) concludes that pro-cyclical instruments that perform in booms and defect in busts will have to offer higher returns than the counter-cyclical instruments despite of their market beta. Hence, another dimension of risk co-variation with the recession periods will become a factor in asset pricing. Investors are willing to pay more for assets that outperform others especially during the recession. This is the time when most investors need their investments to perform well to compensate for losses elsewhere. The investors have to sacrifice some of their expected returns in order for them to obtain assets that perform well during recessions. This is consistent with the objective of the second factor in the asset pricing factor model which is risk-return trade off.

Cochrane (1999) discusses in his findings where empirical evidence examined more direct factors relating to asset returns and these include the CAPM. Under normal circumstances, the capital asset pricing model measures the sensitivity of the asset return to the market portfolio's returns. However, there is an imperative risk factor that is involved in explaining the movement of future returns that affects the average investor. The empirical researchers are inspired by the imperative risk factor direction and found quite a number of factors to explain the variation in average returns across assets. The two most popular examples of such factors are the size and the book to market ratio.

3.4.1 Market Capitalization and Value Premium

Size and book to market ratio are the two factors that are most commonly used in empirical testing. The size is determined by the market capitalization of the company which is price times the shares outstanding while the book to market ratio is the book equity to market equity ratio. According to Fama and French (1996), company stocks are referred to as value stocks when the book equity to market equity ratio is high. On the other hand, low book equity to market equity stocks is known as growth stocks. The reason behind this is that the stocks with a higher systematic risk will be compensated with higher returns. Fama and French (1996) pointed out that the book to market and size are proxies for distress and that distressed firms may be more sensitive to certain business cycle factors which lead to further vulnerability in regards to their financial positions.

Researchers have argued about the reasons for assigning the high discount rate to small capitalization and high book to market equity firms. According to Fama and French (1993, 1996), the book to market equity and size proxy distressed and troubled firms are more sensitive to economic factors such as recession, compared to firms that are financially less vulnerable. This shows that the investors are willing to give up some of the expected returns in exchange for investments that are sensitive to economic factors. This leads to the premium in small size and high book to market equity stocks. Moreover, Lakonishok et al. (1994) suggest that stocks with high returns are associated with high book to market equity. This is due to investors who incorrectly predict based on the past earnings growth rates of firms. They propose that investors are too optimistic about the firms which have done well in the past and are pessimistic about those that do not perform well. The authors also suggest that the growth stocks are more glamorous than the value stocks and may thus attract naive investors who push up the prices and lower the expected returns of these securities.

Value stocks have small market values compared to the book values of the company's assets. Both the value stocks and the small capitalization stocks have high average returns. The large capitalization and the growth stocks generally have low average returns. The objective of low prices leads to high average returns that are consistent with the CAPM if these stocks have high betas which are highly sensitive to the market. However, growth stocks normally perform worse than the CAPM betas. Cochrane (1999) empirically tested the value size puzzle by sorting stocks into portfolios based on the size and the book to market ratio. The results show the highest portfolios have three times higher average excess returns than the lowest portfolios and this are not related to the market betas.

Fama and French (1995) suggest that a typical value stock has a price that has been driven down due to financial distress. The stocks of the firms which are in the bankruptcy threshold normally generate high average returns. This explains the natural interpretation of the value premium.

3.5 Volatility in the Stock Markets

Volatility is a statistical measure for the changeability or randomness of asset prices. The most commonly used estimate of stock return volatility is variance or standard deviation that estimates the dispersion of returns and summarizes the probability of observing extreme values (Shu and Zhang, 2003). However, the conventional finance theory suggests that only systematic, non-diversifiable risk is priced by the risk-expected return relationship. This means only the proportion of variation in individual stock returns caused by common economic market factors is relevant for asset pricing, and the part of a stock's return variation that is attributed to firm-specific and industry-specific shocks, can be eliminated or reduced to arbitrarily low levels by diversification (Shu and Zhang, 2003). Investors are supposed to hold a representative (market) portfolio of stocks and since all idiosyncratic risk sources are independent, the only risk that remains after extensive diversification is the market risk, which is attributable to market-wide risk sources. Why should anyone including investors be concerned about idiosyncratic volatility that does not have a price? We will discuss the pricing of idiosyncratic volatility later in the chapter.

The volatility of stock returns varies over time. Some researchers have examined the relationship between the volatility and the expected return of the stock market and the time series relation (see Bali, Cakici and Whitelaw, 2010; Fu, 2009; Bali and Cakici, 2008). Ang et al.'s (2006) study examines the pricing of aggregate volatility risk in the cross-section of stock returns. Their results show that stock with high sensitivities in aggregate volatility tends to have low average returns. Sabelhaus and Song (2009) used the Fama-Macbeth firm regression method to test the relationship between financial distress and idiosyncratic volatility on cross-sectional stock returns and found a negative correlation between idiosyncratic volatility and return due to the manifestation of financial distress. Furthermore, the interaction of financial distress with the momentum and value effects is also discussed. According to Sabelhaus and Song's (2009) results, a positive relationship exists between distressed stocks and the momentum effect. However, value effect is the strongest among the distressed stocks.

On the other hand, Guo and Savickas's (2006) study show that the value weighted idiosyncratic stock volatility and the aggregate stock market volatility have strong predictive abilities when it comes to excess stock market returns. The authors found a positive risk-return relation in the stock market, in which idiosyncratic volatility is negatively related to future stock returns. They find that the idiosyncratic volatility forecasts stock returns because of its negative co-movements with the consumption wealth ratio. The consumption wealth ratio factor was argued recently as the proxy for the liquidity premium. According to a Fama and French (1993) model, stocks with high idiosyncratic volatility have low average returns. However, book to market, leverage liquidity, turnover, trade volume and other forecast characteristics cannot be explained using such high idiosyncratic volatility low average return stocks because Fama and French model was mispriced and contained missing factors. Further, Ang et al. (2006) used a different sorting method where the volatility of the market return was used to price cross-sectional risk factor. The firms were sorted based on the idiosyncratic stock return volatility to test the relationship between cross-sectional factors and idiosyncratic volatility. Therefore, the cross sectional expected return patterns on idiosyncratic volatility are present and remain obscure.

The Ang et al. (2006) study was puzzling for two reasons. First, the difference in average returns of the first quintile portfolio of stocks with the lowest idiosyncratic volatility exceeds the average returns of the fifth quintile portfolio of stocks with the highest idiosyncratic volatility by over 1 percent per month. Second, Ang et al.'s (2006) findings could not explain any of the existing asset pricing models. The authors tested the idiosyncratic volatility in environments with frictions and incomplete information but their results showed the idiosyncratic volatility of a stock potentially to be linked to its expected return. However, their results were opposite to Merton (1987) whose results showed stocks with high idiosyncratic volatility to have low expected returns in the presence of market frictions. These results are puzzling because standard theory such as Merton (1987), does not account for the relation of idiosyncratic volatility and expected return. Hou and Moskowitz's (2005) method has been used by Ang et al. (2006) to control the delay of market frictions with which a stock's price responds to information and by Chordia, Huh and Subrahmanyam (2005) to test trading volume. However, none of the information and trading volume factors explains the relationship between high idiosyncratic volatility and low average returns. Boyer et al. (2009) argue that stocks with high idiosyncratic volatilities have low returns because these stocks have a high expected idiosyncratic skewness. In addition, idiosyncratic volatility can be explained with expected idiosyncratic skewness which is negatively correlated with the returns. The results suggest that the idiosyncratic volatility puzzle lies in the preferences of the investors.

3.5.1 Idiosyncratic Risk

Idiosyncratic risk is an unsystematic risk or a risk that is uncorrelated to the overall market risk. In other words, it is the risk that is firm-specific and can be diversified through holding a portfolio of stocks (http://financial-dictionary.thefreedictionary.com/Idiosyncratic+Risk). Idiosyncratic volatility is the risk of price change due to the unique circumstances of a specific security, as opposed to the overall market (InvestorWords.com website). The standard deviation of these unique and unexplained conditions of a specific security also leads to idiosyncratic volatility (also known as unsystematic risk). The definitions for idiosyncratic volatility varied. Campbell et al. (2001) and Brandt et al. (2008) define idiosyncratic risk as the difference between an individual stock's return and the industry return. Brockman and Yan (2008) interpret idiosyncratic risk as the residual of the asset pricing model. Malkiel and Xu (2004) and Bali and Cakici (2008) used both the CAPM and the Fama and French three factor model (1993) to define idiosyncratic volatility. Even though the idiosyncratic volatility definitions vary, all idiosyncratic volatility represents a part of the risk that cannot be diversified. Therefore, idiosyncratic volatility is useful in measuring idiosyncratic risk.

Attention into stock market volatility increased during the late 1990s. Malkiel and Xu (1997) claimed that there is a positive relationship between idiosyncratic volatility and expected stock returns. The authors used Standard & Poor's 500 stock indexes from 1963 to 1994 to show that idiosyncratic volatility has increased over time while the volatility of the whole market has been remarkably stable. Therefore, the correlation among the returns for individual stocks decreases over time. Malkiel and Xu (2003) argue that the attention given on the financial press to the increase in stock market volatility during the late 1990s has been misplaced. This is because Schwert's (1989) study shows that no long-run uptrend is evident for the volatility of the market as a whole. Campbell et al. (2001) revealed that the volatilities of individual stocks have increased over the 1980s and the 1990s. The authors studied the returns of US equities from January 1962 to December 1997 and noticed that there is a steady increase in the idiosyncratic volatility of individual firms, whereas the aggregate market volatility and the industry volatilities developed over time.

Goyal and Santa-Clara (2003) predicts the stock market returns with risk measures. They found a significant positive relation between average stock variance, especially the idiosyncratic risk, and the return on the market. Reversely, the market variance has no predicting power on the market return. However, the relationship to forecast the stock market exists after they control for the macroeconomic variables. Ang et al. (2006) argue that stocks that have past high sensitivities to innovations in aggregate volatility have low average returns. They also find that stocks with past high idiosyncratic volatility have low returns. However, this cannot be explained by the exposure to the aggregate volatility risk. Further, the size, the book to market and the momentum effect cannot explain the low returns of stocks with high idiosyncratic risk. On the other hand, Jiang and Lee (2006) find that idiosyncratic volatility is inversely related to future stock earnings. Their results show that the return predictive power of idiosyncratic volatility is due to future earning shocks. The return predictive power of idiosyncratic volatility is caused by its information content on future earnings. Jiang and Lee (2006) results were supported by empirical findings where firms with poor prospects of future earnings tend to disclose less information, which results in a higher degree of heterogeneity in investors beliefs, which led to higher stock return volatility and trading volume.

Bali and Cakici (2006) examine the cross-sectional relation between idiosyncratic risk and the expected stock returns using the NYSE, AMEX and NASDAQ as the research sample and their results showed that the data frequency used to estimate idiosyncratic volatility, the weighting scheme used to compute average portfolio returns, the breakpoints utilized to sort stocks, the size, the price and liquidity are important in determining the relationship between idiosyncratic risk and cross-section of expected returns. However, their research findings show that there is no robust, significant relation between idiosyncratic volatility and expected returns. Speigel and Wang's (2005) findings showed idiosyncratic risk and liquidity to be negatively correlated. The authors used the monthly data and found that stock returns are increasing with the level of idiosyncratic risk and decreasing in a stock's liquidity. It indicates that one standard deviation change in idiosyncratic risk will lead to 2.5 and 8 times change in liquidity on cross sectional expected returns.

3.5.2 Latest Research on Idiosyncratic Volatility

Malkiel and Xu (1997) argued that a positive relationship between idiosyncratic volatility and the expected returns draws attention from academicians, practitioners and investors. Following the Malkiel and Xu (1997) study, researchers continued testing the idiosyncratic volatility on different markets using different methods and variables. For example, Malkiel and Xu (2003) conducted further research on the idiosyncratic volatility. The authors claimed that systematic volatility and idiosyncratic volatility made up the total volatility of individual stocks.

Doran, Jiang and Peterson (2008) investigate the January idiosyncratic volatility puzzle in NYSE, AMEX and NASDAQ stock markets for the period from July 1963 to December 2006. The results show that high idiosyncratic volatility stocks on average outperform low volatility stocks in January in terms of firm size, book to market equity, past returns and institutional trading. Their results are similar to Ang et al.'s (2006) findings, where a pure non-January phenomenon accounts for the underperformance of high idiosyncratic volatility stocks. Furthermore, volatile stocks have greater dispersion in expected returns and price reactions during earnings announcements. These findings conclude that the factors that lead to volatility of stocks include greater mispricing, short sale constraints, noise trading and investor overconfidence.

Jiang and Lee (2006) findings show that idiosyncratic volatility is inversely related to future earnings shocks. Information content on future earnings is useful in predicting idiosyncratic volatility return. The authors' results show that firms with low prospects of future earnings tend to disclose less information that leads to a higher degree of heterogeneity in investors' beliefs which results in a higher trading volume and a higher stock return volatility.

Bali et al. (2008) conducted a research using the Fama and French three factor regression model to measure the aggregate idiosyncratic risk. The authors' model is based on the concept of gain from portfolio diversification and does not require an estimation of market betas or correlations. Their statistical results and graphical analyses prove that there are significant level and trend differences compared to the Campbell et al. (2001) methodology. Both methods show there is an increase in the firm-level idiosyncratic risk, however, the Campbell et al. (2001) method which uses greater volatility measure results in a stronger upward trend. The main factor that results in the significant upward trend is the increase in the cross-sectional dispersion of the volatility of individual stocks. The upward trend is found to be stronger for younger, small size and lower priced firms.

Boyer et al. (2008) also tested the relationship between expected returns and idiosyncratic skewness. The authors use the Nasdaq stocks dataset daily returns from February 1978 to December 2005. Their results show that the expected idiosyncratic skewness and the expected returns are negatively correlated and that helps in explaining the anomaly for stocks where high idiosyncratic volatility has low expected returns. Market imperfections such as asymmetric information and short sale constraints can affect the stock anomalies but the authors' results suggest that an understanding of the negative relationship between idiosyncratic volatility and the expected returns still depends on the investors' preferences.

Bekaert et al. (2010) examined aggregate idiosyncratic volatility in 23 developed stock markets and found no evidence of upward trends when they extended the sample between 1964 and 2008. However, idiosyncratic volatility is well described by a stationary autoregressive process that has a relatively short duration and occasionally switches into a higher-variance regime. Their research results show that idiosyncratic volatility is highly correlated across countries. Besides that the authors find that three factors namely growth opportunities, total market volatility and the variance premium accounted for the bulk of the variation. Their findings have important implications for studies of portfolio diversification, return volatility and contagion.

Bergbrant (2011) tested the relation between idiosyncratic volatility and returns and found a positive relation between them. However, this relationship only exists for firms which are difficult to arbitrage. The relation between idiosyncratic volatility and returns is strong for small and illiquid stocks, but the relationship decreases for size and liquidity and becomes non-existent for the largest and the most liquid firms. The zero cost portfolios based on idiosyncratic volatility and size do not yield positive returns when conservative trading costs are considered. This finding is consistent with the efficient market hypothesis.

Bhootra and Hur (2011) used data from NYSE, AMEX and NASDAQ from July 1963 to December 2007 and found that the negative relationship between idiosyncratic volatility and stock returns is concentrated in stocks with unrealized capital losses, but are non-existent in stocks with unrealized capital gains. Their finding is robust in controlling for short-term return reversals and a maximum daily return, among other variables. Moreover, the negative volatility-return relationship is stronger among stocks with greater proportional ownership by individual investors.

3.5.3 Empirical Evidence of Idiosyncratic Volatility in Asian Stock Markets

Limited research has been conducted on idiosyncratic volatility in the Asian stock markets. Drew, Naughton and Veeraraghavan (2003) examined whether idiosyncratic volatility has been priced in the Shanghai stock exchange using the Fama and French (1996) portfolio approach. Their findings show that idiosyncratic volatility is priced and the multifactor model is more useful than traditional CAPM in measuring the average returns. They suggest that investors who are risk takers should invest in small and low idiosyncratic volatility firms. This is because the results from their findings show that investors can get substantial returns by investing in strategies which are non-related to market movements.

Angelidis (2008) investigates idiosyncratic risk in 24 emerging markets which includes 8 Asian countries. The results show no upward trend and that the idiosyncratic risk explains 55% of the total volatility. Idiosyncratic volatility does affect the number of stocks included in a portfolio, especially the component of tracking error volatility. Drew and Veeraraghavan (2002) conducted a study on the role of idiosyncratic volatility in asset pricing for the Hong Kong, India, Malaysia and Philippines stock markets and they found small and high idiosyncratic volatility firms generating superior returns and concluded that such firms carry risk premia. Umutlu, Akdenic and Altay-Salih (2010) created a modified market model that is partially segmented and integrated emerging markets in aggregated return volatility of stocks. Their results show that equity outflow has an increasing impact on the aggregated stock return volatility while an equity inflow has a decreasing impact. In other words, the net equity flow affects the aggregated total volatility through the local volatility and aggregated idiosyncratic.

Wu and Ju (2002) use a disaggregated approach to study the volatility of common stocks in the Chinese stock markets at market, industry, and firm levels over the period of 1993 to 2001. Their results show that there are downward trends for all the market, industry and firm levels. However, there is a substantial increase in firm-level volatility relative to the market and the industry volatility levels. The firm-level volatility contributes the most to the total volatility among the three components. Zheng and Deng (2009) examine the idiosyncratic volatility puzzle in China's equity market and their empirical result shows that lagged idiosyncratic volatility is not a good estimate of expected idiosyncratic volatility and that the puzzle occurred when the lagged volatilities were used by the researchers as proxies. The authors use the ARMA model to calculate the expected idiosyncratic volatility and to test the relationship between the expected idiosyncratic volatilities and the expected returns. Their results showed that there is a significant positive relationship between the expected returns and the expected idiosyncratic volatilities, even when controlled variables were taken into consideration. Pukthuanthong and Visaltanachoti (2009) use the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) to estimate the conditional idiosyncratic volatility of individual stocks across 36 countries from 1973 to 2007. Their results show that idiosyncratic risk is priced on a significantly positive risk premium for stock returns. The evidence supports the prediction of existing theories that idiosyncratic risk is positively related to expected returns.

Nartea, Wu and Yao (2010) tested the relationship between idiosyncratic risk and the returns for five ASEAN markets which included Malaysia, Singapore, Thailand, Indonesia and the Philippines. They found no evidence of the idiosyncratic volatility puzzle in these Asian stock markets, but there is evidence of a positive relationship between idiosyncratic volatility and returns in Malaysia, Singapore, Thailand and Indonesia and no relationship in the Philippines. The authors suggest that the idiosyncratic volatility trading strategy could result in significant trading profits in Malaysia, Singapore, Thailand and some in Indonesia. They concluded that generalizing empirical results from the developed stock markets to new and emerging markets could be misleading. On the other hand, Nartea et al. (2010) find a negative IV effect in the Chinese stock market, but there is no trend of IV from 1993 to 2008. Nartea and Ward's (2009) research examines whether the three main empirical findings on idiosyncratic volatility in the US market can be applied on the Philippine stock market. However, their results show that they cannot generalise the US research findings on the Philippine stock market. First, the authors do not find a trend in idiosyncratic volatility over their study period from 1992 to 2007. Secondly, their results on the relationship between idiosyncratic volatility and market returns contradict Goyal and Santa-Clara's (2003) findings. The authors found the average equal-weighted idiosyncratic volatility to be negatively related to market returns. Thirdly, their result is opposite to Ang, Hodrick, Xing and Zhang (2006) who found no relation between idiosyncratic volatility and abnormal returns.

Hsin's (2010) research sample covers 29 emerging markets from Europe, America, Asia and Africa from January 1990 to December 2005. Hsin's result shows that idiosyncratic risk may not be a good measure of informativeness within emerging markets. This means stocks with greater idiosyncratic risk do not necessarily mean that their firm specific information is being priced more efficiently. The author suggests that the trading styles of the investors in the emerging markets serve as significant contributors to the idiosyncratic risk across emerging markets.

3.5.4 Evidence from the Japanese Stock Market

There is limited research on idiosyncratic volatility in the Japanese stock market. For example, Hamao et al.'s (2003) study on the Japanese stock market suggests that corporate restructuring led to the sharp fall in the firm level volatility during the years from 1990 to 1996 i.e. the post crash era. However, their result shows that the firm volatility does not depend on the economic conditions. Since then, Hamao et al. (2003) argued that capital misallocation and the lack of corporate restructuring makes the Japanese stock market inefficient. This is because capital misallocation and the lack of corporate restructuring make it more difficult for foreigners to invest in the domestic stock markets.

Chang and Dong (2006) conducted research on the Japanese stock market using data from 1975 to 2003. The authors found evidence showing that institutional herding and firm earnings are positively correlated with idiosyncratic volatility. They rejected the hypothesis that institutional investors herd toward stocks with high idiosyncratic volatility. Their results suggested that investor behaviour could be explained better on the negative premium earned by the high idiosyncratic volatility stocks. However, they found the dispersions of change in institutional ownership and return on asset move synchronically with the market aggregate idiosyncratic volatility. Moreover, their results revealed that the time series pattern of the market aggregate idiosyncratic volatility can be best explained by investor behaviour and stock fundamentals.

Hamao et al. (2003) performed an empirical research using the Japanese stock prices during the period of 1975 to 1999. The authors used several methods to measure the idiosyncratic risk in the Japanese stock market. First, they used volume as an additional variable to test the asset pricing studies. Second, the authors ran a robustness test using Lo and Wang's (2001) dual-factor model to measure the firm-level volatility and the trading volume in a multifactor setting. Their studies found a few symptoms unique to the Japanese stock market. First, there is a surprising fall in firm-level volatility and turnover in Japanese stocks after the market crash in 1990. Further, they discovered a significant drop in the variation of systematic risk across firms and a sharp increase in Japanese equity co-movement. These results show a real contrast to the US stock markets where firm level volatility generally increases after a market crash.

Nguyen et al. (2011) tested the influence of corporate governance on the risk taking of Japanese firms. The results showed that family control and ownership concentration are associated with a higher idiosyncratic risk, whereas bank control has the opposite effect. The authors investigate the relationship between idiosyncratic risk and firm performance and his results provide an economic rationale for the higher performance of the family-controlled firms and for the lower performance of the bank-controlled firms. Further, the authors explained that firms with concentrated ownership perform better in regards to the governance structures and the risk-taking strategies that generate greater competitive advantages. Further, the involvement of foreign investors has confirmed the results as controlling variables have a stronger impact on the governance structures. In addition, Nguyen's (2011) findings show that the increased involvement of foreign investors motivated by shareholder value is likely to have triggered a major shift in their risk-taking behaviour. This can be confirmed as the volatility of stock returns, the market to book value and the profitability are found to have significantly increased with the level of foreign ownership. Controlling for endogeneity supports the evidence that the foreign investors have targeted Japanese firms which take lower risks. In general, the authors' results highlight the considerable impact that some categories of investors can have on corporate decisions.

Liang and Lin (2006) investigate how idiosyncratic volatility is cross-sectionally related to the expected returns at the stock and market portfolio levels across 23 developed countries. The authors used a sample data from DataStream from January 1975 to June 2005. The authors found that innovation in local market volatility is a pricing factor only in Spain and the UK. They also discovered that innovation in global market volatility is negatively priced for the 23 market portfolios after controlling for global market, value and size factors. For example, for Japan, the t-value for the global market is -0.58, for the size -0.25 and for the market value -0.38. These results totally contrast with the results at the local stock market level with positive results. The authors uncovered that country market portfolios with higher local market total volatility or higher local market idiosyncratic volatility have higher expected returns after adjusting for the global market, value and size factors. Their results support Merton's (1987) incomplete information model as Liang and Lin's (2006) results suggest that idiosyncratic stock volatility can be diversified away when investors hold locally-diversified market portfolios. Global investors are rewarded by high returns for bearing high risk portfolios measured by local volatility of a country.

Guo and Savickas (2006) tested the changes in idiosyncratic volatility that provides a proxy for changes in the investment opportunity set in the G7 countries. First, the results show that idiosyncratic volatility has statistically significant predictive power for aggregate stock market returns over time. In addition, the model explains approximately 43.1 percent of the stock returns on the value weighted idiosyncratic volatility. Secondly, the authors' findings show that idiosyncratic volatility performs just as well as the book-to-market factor in explaining the cross-section of stock returns. The authors suggested that the hedge against changes in investment opportunities is an important factor of asset prices. De Veirman and Levin (2009) used a new technique which yields instantaneous estimates of the firm-level volatility in every period to test the performance of the US and Japanese firms. In Japan, they found firms having low volatility in the aftermath of the 1990 stock market crash are later experiencing increasing volatility during the 1997 and 1998 banking crises. Veirman and Levin (2009) research finding is consistent with Hamao, Mei and Xu's (2007) study on idiosyncratic stock return volatility in Japan. Hamao, Mei and Xu's (2007) result reflects the observation that government involvement and financier behaviour in the first seven years after the stock market crash dampened the effect of the market forces on the weak and stagnant firms. Hamao et al. (2007) also found out that publicly traded US firms are more volatile than their Japanese counterparts. The reason for this is that the younger and the more volatile firms are more likely to get a listing in the U.S than in

Japan. Another possible reason is that the business and the financing structures specific to Japan have dampened the firm-level shocks to a comparatively large extent.

3.6 Idiosyncratic Volatility Trends

Recently, there has been an increase in the research on the idiosyncratic volatility of stock returns. For example, Campbell et al. (2001) showed that the volatilities of individual stocks have increased over time, but there are some ambiguities that made idiosyncratic volatility increase over time. Since then, there are many researchers trying to justify the ambiguities. For example, Malkiel and Xu (2003) found there are several reasons on why idiosyncratic volatility increased in the stock markets over the decades. Their results showed cross-sectional evidence supporting an association between institutional ownership and the volatility of individual stocks as well as a positive relationship between idiosyncratic volatility and expected earnings growth.

Furthermore, Dennis and Strickland's (2005) findings are consistent with Malkiel and Xu (2003) where the authors examined the time-series and the cross-sectional determinants of idiosyncratic volatility. They tested three hypotheses which include ownership structure, leverage and firm focus. In the time-series test, their results showed that firm-level volatility is positively related to increased institutional ownership, firm focus and leverage. Moreover, the explanatory power of market-model regression has decreased over the sample period. It is negatively related to institutional ownership, firm focus and leverage. Idiosyncratic volatility is positively related to institutional ownership in terms of the cross-sectional test. Furthermore, the authors found a positive relationship between changes in the ownership of equities by mutual funds and changes in the idiosyncratic volatility after controlling for changes in institutional ownership. However, when they imposed a conditional test on returns, they found there is a decrease in idiosyncratic volatility in both positive and negative returns. This finding is in contrast with the leverage hypothesis but consistent with the asymmetric information assumption during the release of firm specific news.

Bennett, Sias and Starks's (2003) research finding shows recent growth in institutional investment combined with shift in preferences toward smaller, riskier securities help in explaining why smaller stocks in a market bring greater firm-specific risk and liquidity. The authors' analyses suggest that institutional investors choose smaller securities because such securities offer them better dividends. Moreover, Brandt et al. (2005) found that the upward trend in volatility reverted since 2002. Their results showed that the high volatility stocks are predominantly low priced, which they interpreted as evidence that the high volatility episode was due to a speculative episode driven primarily by retail investors. Irvine and Pontiff (2005) pointed out that increasing competitiveness in the product market will yield an upward trend in idiosyncratic volatility. Wei and Zhang (2006) found that the trend in average volatility is accounted for by the downward trend in ROE and the upward trend in the volatility of ROE. Their results are consistent with Fink, Grullon and Weston (2006) who argued that if there is a higher percentage of a new firm traded in the capital markets, it explains the positive trend of idiosyncratic risk. This is because the age of a typical firm that issues public equity has decreased from almost 40 years in the 1960s to less than five years in the late 1990s. However, Brown and Kapadia (2006) argued that the firm age would not lead to higher idiosyncratic volatility because young firms have fewer customers and they can manage the customers well which makes the firm less volatile compared to mature firms that have huge numbers of customers which are difficult to handle. Instead, Rajgopal and Venkatachalam (2005) showed that changes in the fundamental characteristics of the firm cause the idiosyncratic volatility to rise. Brown and Kapadia (2006) found that greater financial market development by issuing IPOs helps riskier firms to access to the public markets, and by controlling the IPO vintage will help in eliminating the trend of volatility.

Bennett and Sias (2006) pointed out that there are three factors that make up the variation in volatility which includes: the decrease within industry concentration, the growth of riskier industries and the increase of smaller firms in the market. On the other hand, Brandt et al. (2005) put the blame for the upward trend of idiosyncratic volatility on the irrational investors. Chang and Dong (2006) suggest that investors' behaviour and stock fundamentals help in explaining the time-series pattern of market aggregate idiosyncratic volatility. The market aggregate idiosyncratic volatility is similar to the dispersion of change in institutional ownership and returns on asset. In addition, Irvine and Pontiff (2008) argued that observed trends would vary by using different measures of volatility in fundamentals while Cao and Han (2009) showed that the trends can be well explained by the market to book variable where it is consistent with the growth options.

In addition to the stock market volatility, the idiosyncratic volatility in our study also plays an important role in determining of the time-varying risk premium. Guo and Savickas (2006) determined three reasons that affect idiosyncratic volatility in time-varying risk premium. First, idiosyncratic volatility is priced because many investors hold poorly diversified portfolios (see Levy 1998; Malkiel and Xu 2001). Second, Lehmann (1990) reported that idiosyncratic volatility helps in tracking conditional stock market returns because it measures the conditional variance of the risk factors of the CAPM model. Third, according to Miller (1977), idiosyncratic volatility is an agent for the divergence of opinion which initially leads to stock overvaluation and if short-sales constraints are binding, it will suffer capital losses.

3.7 Idiosyncratic Volatility Pricing- Cross-Sectional Stock Returns

Merton (1987) introduced a model that suggests idiosyncratic risk should be priced when investors hold poorly diversified portfolios and the cross-sectional stock returns should be positively related to their idiosyncratic risk. The asset pricing efficient market hypothesis (EMH) asserts that market information is publicly available for the investors. However, this is difficult to achieve for investors that hold small amounts of stocks. In other words, investors who are unable to hold market portfolios will start to focus on the total risk which includes the transaction cost such as information or trading costs. Merton (1987) asserts that investors expect a higher return as compensation for the transaction cost that leads to greater idiosyncratic risk in the assets they are holding. Merton's (1987) paper presents an extension of the CAPM in which idiosyncratic risk plays a role in the risk and return equilibrium. In Merton's research hypothesis, due to incomplete information on the security characteristics, the investors will only hold securities whose risk and returns characteristics they are familiar with. Therefore, under normal circumstances they hold under-diversified portfolios, in the static mean-variance and demand compensation for securities idiosyncratic risk. On the other hand, in equilibrium, cross-sectional stock returns are positively related to their idiosyncratic risk.

Fama and Macbeth's (1973) study reveals there is a positive cross-sectional relation between market risks and expected stock returns. The authors test the relationship between average return and risk in the New York Stock Exchange. Their result shows that the risk-return regressions are consistent with the "efficient capital market" hypothesis in which the prices of securities fully reflect the available information in the market. Following this, many other researchers have found that the market beta alone cannot fully capture all the dimensions of risk such as the book to market effect (Rosenberg et al., 1985) and the size effect (Banz, 1981).

Roll (1977) argued that it is a challenge to test the CAPM for two reasons. First, the mean-variance efficiency of the market portfolio is equivalent to the CAPM equation where the stock's unconditional alpha depends primarily on the covariance between its beta and the market risk premium. This statement is a mathematical intuition and does not require model assumptions. Given a proxy for the market portfolio, testing the CAPM equation is equivalent to testing the mean-variance efficiency of the portfolio. Secondly, the validity of the CAPM is equivalent to the market being mean-variance efficient with respect to all the investment opportunities. Without looking into all the investment opportunities, it is not possible to test whether the portfolio is mean-variance efficient. Therefore, it is not possible to test the CAPM.

Fama and French (1992) showed that the relationship between the market beta and the average return is flat and only the size and the book to market effect can take hold of the cross-sectional variation in stock returns. There are some other cross sectional explanatory variables used to test the relationship with the stock returns such as the momentum effect (Jegadeesh and Titman, 1993) and the liquidity risk (Pastor and Stambaugh, 2003) which are discussed in detail in later sections. The momentum effect is the empirically observed tendency for rising asset prices to keep rising further and falling prices to keep falling. Jegadeesh and Titman (1993) showed that stocks with strong past performance continue to outperform stocks with poor past performance in the next period with an average excess return of about 1% per month. Furthermore, liquidity plays an important role for well-functioning stock markets as it impacts the traders, stock exchanges and listed companies. Pastor and Stambaugh (2003) found expected stock returns to be related cross-sectionally to the sensitivities of returns to fluctuations in aggregate liquidity. Over a sample period of 34 years, the average return on stocks with high sensitivities to liquidity exceeds that of stocks with low sensitivities by 7.5% annually, adjusted for exposures to the market returns as well as size, value and momentum factors.

3.7.1 Momentum Effect

The momentum anomaly was first discovered by Jegadeesh and Titman (1993). The authors argued that buying stocks with high returns and selling stocks with low returns provides both statistically and economically significant profits. According to Arena et al. (2008), even though the momentum strategies are well recognized in generating significant returns, however there is a lack of unity about the sources of momentum profits. Jegadeesh and Titman (2001) used the CSRP daily data over the period from 1965 to 1989 and found that momentum profits exist in their sample period due to delayed investor's overreactions to stock market performance that eventually reversed. Rouwenhorst (1998) tested more than 1,700 firms from 20 countries and the author found emerging market stocks to exhibit momentum, small stocks outperforming large stocks and value stocks outperforming growth stocks. The author also found strong cross-sectional correlation between the return factors and share turnover. However, it is unlikely that liquidity can explain the emerging market return premiums.

The momentum effect is a market anomaly which is either risk based or behaviour based. According to Berk, Green and Naik (1999), the systematic risk will affect changes in a firm's growth options and therefore generate momentum in its returns. Chan et al. (2000) investigated the momentum effect based on individual stock market indices in 23 countries. Their result shows that there is statistical evidence of momentum profits. However, Hameed and Kusnadi (2002) indicate that the factors that lead to the momentum effect in the US are not prominent in the Asian markets.

Lee and Swaminathan (2000) reported that the momentum effect mostly appears in high volume stocks rather than low volume stocks. The authors' results show that trading volume is weakly correlated with liquidity proxies hence the volume effect is robust towards the various risk adjustments. Moreover, Scott et al. (2003) suggest that the predicting power of the price momentum and trading volume is the outcome of the reaction of investors to earnings news which is an effect that is most dynamic for high growth companies. Wang et al. (1994) developed a dynamic model using asymmetric information to test the relationship between volumes and returns differences that depend on the trading motive by the "informed investors". Under this model, uninformed investors are involved in rational trend chasing behaviour. For informed investors who have traded before in the former period and have a better understanding of stock fundamentals, momentum in consecutive returns is likely to occur. In fact, return reversal would be likely to occur if the informed investors acted as contrarians and their primary motive changed their investment opportunities. In other words, the high information asymmetry stocks have higher volatility and greater momentum.

Barberis, Shleifer and Vishny (1998), Daniel, Hirshleifer and Subrahmanyam (1998), and Hong and Stein (1999) propose that investors interpret imperfect information biases as consistent with price momentum. For example, Barberis, Shleifer and Vishny (1998) constructed a model that helps to explain the momentum effect in new market firms. In most cases, change is constant in new market firms, and investors may become over-optimistic or over-pessimistic in responding to the good or the bad news. In addition, investors are faced with representative bias which results in delayed overreaction. In most circumstances, idiosyncratic volatility acts as a proxy for the amount of firm specific news, where higher idiosyncratic volatility stocks will suffer more compared to the firms that have lower idiosyncratic volatility. As a result, Barberis, Shleifer and Vishny's (1998) model predicts that high idiosyncratic volatility stocks may generate greater momentum.

According to Daniel, Hirshleifer and Subrahmanyam's (1998) study, their model shows that informed traders possess overconfidence and self-attribution bias. The bias is strong in certain industries especially among investors who are evaluating the values of new firms. Investors' have lack of confidence due to difficulty in valuing stocks or high uncertainty stocks. In most cases, the high uncertainty stocks have high idiosyncratic volatility and are more difficult to value. Daniel, Hirshleifer and Subrahmanyam's results are similar to Barberis et al. (1998) where high idiosyncratic volatility stocks will bring greater momentum. On the other hand, Hong and Stein (1999) identify two types of traders; news watchers and momentum traders. The news watchers are traders that trade according to private information while the momentum traders trade on historical price changes. The momentum is stronger among small firms where information transmits into prices slowly. This leads to an initial under reaction by the news watchers, leading to a greater momentum effect to take place.

The empirical evidence on momentum profits is mixed. Conrad and Kaul (1998) argue that the cross-sectional variation in the expected returns is more important compared to the predictable time-series variation in security returns in the profitability of the momentum strategy. The results of buying high mean return securities and selling low mean return securities mirrors the momentum strategy's average profits. Under normal circumstances, the differences in the unconditional mean returns can be referred to the variations in expected returns, and the cross-sectional differences in risk will lead to momentum profits. Furthermore, Jeegadesh and Titman (2002) study shows that portfolio strategies that buy stocks with high returns over the previous 3 to 12 months and sell stocks with low returns over the same period perform well over the following 12 months. Jeegadesh and Titman's research result contradicts Conrad and Kaul's (1998) result because Conrad and Kaul do not take into account the small sample biases in their tests and bootstrap experiments. However, Jeegadesh and Titman's unbiased empirical tests show that cross-sectional differences in the expected returns explain very little of the momentum profits.

Chordia and Shivakumar's (2002) study reports that profits from momentum strategies can be explained by macroeconomic variables such as the short-term interest rate on the risk-free asset, the term spread, the default spread as well as the dividend yield. Payoffs from momentum strategies disappear once stock returns are adjusted for their predictability based on the macroeconomic variables. Furthermore, the authors' results show that the industry effect brings momentum to individual stock returns in the US market. Moskowitz and Grinblatt (1999) found a strong momentum effect in the industry components of stock returns which accounts for much of the individual stock momentum anomaly. When the authors control for industry momentum, the investment strategies, which include buying past winning stocks and selling past losing stocks, are significantly less profitable. On the other hand, the industry momentum investment strategies, in which one buys stocks from past winning industries and sells stocks from past losing industries, yield higher profits even after the authors control for size, book to market, individual stock momentum, cross-sectional dispersion in mean returns and potential microstructure influences. Crombez (2001) research, which is based on a simulation experiment, found that momentum strategies exist due to the noise in expert information. The author found the noise is still observable in a large and liquid sample. Thus, momentum can be found in his research sample even when the agents are rational and the markets are efficient.

3.7.2 Size and Book to Market Effect

Fama and French (1992) were the first to prove that market beta cannot explain the cross sectional variation of expected returns on US stocks using the non-financial stocks traded in the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ during the 1963 – 1990 periods. Further, they found that firm size and book to market equity does explain the cross sectional variation of expected returns on US stocks. Since then, subsequent researchers such as Chan et al. (1991), Daniel and Titman (1997), and Chui and Wei (1998) have shown that the book to market effect does play an important role in explaining the cross sectional variation of the Japanese stock market. This empirical evidence shows that the market beta is not related to the expected stock returns. Daniel and Titman's (1997) study on the Japanese stock market suggests that when comparing the evaluated returns to the matched samples formed on the basis of capitalization, book to market and past returns, the intercepts from regressions on factor portfolios would be preferred to account for the Jegadeesh and Titman (1993) momentum effect. In addition, their result also suggests that the relationship between book to market and turnover is relatively weak. Furthermore, Daniel et al. (2001) replicates the Daniel and Titman (1997) study to test the Tokyo stock exchange and found Japanese stock returns to be more closely related to their book to market ratios than those of their U.S counterparts due to the proxies for covariance with priced factors. The authors reject the Fama and French (1993) three factor model but fail to reject the characteristic model. They suggest that it is possible that a variant of their factor model may explain the returns much better.

Rosenberg et al. (1985) was the first who discovered a positive relationship between a return premium in the US stock markets and the high ratio of a firm's book to market value. The book to market effect was further confirmed by Chan et al. (1991) in the Japanese stock market data, which showed a positive relationship between the average return and companies' book to market value. Davis (1994) also found similar results using US data during the period from July 1940 to June 1963.Davis's results showed that book-to-market, earnings yield and cash flow yield have significant explanatory power.

The size effect was first tested by Banz (1981) and Reinganum (1981) on the US stock market and both found a return premium on small market capital stocks. According to Coleman (1997), size as measured by the market value of the equity capitalization of a company is a fallacious explanation of expected return. The "size effect" considers that market equity has significant marginal explanatory power on security returns. Blume and Stambaugh (1983) confirmed the size effects using US data with the size of the bias in daily returns on stocks of small firms which is sufficient to alter the conclusions about the size effect. The biases can arise in any study that forms equally weighted rebalanced portfolios and the biases can be greatly reduced by using returns implicit in a buy and hold strategy. Moreover, Hawawini and Keim (1995) research results showed the presence of a size effect in Japan and several European markets. Heston et al. (1995) examined the beta and the size in twelve European countries and found that average stock returns are positively related to beta and negatively related to firm size. The beta premium is due to high beta countries that outperform low beta countries. Countries with high beta stocks outperform low beta stocks only in January. The authors reject the hypothesis that the differences in average returns on the size and beta sorted portfolios can be explained by the market risk and the exposure to the excess return of the small over large stocks. They found no relationship between the average returns and the small over large stocks when they controlled for size.

Halliwell, Heaney and Sawicki (1999) were the first to test the Australian stock market using the Fama and French three factor model. However, their results do not have a strong ground in supporting or rejecting the Fama and French model. Their results showed evidence of the size effect and some weak evidence of the book to market effect. In addition, they compared their Fama and French model results with the CAPM using the same data sample but there is not much improvement in the result. Their weighted average beta is much lower than expected which indicates that there might be some problem with their data sample. Faff (2001) tested the Australian stock market for the period 1991-1999 using the Fama and French model and showed strong evidence of a negative size effect and a positive book to market effect. (See Anderson, Lynch and Mathiou, 1990, Beedles, Dodd and Officer, 1988, and Brown, Keim, Kleidon and Marsh, 1983). In spite of a negative size effect and a positive book to market effect, Gaunt, Gray and McIvor (2000) were the only ones who showed evidence of a positive size effect in the Australian stock market returns.

Sehgal and Tripathi (2005) examined whether there is a size effect in the Indian stock market using a sample of 482 companies for the period from 1990 to 2003. They found a strong size effect using the measures of market capitalization, enterprise value, net fixed assets, net annual sales, total assets and net working capital. The Sehgal and Tripathi study has a huge impact on investors and practitioners who are looking for trading strategies that beat the market. The strong size effect in the Indian stock market raises doubts for investors regarding the informational efficiency. Kassimatis (2002) investigates the significance of the size, book to market and momentum risk factors in explaining portfolio returns in the Australian stock market. The author compared the CAPM to the Fama and French Four factor model and found that size, book-to-market and momentum have significant explanatory power. Under the time-varying assumption, the significance of size, book to market and momentum become marginal and may work as a proxy for mis-specified market risk. Djajadikerta and Nartea (2005) studied the New Zealand stock market from 1994 to 2002 to examine the size and book to market as determinants of returns in the New Zealand stock market and whether the Fama and French three factor model is able to explain the variation in stock returns. Their results showed a significant size effect, but a weak book to market effect. The three factor model explained the study well compared to the CAPM.

3.8 Extreme Returns

Longin (1996) defines an extreme return as the lowest daily return or the highest daily return of the stock market index over a given period. The author used the NYSE index for the period 1885 to 1990 and showed that the evidence of extreme returns obeyed a Frechet distribution. Furthermore, Kumar (2009) used the US individual investor's portfolio position data for the period from 1991 to 1996 and concludes that there is a specific group of investors who prefers to invest in lottery type stocks. The author defines lottery type stocks as stocks with three characteristics: high idiosyncratic skewness, high idiosyncratic volatility and low stock price. Kumar (2009) used the return moments-based characterization of lottery-type stocks to get away from a large number of behavioural mechanisms which are likely to generate a preference for higher order moments. For example, striking the jackpot can induce a preference for skewness. Barber, Odean and Zheng (2005) discussed the lottery-type stocks as having one or more features investors may use to select stocks such as positively skewed stocks with extreme returns. Thaler and Ziemba (1988) investigated the market efficiency and rationality of wagering markets. The authors find that the lottery-like stocks are efficient except for slight anomalies. Garett and Sobel (1999) used the US lottery games to explain why risk-averse individuals take unfair gambles. Their research results showed theoretical and empirical evidence of the degree of skewness in the payoffs which explains why risk adverse individuals may play the lottery.

Bali, Cakici and Whitelaw (2010) employed the NYSE, AMEX and NASDAQ equity prices for the period from January 1926 to December 2005. The authors found evidence of a negative and significant relation between the maximum daily returns over the past one month (MAX) and the expected stock returns. In addition, size, book to market, momentum, short term reversals, liquidity and skewness are significant with cross-sectional expected returns. The authors also showed that the MAX leads to a positive relationship between idiosyncratic volatility and returns. The result also shows that investors may be willing to pay more for stocks that exhibit extreme positive returns and hence these stocks exhibit lower returns in the future. Bali, Cakici and Whitelaw's (2010) result is consistent with Barberis and Huang's (2008) cumulative prospect theory where a security's own skewness can be priced; a positively skewed security can be "overpriced" and will earn a negative average excess return.

Boquist (2010) recently investigated the US stock market from 1963 to 2009 on the relationship between idiosyncratic volatility, liquidity and extreme returns. The author's results show that firms with high liquidity and low idiosyncratic volatility have significantly positive adjusted returns. Boquist also examined the effect of extreme returns on the relationship between idiosyncratic volatility and returns. The author's results show that the negative relationship between the highest and the lowest idiosyncratic volatility quintiles and the subsequent returns will be reduced significantly if the extreme one day returns have been removed.

Poon, Rockinger and Tawn (2003) used two simple non-parametric measures to identify and quantify the tail dependence among stock returns in five international stock markets including S&P 500, FTSE 100, DAX 30, CAC40 and Nikkei 225. The sample period is from December 26th 1968 to May 31st 2000. The authors explained that there is strong evidence in favour of asymptotically independent models for the tail structure of stock market returns and the extreme dependence is due to heteroskedasticity in the stock returns process. Silva and Mendes (2003) use the extreme value theory to analyze ten Asian stock markets and identify which type of extreme value asymptotic distribution fits the historical extreme market events better. The authors' empirical test results show that the return distributions are not characterized by normality and that the maximum and minimum of the return series may be satisfactorily modelled within an extreme value framework. Moreover, the results suggest that the estimating value at risk extreme value method is a conservative approach to determine capital requirements.

3.9 Summary of the Literature Review

There are several studies on the asset pricing impact on idiosyncratic volatility. Table 3.1 shows an overview of the empirical results on the inter-temporal and cross sectional relationship of idiosyncratic risk and return.

Table 3.1: Synopsis of idiosyncratic risk and return

Author	**Sample period**	**Market tested**	**Idiosyncratic risk definition**	**Measure of Expected Volatility**	**Result**
		Panel A: Inter-temporal relationship			
Campbell et al. (2001)	1962-1997	US stock market	Total variance	Lagged	Positive relationship
Hamao et al. (2003)	1975-1999	Japan stock market	Total variance	Lagged	Positive relationship
Goyal & Santa-Clara (2003)	1962-1999	US stock market	Total variance	Lagged	Positive relationship
Bali et al. (2005)	1962-2001	US stock market	Total variance	Lagged	No relationship
Guo & Savickas (2006)	1963-2002	US stock market	Total variance	Lagged	Negative relationship
Chang & Dong (2005)	1975-2002	Japan stock market	Total variance	Lagged	Positive relationship

Panel B: Cross-sectional relationship

Lintner (1965)	1954-1963	US stock market	CAPM residuals	Lagged	Positive relationship
Lehmann (1990)	1931-1983	US stock market	CAPM residuals	Lagged	Positive relationship
Malkiel & Xu (2004)	1975-2000	US stock market	FF 3 factor residuals	Lagged	Positive relationship
Spiegel & Wang (2005)	1962-2003	US stock market	FF 3 factor residuals	EGARCH	Positive relationship
Ang et al. (2006)	1963-2000	US stock market	FF 3 factor residuals	Lagged	Negative relationship
Eiling (2006)	1959-2005	US stock market	CAPM residuals	EGARCH	Positive relationship
Brockman & Yan (2006)	1926-1962	US stock market	FF 3 factor residuals	Lagged	Negative relationship
Huang et al. (2007)	1963-2004	US stock market	FF 3 factor residuals	EGARCH	Positive relationship
Brockman &Schutte (2007)	1980-2007	US stock market	FF 3 factor residuals	EGARCH	Positive relationship
Bali &Cakici (2008)	1963-2004	US stock market	FF 3 factor residuals	Lagged	No relationship
Fu (2009)	1963-2006	US stock market	FF 3 factor residuals	EGARCH	Positive relationship
Bali, Cakici& Whitelaw (2010)	1926-2005	US stock market	FF 3 factor residuals	Lagged	Negative relationship

Fama and French -3 factor refers to the Fama and French (1993) three factor models and EGARCH to the exponential GARCH introduced by Nelson (1991).

In summary, transaction costs and unavailable information are some of the factors that prohibit investors from fully diversifying their portfolios. Idiosyncratic risk also known as diversifiable risk is part of the investors' concern. The investors want to be compensated for the higher idiosyncratic risk with a higher return. Merton's (1987) model established a positive relationship between idiosyncratic volatility and expected return. However, Ang et al. (2006) showed evidence of a negative relationship between idiosyncratic volatility and expected return. This was later confirmed by Brockman and Yan (2006) who tested the US stock market from 1926 to 1962. The authors obtained similar results as Ang et al. (2006). This has been extensively debated by the researchers who were criticized on the methods used. Fu (2009) commented that idiosyncratic volatilities are time-varying and therefore a one month lagged value is not a good proxy for the expected value. The author suggested the EGARCH model should be used instead to estimate the expected idiosyncratic volatilities as they are positively related to the expected return.

CHAPTER 4

Research Methodology

4.0 Introduction

This chapter discusses the research methodology. Section 4.1 describes the data collection process and the definitions of the control variables used in the study. Section 4.2 describes the computation methods for both IV and extreme returns. This study used Ang et al.'s (2006) method to compute IV and Bali et al.'s (2011) method to calculate extreme return. Finally, Section4.3 discusses the grouping method and the computation of Fama and French-3 alpha.

4.1 Data Collection

The data for this study includes daily and monthly stock prices, return indexes, book to market ratio and market capitalization for individual firms' from the Japanese stock market. The data was obtained from the Thomson Financial DataStream and the sample period is from January 1980 to December 2007 with 2414 firms included in the sample. The risk free rate, which is also referred to as the interbank interest rate, was also obtained from Thomson Financial DataStream. Market returns are the value weighted returns of all firms used in the study. The stock returns are computed from the return indexes (RI) variable provided in DataStream. The daily returns are calculated using the percentage change in return indexes:

$$R_t = RI_t - 1 * \frac{PI_t}{PI_{t-1}} * (1+ \frac{DY_t}{100} * \frac{1}{N}) \qquad (4.1)$$

Where $\mathrm{R_t}$ is the return index on day t;

$\mathrm{R_{t-1}}$ is the return index on previous day;

$\mathrm{PI_t}$ is the price index on day t;

$\mathrm{PI_{t-1}}$ is the price index on previous day;

$\mathrm{DY_t}$ is the dividend yield % on day t;

N is the number of working days in the year (Taken to be 260)

The current study employs the same methodology to compute both daily and monthly stock returns for each individual stock. We eliminate all daily returns of less than -100% as they are the result of measurement error in the return index. The formula is:

$$\mathrm{R_t} = \mathrm{Ln}\left(\frac{RI_t}{RI_{t-1}}\right) \qquad (4.2)$$

Where $\mathrm{R_t}$ is the stock return on day (month) t;

$\mathrm{RI_t}$ is the return index on day t;

$\mathrm{RI_{t-1}}$ is the return index on day (month) t-1;

In order to control the effect of outliers, elimination criteria are listed. First, all monthly returns exceeding 200% were eliminated (Brockman and Yan, 2008). Second, we follow the Ang et al.'s (2009) method by excluding the return observations in the lowest 5% of the sample size based on the market capitalization. Following this, we compute the value weighted market return, daily and monthly size (SMB) and high value stocks over growth stocks (HML) risk factors using

Fama and French (1992) method. The risk-free rate used in this study is 3-month Gensaki bond which is equivalent to interbank overnight interest rate.

4.2. Individual Stock Returns

The monthly individual stock returns are obtained from DataStream. The monthly stock returns are computed as a log of the end of the current month's price minus the log of the end of last month's price. All stock prices are adjusted by any capital distributions, such as a dividend distribution or a dividend reinvestment plan. Individual stock returns will be used to determine the size, book to market and momentum effects in the Japanese stock market.

4.2.1 Risk Free Rate

The risk free rate used in this research is the 3-month Gensaki bond, obtained from DataStream at the beginning of each month. The risk free rate is used to calculate the monthly excess market returns and the monthly excess portfolio returns. Since the interest rate can be obtained with no risk, it is implied that any additional risk taken by an investor should be rewarded with an interest rate higher than the risk-free rate.

4.2.2 Monthly Market Rate of Returns

In order to compute the monthly market rate of return, the value-weighted method was used. First of all, market capitalization of each stock was added together. Secondly, market capitalization of each stock was divided by the total market capitalization of the whole stock market in order to get the market capitalization factor. Thirdly, the factor obtained in the second step was used to multiply with the return of each stock on that trading day. Fourthly, to get the value-weighted market return, the sum of values in the third step was calculated. This method has been adopted to calculate the daily and monthly value-weighted market rate of return.

4.2.3 Market Capitalization of Individual Stocks (MV)

Market capitalization is use to measure firm size. Following the Ang et al.'s (2009) method, the firm size is measured by the logarithm of the market value of equity (the number of total shares outstanding multiplied by market share price at the end of month t-1 for each stock). The concept of market capitalization is simple where different size companies perform differently. Most of the empirical studies show that firms with small market capitalization tend to outperform large firms.

4.2.4 Book to Market

We follow Fama and French's (1992) approach to compute the firm's book to market ratio in month t using the market value of its equity at the end of December of the previous year (calendar year t-1) divided by the market equity at the end of December of year t-1. This is similar to Drew et al. (2003) who used the book value of common equity in year t-1 divided by market value of equity at year t-1 as the book to market ratio in year t. The book to market ratio is used to identify under-valued or overvalued securities. If the ratio is above 1, then the stock is undervalued; if it is less than 1, the stock is overvalued. However, DataStream does not provide book to market ratio. It only provides market to book value of each stock. Therefore, in order to obtain the market to book value, market value is divided by the net book value calculated manually.

4.2.5 Momentum

Following the Jegadeesh and Titman (1993) method, the momentum variable for each stock in month t is defined as cumulative return on the stock over the previous 11 months starting from 2 months ago. For example, in order to obtain the momentum for December 2007, we will need the cumulative return from December 2006 to October 2007. Jegadeesh and Titman

(1993) show evidence that the low momentum stocks have lower returns than the high momentum stocks. Moreover, Hong et al. (2000) indicates that the momentum effect is asymmetric and has a stronger negative effect on declining stocks than a positive effect on rising stocks.

4.2.6 Maximum Return (MAX)

MAX is the maximum daily return within the number of trading days in the month t.

$$MAX_{i,t} = \max(R_{i,d}) \quad d = 1, \ldots, D_t \qquad (4.3)$$

Where $R_{i,d}$ is the return on stock i on day d and D_t is the number of trading days in month t.

According to Bali et al. (2011), in a cross-sectional regression context when both maximum returns and idiosyncratic volatility are included, the coefficient on the maximum return is negative and significant while the idiosyncratic volatility is positive.

4.3. Idiosyncratic Volatility Measures

Before computing idiosyncratic volatilities, we will first eliminate observations during months where firms are traded for less than 15 trading days. We will also eliminate firms with less than 30 months of consecutive market information. The elimination process mentioned above was done using the special made programme. The unfiltered sample contains 3218 firms. After imposing the above-mentioned restrictions, the sample is reduced to 2414 firms. We use these assumptions to reduce the impact of infrequent trading on the idiosyncratic volatility estimates.

There are various ways of estimating the expected idiosyncratic risk based on the literature such as Eiling (2006) who used CAPM residuals; Bali et al. (2011) used the Fama and French 3 factor residuals. We use Ang et al.'s (2006) method to calculate idiosyncratic volatility. Ang et al. (2009) found that stocks with lower lagged idiosyncratic risk have higher expected returns not only in the US but also in 23 developed countries including Japan. We use the following equation to calculate the idiosyncratic volatility:

$$r_{i,t} = \alpha_{i,t} + \beta 1_{i,t} MKT_t + \beta 2_{i,t} SMB_t + \beta 3_{i,t} HML_t + \varepsilon_{i,t} \quad (4.4)$$

Where $r_{i,t}$ is the daily excess return of an individual stock, α is the constant, βs are the coefficients of each variable, MKT, SMB and HML are from the Fama and French (1993) three factors model, where MKT is the excess return of the market portfolio over the risk free rate, SMB is the size factor determined by the excess return of the small firms over the big firms, HML is the excess return of the high book to market ratio firms over the low book to market ration firms and $\varepsilon_{i,t}$ is the residual. According to Ang et al. (2006), monthly idiosyncratic volatility calculations can be obtained by first regressing the daily individual stock returns with the daily Fama and French three factors and each stock's daily residual is saved for the whole sample period. Second, the standard deviation of daily residual $\sqrt{VAR_{[\varepsilon]_{i,t}}}$ is multiplied by the square root of the number of trading days in the month.

4.3.1 Trend Test

Vogelsang's (1998) simple linear trend test is used to test for trends. The benchmark model is given as follows:

$$VOL_t = b_0 + b_1 t + \mu_t \quad (4.5)$$

VOL_t represents the variable where it is equal to the weighted idiosyncratic volatility, the value weighted idiosyncratic volatility and the market capitalization, and t is a linear time trend. Vogelsang (1998) developed the t-PS1 test which is a size robust trend statistic that is valid in both $I\ (0)$ and $I\ (1)$ cases, i.e. whether or not a unit root exists in the error terms. Moreover, Bunzel and Vogelsang (2005) developed the *t*-dan test ("dan" is the subscript for the "Daniell Kernel") to non-parametrically estimate the error variance. The *t*-dan test has a better test power and retains the good size properties of the PS1test. The *t*-dan test is based on additional kernel power among a wide range of kernels. The t-dan test analyzes the power properties of the test with regards to the bandwidth and kernel choices. Among the popular kernels, there are specific kernel and bandwidth choices that deliver tests with maximal power within a specific class of tests that have the correct asymptotic size whether the errors are stationary or have a unit root. The size robustness was achieved using J scaling factor proposed by Vogelsang (1998). The partial sum test of Vogelsang (1998) is also recommended because it provides a viable compromise between the two Daniell Kernel tests when serial correlation is strong.

4.3.2 Single Sorting

Five portfolios were formed every month, at the beginning of each month based on idiosyncratic volatility in order to test the relationship between the idiosyncratic volatility and the one-month ahead stock return. All firms in the sample size were sorted based on idiosyncratic volatility calculated from equation (4.4) and divided equally into five groups. Portfolio 1 is the upper fifth of all firms with the highest idiosyncratic volatility, while Portfolio 2 is the four fifth of all firms, etc. Portfolio 5 is the lowest fifth of all firms with low idiosyncratic volatility. A portfolio of equal weighted and value weighted raw return will be computed. For example, portfolios that were formed at the beginning of January will have their return tracked for the month of January. The portfolios will then be formed for the subsequent month.

4.3.3 Cross-sectional Correlations and Regressions

Fama and Macbeth (1973) regression and double sorting stocks into portfolios based on book-to-market, momentum and size were used in our study. The intuition of using these two approaches is because they will provide a useful robustness check. However, both approaches have some advantages and weaknesses. The double sorting approach is a simple non-parametric method to analyze stock returns across the variables without any linear restrictions. The weakness for this approach is the weighting scheme used for calculating the portfolio returns (Fama and Macbeth, 1973). If the value weighted returns approach has been chosen, a few big firms might dominate the returns. On the other hand, equally weighted portfolios may be dominated by extremely small stocks in which the results may not represent the overall picture of the effect of the anomaly. It is difficult to draw a conclusion on the cross-sectional correlation and regression results whether the average returns can be well explained by the variables as the results contradict the multiple regression slopes which provide direct estimates of the marginal effects.

The Fama Macbeth regression is a method used to eliminate parameters for asset pricing models such as CAPM. The method estimates the betas and risk premia for any risk factors that are expected to determine asset prices (Fama and Macbeth, 1973). The parameters are estimated in 2 stages:

1. First we select all stocks with at least 24 returns over the last 60 months and regress those returns on a constant and a Fama and French 3 factor.

2. The factor coefficients for each stock are saved and used as the 3 “betas” of the stock as the next 12 months.

Fama and French (2008) pointed out that double sorting is inadequate to test the relationship between stock returns and pricing variables such as momentum, size, book to market, etc. On the other hand, the advantage of the regression approach is the direct intervention of the marginal effects of the variable within the whole sample by imposing restrictions on testing the relationship between the explanatory variables and returns. However, the linear relationship assumption is incorrect because we cannot borrow or lend at the risk-free rate and cannot leverage without limit. In real life, some investors cannot or will not sell short (Arnott et al., 2005). Small companies will dominate in the regression approach as value weight is given to all companies. In some cases, the return of individual stocks might be extreme and this will lead to observation problems in the cross-sectional regressions. Moreover, high correlation between explanatory variables such as the multicollinearity problem will offset the estimates for the marginal effects of individual variables. Cross-sectional Pearson correlation is computed to test whether there are high correlations between the explanatory variables.

4.3.4 Double Sorting Method

The portfolios are formed to study the impact of asset pricing over the idiosyncratic risk and cross-sectional effects such as size, momentum and book to market effects. A portfolio strategy is the most common method used in asset pricing research because it is easy to analyze and interpret the stock returns without introducing any linear restrictions (Cochrane, 1999). However, the double sorting method used in this thesis followed Ang et al.’s (2006) method. First of all, we sort the stocks into 5 portfolios according to its characteristics (for example: Size) in the previous month at the beginning of each month. Each portfolio has the same number of stocks. Secondly, the stocks are sorted again into 5 portfolios according to the stocks IV within each stock portfolio control variable such as size. Thirdly, 25 stock portfolios are formed which accommodate the same amount of stocks. Besides that, equal-weighted and value-weighted portfolio raw returns for the current month were computed. For example, by using Size as the control variable, the stocks are first sorted into 5 portfolios according to the stock's Size. Therefore, the SIZE 1 portfolio contains the first top 20 percent stocks with the highest Size value; the SIZE 2 portfolio contains the second top 20 percent stocks, the SIZE 3 portfolio contains the third top 20 percent stocks, the SIZE 4 portfolio contains the fourth top 20 percent stocks, the SIZE 5 portfolio contains the lowest 20 percent of all stocks with low Size values. After that, stocks are further sorted into 5 portfolios according to the stocks IV within each SIZE portfolio. On the other hand, SIZE-IV portfolios accommodate same amount of stocks. Finally, 25 portfolios were formed and can be identified as SIZE1-IV Low, SIZE1-IV 2, SIZE1-IV 3, SIZE1-IV 4, and SIZE1-IV-High, SIZE2-IV Low, SIZE2-IV2 and etc. This method was also used for other control variables and MAX. On top of that, this study also used the Fama and French three factor model (1993), similar to Ang et al.'s (2009) study to obtain alpha for each of the 25 double sorted portfolios.

4.4 Conclusion

This chapter presented the research methods used in the study which includes the single portfolios sorting, the double portfolios sorting and the Fama and Macbeth approach. The chapter also describes the data collection and explains the restrictions set for filtering the data.

This study has followed Ang et al.'s (2006) method to test the relationship between idiosyncratic risk and the expected returns. This is because Ang et al. (2006) is well known for the puzzle in asset pricing. Further, the three factor model is used to examine the different patterns of idiosyncratic risk in the Japanese stock markets and to estimate the relationship between idiosyncratic risk and the expected returns. This study investigates whether variables such as book to market, momentum and size affect the relationship between idiosyncratic risk and the expected returns. In order to ensure that the results are reasonable, robustness tests based on the market model and four-factor model were performed. The research findings are discussed in Chapter 5.

CHAPTER 5

Research Results and Findings

5.0 Introduction

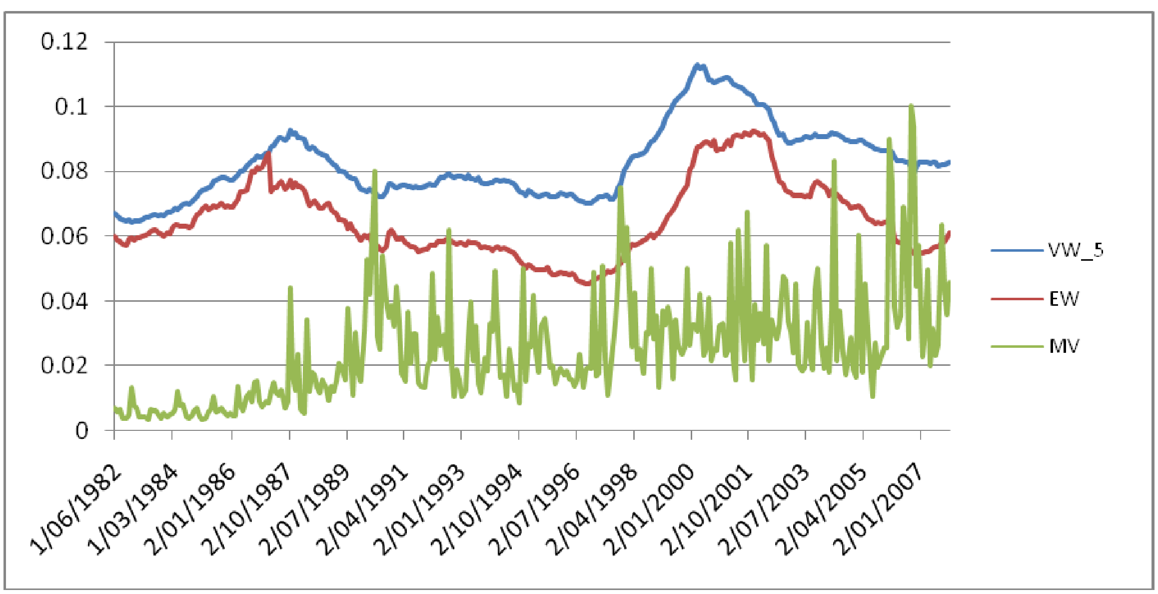
This chapter discusses the empirical findings of the idiosyncratic volatility trend, the Fama and French three factor model and Fama and Macbeth's regressions in the Japanese stock market. The chapter is structured as follows: Section 5.1 discusses the graphical analysis, the descriptive statistics and the estimated results for the time trend of the volatility series. Section 5.2 discusses the estimated results in predicting one-month ahead excess market returns. Section 5.3 shows the average monthly raw returns of the stock portfolios sorted according to idiosyncratic volatility and extreme returns. Section 5.4 discusses the estimated results from the Fama and French three factor models and the Fama and Macbeth model on idiosyncratic volatility and extreme returns.

5.1. Graphical Analysis

It has been a hot issue in the finance field that the US stock market volatility has increased over time. However, Campbell et al.'s (CLMX, 2001) study shows that there is no long term upward trend in the volatility of the NASDAQ composite index for the period from 1962 to 1997.

This study applies the same argument on the Japanese stock market. Figure 5.1 plots the IV^{EW}, IV^{VW} and MV idiosyncratic and market volatility, respectively. The equal weighted and the value weighted idiosyncratic volatility measures show that they move together. This is confirmed with the high correlation coefficients reported in Table 5.1. The idiosyncratic volatility peaked at the end of 1999 and in early 2000. This can be explained by the world economic crisis that has affected Japan with deflation being the main problem. Deflation began in Japan in 1999 and by 2005 the Japanese Yen had lost around 103% of its buying power. After the idiosyncratic volatility reached its peak at the end of 1999/ early 2000, idiosyncratic volatility has been on a downwards trend since then. According to Iwasawa (2003), the Japanese market volatility has not increased during 1990s. Their average annual standard deviation has declined from 24 percent in 1990 to 1994 to 17 percent during 1995 to 1999. Further, Iwasawa (2003) pointed out that the industry and the firm level volatilities were high in non-recession months in 1999 and 2000 due to the technology bubbles which caused the share values of technology companies to tumble violently, bringing down the Japanese stock market.

Figure 5.1: Idiosyncratic and Market Volatility



Note: VW_5 is value weighted idiosyncratic volatility
EW is equal weighted idiosyncratic volatility
MV is market volatility

Source: Data for Figure 5.1 are obtained from the calculated IV and MV figures

5.1.1 Descriptive Analysis

Panel A in Table 5.1 reports the descriptive statistics for three volatility series which include IV^{EW} , IV^{VW} and MV. IV^{EW} and IV^{VW} are equal weighted and value weighted idiosyncratic volatilities. IV is the standard deviation of residuals from the Fama and French three factor models. MV is the monthly market volatility computed using the daily value weighted market returns. For example, MV as at end of month *n* is the standard deviation of the daily value weighted market returns for the past 22 trading days ending on the last trading day of month *n*. IV^{EW} has a higher mean and median compared to IV^{VW}. This shows the implication of smaller firms having higher IV and consistent with the literature (See Drew et al.,2006) and Bekaert et al.,2009)) on other markets especially the US market. In addition, IV^{EW} have smaller coefficient of variation value compared to IV^{VW}. That shows IV^{VW} is more variable than IV^{EW} . On the other hand, MV has higher coefficient of variation (CV) which indicates that the results that MV has greater dispersion compared to IV^{EW} and IV^{VW}. Before analysing the trend, we will consider the absolute magnitudes of the volatility components in the benchmark sample based on monthly returns. The mean of IV^{EW}, IV^{VW} and MV are 0.0835, 0.0653 and 0.0251, respectively, with an annual standard deviation of 1.2 percent, 1.18 percent and 1.72 percent, respectively.

Panel B in Table 5.1 shows that both IV^{EW} and IV^{VW} are highly correlated with a value of 0.8031 as expected. However, IV^{EW} is positively correlated with MV while IV^{VW} is negatively correlated with MV. According to Blume and Stambaugh (1983) and Bali et al. (2005), IV^{EW} is highly correlated to MV compared to IV^{VW} because the value-weighted volatility measures are less affected by microstructure issues such as the bid-ask bounce problem than the equal-weighted measures. It is well know that the bid-ask bounce inflate volatility and this will affect the small and illiquid stocks.

Panel C in Table 5.1 reports the auto-correlation coefficients for the three volatility measures. All three volatility series show a significantly high correlation, which raises the possibility that they contain unit roots.

In order to test the presence of unit roots, we perform the augmented Dickey Fuller (1979) t-tests based on the regressions of time series on their lagged values and the lagged difference terms that account for serial correlation. The Dickey Fuller (1979) test results are shown in Panel D in Table 5.1. The results showed no unit roots for all three volatility series at the 0.05 level of significance, regardless of whether a trend is included or not. Therefore, we will use levels instead of first differences for our volatility series analysis.

Table 5.1: Descriptive Statistics of Volatility Series in the Japanese stock market

Panel A: Summary Statistics (%)

	Mean	**Median**	**Std. Dev.**	**CV**	**Max**	**Min**
IV^{EW}	8.35	7.99	1.20	14.34	11.65	6.53
IV^{VW}	6.53	6.29	1.18	17.98	9.31	4.51
MV	2.51	2.17	1.72	68.35	10.01	0.34

Panel B: Correlation Table of Volatility Series in the Japanese stock market

	IV^{EW}	IV^{VW}	**MV**
IV^{EW}	1.0000	0.8031	0.2769
IV^{VW}		1.0000	-0.0087
MV			1.0000

Panel C: Autocorrelation Structure of Volatility Series in the Japanese stock market

	IV^{EW}	IV^{VW}	**MV**
ρ_1	0.993	0.994	0.520
ρ_2	0.983	0.985	0.430
ρ_3	0.970	0.973	0.497
ρ_4	0.956	0.959	0.363
ρ_6	0.920	0.926	0.390
ρ_{12}	0.787	0.795	0.286

Panel D: Unit root test t-statistics of Volatility Series in the Japanese stock market

	Constant	**Constant and Trend**
IV^{EW}	-2.4360	-2.4667
IV^{VW}	-2.8963	-3.1868
MV	-2.3854	-3.7416

5.1.2 Deterministic Time Trend Model

In this section, we test the hypothesis on the existence of a deterministic linear time trend. The estimated time trend volatility and its t-statistics are reported in Table 5.2. The standard t-test shows a negative trend for IV^{EW}, IV^{VW} and MV which means the equal-weighted and value weighted idiosyncratic volatility and the market volatility are stronger over time. Vogelsang (1998) argues that the null hypothesis of no trend is rejected too often when errors in the trend regression are persistent. Since volatility series are fairly persistent and standard trend tests are not valid, therefore, we will use the procedure suggested in Bunzel and Vogelsang (2005). Vogelsang (1998) suggests the t-PS1 test which is a size robust trend statistic that is robust in both I(0) and I(1) cases, for example whether or not a unit root exists in the error terms. In addition, Bunzel and Vogelsang (2005) introduced the t-dan test which is much improved and has better power than the t-PS1 while retaining its good size of properties. Table 5.2 showed the t-dan test statistics and confirmed the occurrence of a negative trend in all volatility series. The t-dan statistics for IV^{EW}, IV^{VW} and MV are -4.2806, -3.3859 and -2.2733, respectively, and all are significant at the 95 percent level. We found the negative idiosyncratic risk trend in Japanese stock market to be similar to the Chang and Dong (2006) results where the authors found a statistically significant downward trend in the idiosyncratic volatility during a post bubble period. Further, from Figure 5.1 we can see that an individual stock's volatility has increased from 1997-2000 and then decreased from 2000-2007 in the Japanese stock market. In summary, we found a negative trend of IV^{EW} and MV. They are both statistically significant under the t-dan test. However, negative trend of IV^{VW} is statistically insignificant under the t-dan test. Our findings are useful in proving the various hypotheses that explain the downward trend in idiosyncratic volatility.

Table 5.2: Time Trend of the Volatility Series

	Linear trend (x 10^{-5})	**t-stat**	**t-dan**
IV^{EW}	-7.21	-10.9808	-4.2806**
IV^{VW}	-1.68	-2.0732	-1.3859
MV	-7.24	-11.9579	-2.2733**

Note: ** Statistically significant for t-dan is 1.726.

5.2 Idiosyncratic Risk and the Market Return

All three volatility series have some high frequency noise. After checking the trends in the variance series, we analyzed the forecasting power of the total return volatility of the market return. Goyal and Santa Clara (2003) used CRSP data from July 1962 to December 1999 and they regressed the monthly excess value-weighted portfolio return on two lagged monthly measures of volatility, which includes the variance of the value weighted portfolio's daily returns and the arithmetic average of the variance of each stock's daily returns. They found that the lagged stock variance averaged over all the stocks traded can forecast the market return in the US. Their research results showed that the arithmetic average of the variance of each stock's daily returns still has a positive significant coefficient regardless of adding the variance of the value-weighted portfolio's daily returns as an independent variable. Therefore, Goyal and Santa Clara (2003) argued that the total risk which includes systematic risk and idiosyncratic risk is priced in the market returns because it matters to investors who hold undiversified portfolios.

Goyal and Santa-Clara (2003) found evidence of forecasting ability with a positive relationship between the equal-weighted average stock idiosyncratic volatility and the market return, but found no significant relationship between the market volatility and the market return in the US stock market during the period 1963 to 1999. Wei and Zhang (2006) argued against the relationship found by Goyal and Santa-Clara (2003) between idiosyncratic volatility and market return. Wei and Zhang suggested one of the reasons for the positive relationship between the equal-weighted average stock idiosyncratic volatility and the market return is because they used the 1990s data. Moreover, Bali, Cakici, Yan and Zhang (2005) justified that the relationship between total volatility and market return is unstable and they argued that the Goyal and Santa Clara (2003) results are due to small stocks and a liquidity premium issue. Bali et al. (2005)

extended the Goyal and Santa-Clara (2003) sample size by two years and found that the relationship between total volatility and market return disappears when they used the value weighted average to measure the stock volatility compared to Goyal and Santa Clara (2003) who used the equal weighted measures. Brockman and Yan (2006) debated regardless of equal or value-weighted measures; they did not find any evidence of forecasting ability during their research sample from January 1926 to June 1962 in the US stock market.

In our sample data we test whether idiosyncratic volatility and market volatility can predict market return:

$$MKTR_{t+1} = \alpha + \beta_{vol} VOL_t \quad (5.1)$$

where MKTR is the market return minus the risk free rate, VOL represents IV^{EW} (Equal-weighted idiosyncratic volatility), IV^{VW} (Value-weighted idiosyncratic volatility) and MV (market volatility). In Table 5.3, we report three regression results based on IV^{EW}, IV^{VW} and MV. The results showed that neither the equal-weighted, value-weighted idiosyncratic volatility nor the market volatility is able to forecast the one month ahead market excess returns. The t-values associated with the volatilities are not greater than 1.4527. The R-squared values for the three regressions do not increase more than 0.46%. In summary, our research findings confirm that volatilities, be it equal-weighted, value-weighted idiosyncratic volatility or market volatility is unable to forecast the one month ahead excess market returns. Our research results confirm Brockman and Yan's (2006) finding. They found no evidence of forecasting ability during their research sample from January 1926 to June 1962 in the US stock market. In general, our results contribute to the literature in regards to the predictive ability of volatilities where our research results showed that equal-weighted, value-weighted idiosyncratic volatility and idiosyncratic volatility cannot predict the one month ahead market excess returns.

Table 5.3: Predicting One-Month Ahead Excess Market Return

$$MKTR_{t+1} = \alpha + \beta_{vol} VOL_t$$

α	IV^{EW}	IV^{VW}	**MV**	R^2
-0.0208	0.1622			-0.0062
(-2.3367)	(1.4527)			
-0.0185		0.1672		0.0046
(-2.1830)		(1.2441)		
-0.0052			-0.1456	0.0023
(-1.1111)			(-0.8944)	

Note: Numbers in parenthesis are t-statistics.
VOL is the volatility which includes the equal weighted IV (IV^{EW}), value weighted IV (IV^{VW}) or market volatility (MV)
Reported regression coefficients are re-estimated coefficients using M-L ARCH for cases with significant serial correlation and/or heteroskedasticity, otherwise OLS estimates.

5.2.1 Maximum Return (MAX) and the Market Return

After we found that idiosyncratic volatility has no predictive ability on one month ahead excess market return, we then use the maximum return to check whether it helps in predicting one-month ahead excess market return. Our research motivation is derived from Bali et al. (2011) who found a negative and significant relationship between the maximum daily return over the past one month and expected stock returns in portfolio and firm level cross-sectional regressions. Most of the literature (See: Goyal and Santa-Clara (2003), Bali, Cakici, Yan and Zhang (BCYZ)(2005), Brockman and Yan (2006)) discuss volatilities predicting one-month ahead excess market return but none of them use the maximum return to predict one-month ahead excess market return. Therefore, our research is the first to use the maximum return and idiosyncratic volatility to predict one-month ahead excess return in the Japanese stock market. We use the maximum return forecasting ability in our sample data:

$$MKTR_{t+1} = \alpha + \beta_{vol} VOL_t \quad (5.2)$$

where MKTR is the market return minus the risk free rate, VOL represents MAX (maximum return) and MV(market volatility). In Table 5.4, we report two regression results based on MAX and MV. The results showed that MAX is able to forecast one month ahead market excess returns because the t-value associated with the maximum return is 3.4820. In conclusion, our research findings confirm that MAX is significant in forecasting one month ahead excess market returns in the Japanese stock market.

Table 5.4: Predicting One-Month Ahead Excess Market Returns

$MKTR_{t+1} = \alpha + \beta_{vol} VOL_t$			
α	**MAX**	**MV**	R^2
-0.0122	0.0769		0.0350
(-4.019)	(3.4820)		
-0.0052		-0.1456	0.0023
(-1.1111)		(-0.8944)	

Note: Numbers in parenthesis are t-statistics.
VOL represents the MAX which is maximum return or market volatility (MV).
Reported regression coefficients are re-estimated coefficients using M-L ARCH for cases with significant serial correlation and/or heteroskedasticity, otherwise OLS estimates.

5.3 Cross-sectional Stock Returns

In this section, we analyze the relationship between idiosyncratic volatility, maximum daily returns and cross sectional stock returns. Ang et al.'s (2006) research findings on cross-sectional stock returns had puzzled the researchers as their results showed stocks with high idiosyncratic volatility to have abysmally low average returns. Similarly, Bali et al.'s (2010) findings again puzzled the researchers where the authors showed maximum daily returns reverse the puzzling negative relationship between returns and idiosyncratic volatility documented in Ang et al.'s (2006) study. Bali et al. (2010) interpreted their results in the context of a market with poorly diversified risk averse investors who preferred lottery-like assets. This may be due to the investor's preference for lottery-like payoffs leading to under-diversification. Moreover, the expected returns on stocks that generate extreme positive returns are low, but when they control this effect, the stocks with high idiosyncratic risk are expected to fetch high expected returns.

5.3.1 Is There a Relationship Between Stock Return and Idiosyncratic Volatility?

This section provides the descriptive evidence of the relationship between idiosyncratic risk and stock returns. Table 5.5 shows the value-weighted and equal-weighted average monthly returns of stock portfolios that are formed by sorting the stocks from the Japanese stock market based on the idiosyncratic volatility (IV). The results are reported for the sample period of January 1980 to December 2007. At the beginning of each month, we form five portfolios on the basis of the previous month's idiosyncratic volatility. For the value-weighted portfolios, we calculate the portfolio returns by using market capitalization weights. The equal-weighted returns are calculated over each month and as averages.

Portfolio 1 (low IV) is the portfolio of stocks with the lowest idiosyncratic volatility during the previous month, and portfolio 5 (high IV) is the portfolio of stocks with the highest idiosyncratic volatility during the past month. The value-weighted average raw return difference between portfolio 5 (high IV) and portfolio 1 (low IV) is -0.12% with a corresponding t-statistic of -0.23. Besides the average raw returns, the intercepts from the regression of the value-weighted portfolio returns, the excess market return, the size factor (SMB) and the book to market factor (HML) from the Fama and French three factor alphas are reported in Table 5.5. The difference between the alphas for high IV and low IV portfolios is 0.18 with a t-statistic of 4.96. When we look at value-weighted average returns and alphas across quintiles, the results show no increase in the average return when idiosyncratic volatility increases in the portfolios. The average returns increase in quintiles 1 to 3 from 0.23 to 0.41 but drop significantly from 0.29 to 0.l1 in quintiles 4 to 5. The most interesting part is how alphas for quintiles 1 to 3 are close to zero but increase significantly in quintiles 4 to 5, from 0.14 to 0.18.

The equal-weighted portfolios column in Table 5.5 shows there are more statistically significant results. The average raw return difference between low IV and high IV is -0.10 with a t-statistic of -0.23. The corresponding difference in alphas is 0.54. In general, our empirical results contradict the findings reported by Ang et al. (2006). They reported that firms with low idiosyncratic volatility outperformed risk-adjusted returns while firms with high idiosyncratic volatility were underperformers. However, high idiosyncratic volatility portfolio exhibits positive alpha but low idiosyncratic volatility portfolio exhibits negative alpha for equal-weighted portfolios and zero alphas for the case of value-weighted portfolios. In regards to the alphas, our results behave opposite to Brockman and Yan's (2006) finding for the US market over a different time period. We can conclude that high idiosyncratic volatility portfolios outperformed the benchmark index by 0.23% for equal-weighted portfolios and 0.18% for value-weighted portfolios. In addition, our findings behaves opposite to Bali and Cakici's (2008) findings as their study on the U.S. stock market shows a negative relation between the returns and the idiosyncratic risk disappears for the equally-weighted portfolios.

Table 5.5: Returns and Alphas on Portfolio of Stocks sorted by IV

	VW Portfolios		EW Portfolios	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low IV	0.23	0.00	0.28	-0.32
2	0.37	-0.10	0.43	-0.29
3	0.41	0.03	0.34	-0.11
4	0.29	0.14	0.30	0.14
High IV	0.11	0.18	0.18	0.23
High-Low	-0.12	0.18	-0.10	0.54
t-stats	(-0.23)	(4.96)	(-0.23)	(12.85)

Note: In Table 5.5, the quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on IV (idiosyncratic volatility). The table reports the value-weighted (VW) and equal-weighted (EW) average monthly returns, the three factor Fama and French alphas on the value-weighted and equal-weighted portfolios. The last two rows show the differences in the monthly returns and the differences in alphas with respect to the three factors Fama and French model between portfolios 5 and 1 are the corresponding t-statistics. The average raw and risk-adjusted returns are given in percentage terms. T-statistics are reported in parentheses.

5.3.2 Is There a Relationship between Stock Return and Maximum Return?

This section provides descriptive evidence of the relationship between maximum returns and stock returns. Table 5.6 shows the value-weighted and the equal-weighted average monthly returns of stock portfolios that are formed by sorting the stocks from the Japanese stock market based on their maximum returns (MAX). The results are reported for the sample period from January 1980 to December 2007. At the beginning of each month, we form five portfolios on the basis of the previous month's maximum return. For the value weighted portfolios, we calculate the portfolio returns by using market capitalization weights. The equal-weighted returns are calculated over each month and as averages, while the test statistics reported are the difference between portfolio 1 and portfolio 5.

Portfolio 1 (low MAX) is the portfolio of stocks with the lowest maximum return during the previous month, and portfolio 5 (high MAX) is the portfolio of stocks with the highest maximum return during the past month. The value-weighted average raw return difference between portfolio 5 (high MAX) and portfolio 1 (low MAX) is 0.15% with a corresponding t-statistic of 0.32 which is insignificant. Besides the average raw returns, the intercepts from the regression of the value-weighted portfolio returns on a constant, the excess market return, a size factor (SMB) and a book to market factor (HML) from Fama and French three factor alphas are shown in Table 5.6. The difference between the alphas for high MAX and low MAX portfolios is 0.08 with a t-statistic of 1.86. When we look at the value-weighted average returns and the alphas across quintiles, there is a clear sign that the average returns increase when the maximum returns during the previous month increase in the portfolios. The average returns increase in quintiles 1 to 3 from 0.19 to 0.27 but drop in quintile 4 to 0.22 and increase significantly from 0.22 to 0.34 in quintile 5. The most interesting point is that the alphas for quintiles 1 to 3 drops significantly from 0.05 to -0.04 but increase significantly in quintiles 4 to 5, from 0.04 to 0.13. Under normal circumstances, investors who are risk averse and hold poorly diversified portfolio would be willing to pay more for an extremely positive return portfolio and to accept lower expected returns. However, our results showed this is not the case.

The equal-weighted portfolios column in Table 5.6 shows the results are statistically insignificant. The average raw return difference between the low MAX and the high MAX is 0.16 with a t-statistic of 0.33. The corresponding difference in alphas is 0.08 with a t-statistic of 1.83. When compared to the value-weighted returns, the average return has a similar trend where there are extreme quintiles, quintiles 4 and 5 with average returns of 0.24 and 0.37.

In general, our empirical results are contradicted to the findings reported in Bali et al. (2010), where our research results showed firms with high maximum return outperformed firms with low maximum returns. However, the high and low maximum return portfolios obtained showed positive alpha for both equal-weighted portfolios and value-weighted portfolios. From our research findings, we can conclude that high maximum return portfolios outperformed the benchmark index by 0.14% for equal-weighted portfolios and 0.13% for value-weighted portfolios. According to Bali et al.'s (2010) study, investors overpay for stocks that exhibit extreme positive returns and those stocks consequently exhibit lower returns in the future. Their results were robust across the robustness test on single, two, three, four and five highest daily returns within a month. The bias explanation on the inefficiency were errors in the probability weighting of investors lead them to over-value stocks that have small probability of a large positive return.

Table 5.6: Returns and Alphas on Portfolio of Stocks sorted by MAX

	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low MAX	0.19	0.05	0.21	0.06
2	0.25	-0.00	0.28	0.00
3	0.27	-0.04	0.29	-0.04
4	0.22	0.04	0.24	0.04
High MAX	0.34	0.13	0.37	0.14
High-Low	0.15	0.08	0.16	0.08
	(0.32)	(1.86)	(0.33)	(1.83)

Note: Table 5.6 shows the quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on MAX (maximum daily return). The table reports the value-weighted (VW) and equal-weighted (EW) average monthly returns, the three factor Fama and French alphas on the value-weighted and equal-weighted portfolios. The last two rows present the differences in monthly returns and the differences in alphas with respect to the three factor Fama-French model between portfolios 5 and 1 and the corresponding t-statistics. The average raw and risk-adjusted returns are given in percentage terms. T-statistics are reported in parentheses.

5.3.3 Descriptive Analysis on Controlling Variables

Previous studies such as Fama and French (1992) documented a significant relation between firm sizes, book to market ratios and security returns for non-financial firms. Moreover, Jegadeesh and Titman (1993) documented the existence of a momentum effect. The authors explained the existence of the effect as a result of the investors under-reacting to the release of firm-specific information, i.e. a cognitive bias. Both studies show that all variables have an effect on the cross-sectional returns. We control the variables for the following cross-sectional tests. Table 5.7 reports the descriptive statistics and the simple correlations among the study variables. Panel A in Table 5.7 reports the following: mean, median, standard deviation, maximum and minimum of the main variables. We report values for the size (SIZE) or the market capitalization (in millions of dollars), the idiosyncratic volatility (IV), the book to market ratio (BTM), the one month lagged return (MOM) and maximum (MAX) daily return (in percent). The mean SIZE in the sample period is 9.21% and the IV mean is 6.19%. The mean BTM is 6.12%, the MAX mean is 6.04% and the MOM is 0.09% which is the lowest among the controlling variables. SIZE has the highest median which is 10.36% while MOM has the lowest median with 0.48%. On the other hand, BTM has the highest standard deviation which is 4.19% and MOM has 0.31% standard deviation which is the lowest.

We use a cross-sectional regression test to investigate the correlations between the variables, which can be regarded as a univariate test. Panel B in Table 5.7 presents a correlation matrix. The simple correlation between the excess return and the market return is positive. The IV correlates positively with the excess return, which is consistent with the results of Fu (2009) and Ang et al. (2006). The returns are positively related to BTM with a correlation coefficient of

0.098 which is consistent with the findings in the earlier literature. From the results in Panel B, it clearly shows that the BTM ratio has the highest significant correlation with IV, with a value of 0.842. This is followed by a correlation coefficient of 0.813 for EM and IV. On the other hand, it appears that MOM shows a negative relationship with the other variables, which means MOM does not have strong correlations with other variables such as SIZE, IV, BTM ratio and MAX. Strong correlations between the BTM ratio and SIZE with IV show that these two variables do have significant impact on idiosyncratic volatility.

Finally, it is necessary to note that basically the BTM ratio, the SIZE and the MAX variables are highly collinear with each other. The high co-linearity arises from the fact that it is likely that when values of the three variables increase, idiosyncratic volatility will increase as the variables have a positive relationship with idiosyncratic volatility.

Table 5.7: Descriptive Statistics for Main Variables

Panel A: Summary Statistics

	Mean	Median	Std Dev	Max	Min
ER	-0.57	-0.50	5.76	20.22	-29.65
EM	-0.93	-0.69	0.90	7.22	-3.82
SIZE ($$10^6$)	9.21	10.36	2.28	11.42	5.20
IV	6.19	6.74	2.80	11.33	3.29
BTM	6.12	5.11	4.19	16.26	11.67
MOM	0.09	0.48	0.31	20.42	-27.39
MAX	6.04	4.62	0.82	61.51	1.58

Panel B: Correlation Table

	ER	EM	SIZE	IV	BTM	MOM	MAX
ER	1.000						
EM	0.101	1.000					
SIZE	-0.066	0.649	1.000				
IV	0.036	0.813	0.759	1.000			
BTM	0.098	0.816	0.579	0.842	1.000		
MOM	0.103	-0.001	-0.093	-0.034	-0.079	1.000	
MAX	0.145	0.093	0.091	0.129	0.110	-0.022	1.000

Note: Table 5.7 reports the descriptive statistics of the regression variables. ER is the excess return, ER is the market return, SIZE is the market value of equity in the previous month (in millions of dollars), IV represents idiosyncratic volatility, BTM is the book equity divided by market value of equity in the previous month, MOM is the momentum and MAX is the maximum daily returns.

5.3.4 Controlling for Various Cross-sectional Effects (Double Sorting Portfolios)

5.3.4.1 IV Effect

We examine the relationship between the idiosyncratic volatility, the maximum daily returns and the cross-sectional stock returns in this section. In order to evaluate whether the other variables are significant in our research model, we test by controlling for other potential cross-sectional asset pricing effects such as MOM, SIZE and BTM. First, we sort the stocks into five portfolios based on a characteristic for every month (MOM, SIZE, BTM), then we sort the stocks into five portfolios based on their idiosyncratic risk. This yields 25 portfolios. The sorted portfolios are classified as low, 2, 3, 4 and high and average over the five characteristic portfolios. Thus, we obtain the idiosyncratic risk quintile portfolios controlling for each of the factors accordingly, such as MOM, SIZE and BTM.

5.3.4.1.1 Controlling for Momentum

Jegadeesh and Titman (1993) show evidence in which the low momentum stocks have lower returns than the high momentum stocks. Hong et al. (2000) indicate that according to their results, the momentum effect is asymmetric and the negative effect on the declining stocks is stronger than the positive effect on the rising stocks. They argued that loser stocks are overrepresented in the high idiosyncratic risk portfolio and that causes the idiosyncratic risk puzzle. According to Fama and French (1992), liquidity and momentum are the two most important variables that have an impact on the cross-sectional returns. However, in our case, we focus on momentum. The momentum we used in this study was an intermediate term momentum. Brennan and Subrahmanyam (1996), Datar, Naik and Radcliffe (1998), Chordia, Subhrahmanyam and Anshuman (2001) showed that past winners on average perform better than past losers during the intermediate horizon of 3 to 12 months. Therefore, it can be explained that momentum does occur in stock prices and past returns do help in predicting future returns.

The results for the portfolio return controlling for momentum is shown in the last row of Table 5.8, Panel A. The value-weighted average raw return difference between the low IV and high IV quintiles is -4.5469% with a corresponding of t-statistic of -7.7976. The low IV and high IV difference in alphas in Table 5.9 are also negative and highly significant at a significant level of 5%. Similarly, the equal-weighted average raw return difference between the low IV and the high IV quintiles is -1.7730% with a corresponding t-statistic of -2.6925 as shown in Table 5.9, Panel B. The low IV and the high IV difference in alphas, from Table 5.9, are also negative with -4.7441% which is highly significant. Similarly, the alpha spreads for equal and value-weighted is negative and highly significant. The evidence from Table 5.9 suggests that there is a significant negative IV effect. Damodaran (2010) pointed out, the negative and highly equal and value-weighted portfolios suggested a negative IV effect instead of a positive effect for loser stocks. Our research results suggested that investors in the Japanese stock market prefer loser stocks with high IV because they are hoping for strong momentum from these stocks. Therefore, these results suggest that a negative IV effect could explain the relationship between the IV and risk-adjusted returns.

5.3.4.1.2 Controlling for Book-to-Market

Fama and French (1992) determined the market value and the book to market ratio as two important variables for the cross-sectional expected returns. Fama and French (1995) pointed out that growth in book to market ratio is high for growth stocks and low for value stocks due to high earnings and reinvestment of growth stocks.

Fama and French (2008) suggested that the book to market ratio is a noisy measure of expected returns because it will change depending on the expected cash flows. Accordingly, Fama and French (2008) examined whether the past changes in book to market ratio does contain information about the expected cash flows and the expected returns that help in forecasting the expected future returns.

The empirical evidence in literature on asset pricing shows that value stocks earn higher returns than growth stocks. Thus, we control the BTM ratio next. The results for the portfolio return controlling for the BTM ratio is shown in the second last row of Table 5.8. The value-weighted average raw return difference between the low IV and the high IV quintiles is 0.4186% with a corresponding t-statistic of 1.2603. In Table 5.9, it is showed that the low IV and the high IV difference in alphas is negative at -0.2066%. Similarly, the equal-weighted average raw return difference between the low IV and the high IV quintiles is 0.3508% with a corresponding t-statistic of 1.2913. The low IV and the high IV difference in alphas is 0.1552%. When comparing the results for the equal-weighted and the value-weighted portfolio return controlling the book to market ratio, the results are different where the value-weighted portfolio has a negative average return and the equal-weighted portfolio has a positive average return. However, our research results are consistent with previous studies, including Lessard (1976), Roll (1981), Ohlson and Rosenberg (1982), Breen et al. (1989) who all suggest that equal-weighted indices have higher return than value-weighted indices. Our results show that the Book-to-Market effect can explain the positive IV effect that was mentioned earlier.

5.3.4.1.3 Controlling for Size

Goyal and Santa-Clara (2003) and Bali, Cakici, Yan and Zhang (2005) used size as a control variable to test for cross-sectional effects and found the idiosyncratic volatility was statistically related to the future aggregate return in both the equally-weighted and the value-weighed portfolios. In addition, there is a strong and positive relationship with the one month ahead aggregate market return in the US for small firm portfolios. The results for the portfolio return controlling for size for the Japanese stocks of this study is shown in the second row of Table 5.8. The value-weighted average raw return difference between the low IV and the high IV quintiles is –1.6414% with a corresponding t-statistic of -3.0323. The low IV and the high IV difference in alphas from Table 5.9 is also negative with -0.2591% but is statistically insignificant at the 5% level. Similarly, the equal-weighted average raw return difference between the low IV and the high IV quintiles is -1.6362% with a corresponding t-statistic of -3.0276. The low IV and the high IV difference in alphas from Table 5.9 are also negative with -0.2410% but are statistically insignificant at the 5% level. When comparing the results for the equal-weighted and the value-weighted portfolio return controlling size, the results are quite similar. Therefore, the research results indicate based on alpha measures, that the IV effect could be explained by the size effect. However, our research finding shows that bigger Japanese firms tend to have higher returns compared to smaller firms. To some extent, this could explain the fact that low idiosyncratic risk stocks earn higher returns since they tend to be big firms.

Table 5.8: Returns on Portfolios of Stocks Sorted by IV after Controlling for SIZE, BTM and MOM.

Panel A: Value-weighted portfolios

Quintile	SIZE	BTM	MOM
Low IV	2.4241	0.8018	2.5400
2	0.9869	0.8918	2.0196
3	0.3152	0.8911	0.9410
4	0.4780	0.7172	0.4911
High IV	0.7827	1.2204	-2.0069
High-Low	-1.6414 (-3.0323***)	0.4186 (1.2603)	-4.5469 (-7.7976***)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low IV	2.4354	0.9607	2.6954
2	0.9869	0.9680	2.0878
3	0.3178	0.8248	1.0607

4	0.4816	0.6939	0.4443
High IV	0.7992	1.3115	-2.0556
High-Low	-1.6362	0.3508	-4.7510
	(-3.0276***)	(1.2913)	(-8.6894***)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on idiosyncratic volatility after controlling for size, book to market and momentum. In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on idiosyncratic volatility. Quintile 1 is (Low IV) and quintile 5 is (High IV). This table shows the average return across the five control quintiles to produce quintile portfolios with dispersion in IV but with similar levels of the control variable. "Return difference" is the difference in average monthly returns between High IV and Low IV portfolios. Newey West (1987) adjusted t-statistics are reported in parentheses. ** Statistically significant at 1% and * statistically significant at 5%.

Table 5.9: Alphas on Portfolios of Stocks Sorted by IV after Controlling for SIZE, BTM and MOM.

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.3308	-0.4661	0.7936
2	-0.0207	-0.2812	0.3885
3	-0.1742	-0.3088	-0.0000
4	-0.0563	-0.4414	-0.1746
High IV	0.0717	-0.2595	-0.9239
High-Low	-0.2591	-0.2066	-1.7175
	(-1.6003)	(-1.0170)	(-2.4408*)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.3148	-0.0703	0.8212
2	-0.0208	0.0983	0.3981
3	-0.1736	-0.0182	0.0172
4	-0.0555	-0.1320	0.4443
High IV	0.0738	-0.1320	-0.2147

High-Low	-0.2410	0.1552	-1.7730
	(-1.6845)	(1.2292)	(-2.6925***)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on idiosyncratic volatility after controlling for size, book to market and momentum. In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on idiosyncratic volatility. Quintile 1 is (Low IV) and quintile 5 is (High IV). This table shows the alphas across the five control quintiles to produce quintile portfolios with dispersion in IV but with similar levels of the control variable. "Alpha difference" is the difference in alphas between High IV and Low IV portfolios. Newey West (1987) adjusted t-statistics are reported in parentheses. ** Statistically significant at 1% and * statistically significant at 5%.

5.3.4.2 MAX Effect

We now conduct a test to examine the relationship between maximum daily returns and cross-sectional returns. Every month, we sorted the stocks into five portfolios for every month based on each factor accordingly (such as MOM, SIZE and BTM), then we sorted the stocks into five portfolios based on MAX. This yields 25 portfolios. The sorted portfolios were classified as low, 2, 3, 4 and high and average over the five characteristic portfolios. Thus, we obtained the maximum daily return quintile portfolios controlling for one of the characteristics.

5.3.4.2.1 Controlling for Momentum

We control momentum by first forming the quintile portfolios by ranking them based on momentum. Following this, we sort the stocks into quintile portfolios based on the MAX within each momentum quintile. The data in Table 5.10 shows the results for the portfolio return controlling for momentum on the last row. The value-weighted average raw return difference between the low MAX and the high MAX quintiles is -4.5105% with a corresponding t-statistic of -7.6872. The low MAX and the high MAX difference in alphas in Table 5.11 are negative at -1.7124% and it is significant at the 5% level. The equal-weighted average raw return difference between the low MAX and the high MAX quintiles are -1.7706% with a corresponding of t-statistic -3.7259. The low MAX and high MAX difference in the alphas is also negative with -1.7706% and it is highly significant at t-stat -3.7259 and significant at the 5% level. However, when comparing the results for the equal and value-weighted portfolio return controlling momentum reverses the MAX effect from positive to negative. According to Damodaran (2010), there are different points of view on the momentum effect. For example, if investors cash in their shares for profit taking the resulting correction will make the market more likely to be a down day which will lead to negative MAX effect.

5.3.4.2.2 Controlling for Book-to-Market

We control BTM by first forming the quintile portfolios ranked based on the BTM ratio. Following this, we sort stocks into quintile portfolios based on MAX within each BTM quintile. The result for the portfolio return controlling for BTM is reported in the second last row of Table 5.10. The value-weighted average raw return difference between the low MAX and the high MAX quintiles is 0.0912% with a corresponding t-statistic of 1.7611. The low MAX and the high MAX difference in alphas from Table 5.11 is 0.0612%. Similarly the equal-weighted average raw return difference between the low MAX and the high MAX quintiles is 0.0667% with a corresponding t-statistic of 1.5440. The low MAX and the high MAX difference in alphas from Table 5.11 is 0.0637%. When comparing the results for the equal-weighted and the value-weighted portfolio return controlling book-to-market, the results are quite similar. We also find a monotonically increasing relationship between the maximum daily return and the expected returns. The value-weighted and equal-weighted BTM alpha t-statistic 0.9733 and 0.9870 are relatively small and insignificant. The insignificant t-statistics after controlling for BTM means that the MAX effect disappears after controlling for BTM, therefore BTM effect could explain the MAX effect that found earlier.

5.3.4.2.3 Controlling for Size

We control size by first forming the quintile portfolios ranked based on market capitalization. Following this, we sort the stocks into quintile portfolios based on MAX within each size quintile. The results for the portfolio return controlling for size are reported on the first row of Table 5.10. The value-weighted average raw return difference between the low MAX and the high MAX quintiles is -1.6246% with a corresponding t-statistic of -3.9985. The low MAX and the high MAX difference in alpha from Table 5.11 is negative with -0.3281, which is significant at the 5% level. Similarly the equal-weighted average raw return difference between the low MAX and the high MAX quintiles is -1.6374% with a corresponding t-statistic of -4.0126. The low MAX and high MAX difference in alphas from Table 5.11 is also negative with a value of -0.3178 but is statistically insignificant at the 5% level. The difference between the equal-weighted and the value-weighted portfolio return controlling for SIZE is 0.002890. However, our research finding shows that bigger firms tend to have higher returns compared to smaller firms. To some extent, this could explain the fact that low maximum daily return stocks earn higher returns since they tend to be big firms. Hence, we find that there is a decreasing relationship between expected returns and maximum daily returns.

Table 5.10: Returns on Portfolios of Stocks Sorted by MAX after Controlling for SIZE, BTM and MOM.

Panel A: Value-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	2.3340	0.9558	2.5455
2	0.8582	0.8493	2.0416
3	0.2826	0.8245	0.9803
4	0.4884	0.7116	0.4735
High MAX	0.7094	1.0470	-1.9650

High-Low	-1.6246	0.0912	-4.5105
	(-3.9985)	(1.7611)	(-7.6872)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	2.3554	1.0241	2.6940
2	0.8610	0.9335	2.0872
3	0.2844	0.9141	1.0649
4	0.4927	0.7582	0.4453
High MAX	0.7180	1.0908	-2.0501
High-Low	-1.6374	0.0667	-4.7441
	(-4.0126)	(1.5440)	(-7.9963)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on maximum daily return after controlling for size, book to market and momentum. In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on maximum daily return. Quintile 1 is (Low MAX) and quintile 5 is (High MAX). This table shows the average return across the five control quintiles to produce quintile portfolios with dispersion in MAX but with similar levels of the control variable. "Return difference" is the difference in average monthly returns between High MAX and Low MAX portfolios. Newey West (1987) adjusted t-statistics are reported in parentheses.

Table 5.11: Alphas on Portfolios of Stocks Sorted by MAX after Controlling for SIZE, BTM and MOM.

Panel A: Value-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	0.3751	0.0170	0.7981
2	-0.0207	0.1071	0.3908
3	-0.1380	0.0550	-0.0000
4	-0.0385	-0.0723	-0.1899
High MAX	0.0470	0.0782	-0.9144
High-Low	-0.3281	0.0612	-1.7124
	(-1.8983)	(0.9733)	(-3.2617)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	0.3665	0.0178	0.8198
2	-0.0200	0.1218	0.3967
3	-0.1377	0.0724	0.0176
4	-0.0370	-0.0705	-0.2160
High MAX	0.0487	0.0815	-0.9508
High-Low	-0.3178	0.0637	-1.7706
	(-1.6824)	(0.9870)	(-3.7259)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on maximum daily return after controlling for size, book to market and momentum. In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on maximum daily return. Quintile 1 is (Low MAX) and quintile 5 is (High MAX). This table shows the average return across the five control quintiles to produce quintile portfolios with dispersion in MAX but with similar levels of the control variable. "Alpha difference" is the difference in average monthly returns between High MAX and Low MAX portfolios. Newey West (1987) adjusted t-statistics are reported in parentheses.

5.3.5 A Closer Look at the Results

The results showed a significantly negative IV effect when we controlled for momentum, but positive IV effect in the single sort procedure; the MAX effect became significant and negative when we controlled for size and momentum.

For IV effect, the result inconsistency for single sort and double sort method could be due to the reason such as the double sort with controlling for momentum effect suggests that there is a significant negative IV effect. On top of that, the negative and highly statistically significant equal and value weighted portfolio returns suggested a negative IV effect. The results suggested that investors in the Japanese stock market prefer stocks with high IV and they were hoping for a strong reversal from these stocks. Therefore, these results suggested that momentum could explain the relationship between the IV and risk-adjusted returns.

As for the MAX effect, the significant and negative impact on Size and Momentum could be explained by significant negative stock returns. The results suggested that investors in the Japanese stock market under react to the release of firm-specific information, a cognitive bias. For the SIZE effect, the research shows that bigger firms tend to have higher returns compared to smaller firms. This could explain why low maximum daily return stocks earn higher returns as they tend to be big firms. Hence, we find that the relationship between expected returns and maximum daily returns became weak over time.

The results for size and momentum variables contradict the single sorted procedure and cross-sectional effects. Fama Macbeth regression will be used to test the relationship between the expected returns and IV and MAX effect further in the next section.

5.4. Firm Level Cross-sectional Regressions

We use the Fama and Macbeth regressions to analyze the relationship between idiosyncratic risk, maximum daily return and cross-sectional returns. The advantage of this approach is that we can simultaneously control the firm effects shown in cross-sectional stock returns. We present the time-series average slope coefficients from the regressions of monthly stock excess returns on idiosyncratic volatility (IV), maximum daily return (MAX), book to market ratio (BTM), momentum (MOM) and log market capitalization (SIZE). The average slopes help the Fama-Macbeth tests to determine which explanatory variables generate non-zero premiums. The monthly cross-section returns on stocks are estimated with the following model:

$$R_{i,t+1} = \lambda_{0,t} + \lambda_{1,t} MAX_{i,t} + \lambda_{2,t} IV_{i,t} + \lambda_{3,t} BTM_{i,t} + \lambda_{4,t} MOM_{i,t} + \lambda_{5,t} SIZE_{i,t} + \varepsilon_{i,t+1} \qquad (5.3)$$

where $R_{i,t+1}$ is the realized return on stock *i* in month *t*+1. The predictive cross-sectional regressions are run on one-month lagged values of IV, MAX, BTM, SIZE and MOM. We also consider nine different specifications with different control variables when we run these specifications in the nine samples. This is to ensure that the results will not be biased and sample specific.

The results of the cross-sectional Fama and Macbeth regressions are reported in Table 5.12. It reports the time series average slope coefficients $\lambda_{i,t}$ (I = 1,2,3,4,5) over 336 months from January 1980 to December 2007 for the Japanese stock market. The t-statistics in parentheses are the Newey–West adjusted t-statistics. Our results confirm the negative but insignificant cross-sectional relationship between idiosyncratic volatility and stock returns a t-statistic of -1.51. Our results are inconsistent with Ang et al. (2006). However, the negative relationship decreases gradually when we add more control variables in columns (6) to (9). Model 1 shows the IV coefficient is negative and insignificant. This implies there is no relationship between IV and stock returns. Size is the only variable used in Model 5. However, Size is insignificant in Model 5 (See Table 5.12).

In the full Model 9, the IV coefficient is negative and insignificant. However, BTM in Model 9 is highly significant at the 5% level of significance. This shows there is a positive relationship between BTM and stock returns. BTM is also positively significant at 5% level of significance in Model 8. In other words, a 1% change in the BTM causes stock returns to change by 1.4% positively (See Table 5.12). In general, the control variables coefficients are statistically significant and are similar to the findings of Bali et al. (2010); Fu (2009) and Ang et al. (2003). The nine models exhibit a similar relationship with the excess returns and control variables. For example, IV and SIZE exhibit an insignificant relationship with excess returns; MOM exhibits a negative and significant relationship with excess returns while MAX and BTM show a significant positive relationship with excess returns. Our finding for MOM is consistent with the Jegadeesh and Titman's (1993) study where they found momentum strategies are substantially lower or negative between portfolio returns. However, the MAX coefficient is insignificant in our research and contradicts the Bali et al.'s (2010) study. They argue that stocks with high maximum daily returns tend to be small and illiquid. When they controlled for the increased expected return in their study, the maximum daily returns were associated with small and illiquid effects. This will push the return premium associated with the extreme positive return stocks even lower.

In our research findings, the MAX coefficient is quite stable and does not fluctuate much even when we added more control variables to our model from time to time. The BTM is positively significant while the MOM is negatively significant at the 5% level in Model 9. This indicates that the higher the value of book to market, the higher the monthly excess returns. On the other hand, the higher the value of momentum, the lower the monthly excess returns. In Model 6, the IV and the MAX are both insignificant. However, the IV coefficient decreased when we added more control variables to the regression model: for example, when we included SIZE, MAX, MOM and BTM in Model 9 then the t-value decreased from -1.51 to -0.38 and these figures are insignificant (see Table 5.12). This implies that idiosyncratic volatility is not useful in explaining the cross-section of expected returns.

In regression models 8 and 9, we investigate the momentum effect on idiosyncratic volatility and maximum daily returns with excess stock returns. We used the cumulative return on the stock over the previous 11 months starting 2 months before to examine the impact on the portfolios. The momentum coefficients in models 8 and 9 are negative and statistically significant at the 5 percent level. This indicates that the higher the impact of momentum, the lower the monthly excess stock returns. When we include IV, MAX, BTM, MOM and SIZE in model 1 through to model 8, the results are similar to model 9 (See Table 5.12). The result shows momentum to be a significant determinant of monthly excess stock returns.

The IV coefficient is insignificant regardless of the control variables considered in alternate specifications in model 1 through to model 9.The R^2 in model 8 increases from 12.94% to 16.93% in model 9 and it is the highest among all the models (see Table 5.12). The higher R^2 in model 9 can predict the stock returns better than the Fama and Macbeth regression model. The result does not support Merton's (1987) study where the size effect affects the explanatory variables. Merton's research results show that after controlling for idiosyncratic risk, smaller stocks have smaller returns than their larger counterparts. Chichernea et al.'s (2008) research finding shows that the size effect will revert to its initial negative sign when they control for past cumulative returns. Fama and French (1992) examined the cross-sectional return in the three factor study showing that the size and the book to market ratio are significant determinants of cross-sectional returns. Smaller firms have on average higher returns than larger firms and value firms tend to have higher returns than growth firms. Fama and French (2008) found that the size effect is significant in large stocks but not in small stocks. However, the momentum effects are only significant in large stocks.

The Fama and Macbeth model yields some interesting results. The SIZE coefficient is negative and insignificant, which is inconsistent with the Merton (1973) models prediction that larger firms earn higher returns (see Table 5.12). However, our result is consistent with Fama and French (1992) who found the book-to-market ratio to be positively related to the average cross-sectional returns which implies that the value firms tend to have higher returns than the growth firms. On the other hand, the results confirm a negative momentum effect which is consistent with the Jegadeesh and Titman's (1993) study but contradicts with the Chui, Titman and Wei (2000) study where Japan is the only developed stock market that does not exhibit momentum.

Table 5.12: Fama and Macbeth Regressions of Stock Returns on Idiosyncratic Volatility and Maximum Daily Return

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Intercept	-0.004	-0.007	-0.015	-0.008	-0.001	-0.004	-0.014	-0.013	-0.013
	(-1.3)	(-1.86)	(-4.02)	(-1.96)	(-0.09)	(-1.47)	(-4.95)	(-4.49)	(-1.48)
IV	-0.040					-0.040	-0.015	-0.027	-0.009
	(-1.51)					(-1.51)	(-0.57)	(-0.97)	(-0.38)
MAX		0.006				0.007	0.006	0.006	0.006
		(1.62)				(1.83)	(1.7)	(1.58)	(1.74)
BTM			0.015				0.015	0.014	0.015
			(7.74)				(7.68)	(7.44)	(9.67)
MOM				-0.06				-0.062	-0.064
				(-8.29)				(-8.88)	(-9.62)
SIZE					-0.001				-0.000
					(-0.72)				(-0.26)
R^2	7.81%	8.74%	10.6%	9.25%	12.27%	8.13%	9.92%	12.94%	16.93%

Note: Table 5.12 presents the time-series averages of the slopes in cross-sectional regressions using the standard Fama and Macbeth (1973) methodology. The sample period is January 1980 to December 2007. The dependent variable is monthly stock excess return in percentage.

We estimate the idiosyncratic volatility (IV) of each firm for each month as the standard deviation of market model regression residuals using daily returns.

The maximum daily returns (MAX) are estimated for each month. The book to market (BTM) at the end of month t is computed as the book value at month t-6 divided by market value of equity at the end of month t.

Momentum (MOM) is estimated for each stock in month t and it is defined as being the cumulative return on the stock over the previous 11 months starting 2 months ago.

Size is measured by the logarithm of the market value of equity (number of total share outstanding multiplied by market share price on the date itself for each stock).

We report the average coefficients of 336 monthly cross-sectional regressions.

Numbers in parentheses are t-statistics based on the Fama and Macbeth (1973) standard errors.

5.5 Robustness Test Checks

In this section, we provide more detailed research results on the relationship between the stock returns, idiosyncratic risk and the maximum daily return.

5.5.1 IV Effect

5.5.1.1Sub-period Analysis

We further test the idiosyncratic risk puzzle in more detail. The whole sample period is divided into four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. These sub-periods are chosen according to trends in the Japanese economy. The period 1/1980-12/1985 is known as “the recovered economy”, 1/1986-12/1990 “the bubble economy”, 1/1991-12/2000 “the depressed economy” and 1/2001-12/2007 “Koizumi era”. A detailed discussion of each period is provided in Chapter 3. We then check which year during the sample period from 1980 to 2007 dominates the results.

First, we check each sub-period by estimating the Fama-French alpha for each IV sorted portfolio. Further, we report the value-weighted and the equal-weighted average monthly returns. Secondly, we examine the cross-sectional effects of the book to market ratio, momentum and the size on IV. Thirdly, we use the Fama and Macbeth regressions to analyze the relationship between idiosyncratic risk, the maximum daily return and cross-sectional returns. Finally, we determine which sub-periods dominate the research results in our study.

5.5.1.2 Single Sorting Method to Test the Relationship between Idiosyncratic Risk and Stock Returns

We examine the relationship between idiosyncratic risk and stock returns for the whole sample period from January 1980 to December 2007. There are four sub periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. The results of the single sorting method to test the relationship between idiosyncratic risk and stock returns are reported in Table 5.13.

Portfolio 1 (low IV) is the portfolio of stocks with the lowest idiosyncratic volatility during the previous month, and portfolio 5 (high IV) is the portfolio of stocks with the highest idiosyncratic volatility during the past month. The highest value-weighted average raw return difference between portfolio 5 (high IV) and portfolio 1 (low IV) is in sub-period 1/1980-12/1985 with an average raw return of 0.42% but it is insignificant. Table 5.13 also reports the average raw returns; the intercepts from the regression of the value-weighted portfolio returns on a constant, the excess market return, a size factor (SMB) and a book to market factor (HML) from Fama and French three factor alphas. The sub-period 1/1980-12/1985 for the value-weighted portfolio has the highest alpha for the high IV and the low IV portfolios. The difference between the high and low IV portfolio alpha is 0.96% and positive and highly significant at 2.47% per month (see Table 5.13). The results document that there is a significant positive IV effect in the sub-period 1/1980-12/1985.

The equal-weighted portfolios in Table 5.13 show more statistically significant results. The equal-weighted sorted IV portfolio in sub-period 1/1991-12/2000 shows the average raw return is negatively significant at the 5% level. This indicates that the higher the portfolios IV, the lower the stock's average raw returns. In general, our empirical results for the sub-periods contradict the findings reported in Ang et al. (2006) where firms with low idiosyncratic volatility consistently outperform risk adjusted returns while firms with high idiosyncratic volatility are consistent underperformers. However, Brockman and Yan (2006) argued in their study that the high idiosyncratic volatility portfolio exhibits positive alphas but the low idiosyncratic volatility portfolio exhibits negative alphas for the equal-weighted portfolios and zero alphas for the value-weighted portfolios. In regards to the alphas, our results are consistent with the Brockman and Yan (2006) study except for the value-weighted portfolios where we obtained negative alphas for value-weighted portfolios. Moreover, our findings are similar to Bali and Cakici (2008) where their study on the US stock market shows a negative relation between returns and idiosyncratic risk disappears for equally-weighted portfolios. For the Japanese stock market, the relationship between returns and idiosyncratic risk become less significant from portfolio 1 to portfolio 5 for sub-periods 1/1986-12/1990 and 1/2001-12/2007. Our results contribute to the understanding of the Ang et al. (2006) IV puzzle where portfolios with high IV have low expected returns during the period January 1980 to December 2007 and this provided hedging opportunity for investors to increase their average stock variance. In general, when average stock variance increases, investment opportunities will decrease. Thus, investors are not willing to pay higher premium for high IV stocks since their payoff is negative when average return variance is large.

Table 5.13: Sub-period Analysis for Returns and Alphas on Stocks Sorted by Idiosyncratic Volatility

Period: 1/1980-12/1985				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low IV	0.85	-0.60	0.86	-0.61

2	1.02	-0.33	1.03	-0.34
3	0.95	-0.26	0.97	-0.27
4	1.03	0.05	1.05	0.05
High IV	1.27	0.36	1.31	0.38
High-Low	0.42	0.96	0.45	0.99
	(1.26)	(2.47)	(1.33)	(3.61)

Period: 1/1986-12/1990				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low IV	1.06	-0.11	0.45	-0.82
2	1.07	-0.18	0.95	-0.61
3	1.57	0.43	1.15	0.00
4	1.04	0.51	0.98	0.43
High IV	0.86	0.32	0.92	0.37
High-Low	-0.20	0.43	0.47	1.19
	(-0.83)	(1.39)	(1.61)	(4.48)

Period: 1/1991-12/2000				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low IV	-0.72	-0.15	-0.27	-0.44
2	-0.55	-0.41	-0.32	-0.70
3	-0.61	-0.32	-0.64	-0.36
4	-0.70	-0.18	-0.70	-0.18
High IV	-1.01	-0.17	-0.95	-0.12
High-Low	-0.29	-0.02	-0.68	0.32
	(-0.86)	(-0.84)	(-2.01)	(1.92)

Period: 1/2001-12/2007				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low IV	0.47	0.33	0.49	0.34
2	0.63	0.25	0.64	0.25
3	0.62	0.31	0.63	0.31
4	0.56	0.29	0.62	0.32
High IV	0.20	0.26	0.29	0.33
High-Low	-0.27	-0.07	-0.20	-0.01
	(-0.79)	(-0.98)	(-0.61)	(-0.87)

Note: VW =Value weighted and EW =Equal-weighted
The quintile portfolios are formed for every month from January 1980 to December 2007 by sorting stocks based on IV (idiosyncratic volatility).
Table 5.13 reports the value-weighted (VW) and equal-weighted (EW) average monthly returns, the three factor Fama and French alphas on the value-weighted and equal-weighted portfolios.
The last two rows show the differences in monthly returns and the differences in alphas with respect to the three factors Fama and French model between portfolios 5 and 1and the corresponding t-statistics.
The regression is performed for the Japanese stocks t during four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. The average raw and risk-adjusted returns are given in percentage terms. The t-statistics are reported in parentheses.

5.5.1.3 Double Sorting Method to Test Various Cross-sectional Effects

We examine the relationship between idiosyncratic volatility, maximum daily returns and cross-sectional stock returns using four sub-periods to test the robustness of the results in this section. The sub-periods are: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. We conduct a test by controlling for other potential cross-sectional asset pricing effects such as MOM, SIZE and BTM and compare which sub-period dominates in the research results.

<u>Controlling for Momentum</u>

The results for the portfolio return controlling for momentum is shown in the last row in Table 5.14. The difference between the returns of the high and low IV portfolios in sub-period

1/1991 to 12/2000 is negative and statistically significant at the 5 percent level. This indicates that even if we control for momentum, data will show a statistically significant negative IV effect. The value-weighted alpha in sub-period 1/1991 to 12/2000 is negative and is highly significant at the 5 percent level. More importantly, value-weighted and equal-weighted alpha spreads are negative and statistically significant at -2.8198 and -2.9007 respectively (see Table 5.15). Similarly, the highest equal-weighted average raw return difference between the low IV and the high IV quintiles MOM effect is significant at -2.5233 in the sub-period 1/1991 to 12/2000 (see Table 5.14).When comparing the results for the equal-weighted and the value-weighted portfolio return controlling for momentum, the results are quite similar. Moreover, the alpha spreads for equal and value weighted portfolios are negative and highly significant. The evidence suggests that there is a significant negative IV effect. On top of that, the negative and highly statistically equal and value weighted portfolios suggested negative IV effect instead of positive effect for loser stocks. As mentioned earlier, the results suggested that investors in the Japanese stock market prefer loser stocks with high IV and they were hoping for a strong reversal from these stocks. Therefore, these results suggested that the MOM effect could explain the relationship between the IV and risk-adjusted returns.

Controlling for Book-to-Market Ratio

The results for the portfolio return controlling for the BTM ratio is shown on the second last row of Table 5.14. The highest value-weighted average raw return difference between the low IV and the high IV quintiles BTM effect is significant at the 5% level in sub-period 1/1991 to 12/2000. The results for the portfolio return controlling for the BTM ratio is shown on the second last row of Table 5.14. The highest value-weighted average raw return difference between the low IV and the high IV quintiles BTM effect is significant at the 5% level in sub-period 1/1980 to 12/1985. The low IV and the high IV difference in alphas from Table 5.15 is 0.3217% with a corresponding t-statistic of 2.2922. When comparing the results for the equal-weighted and the value-weighted portfolio return controlling book-to-market, the results are quite similar. However, the control variable BTM can explain the IV effect in the Japanese stock market with the value-weighted and equal-weighted BTM alpha t-statistic 2.2922 and 1.9914 are small and slightly significant in sub-period 1/1980 to 12/1985. Moreover, the insignificant t-stats after controlling for BTM in other sub-period like 1/1986 to 12/1990, 1/1991 to 12/1995 and others means that the IV effect disappears after controlling for BTM, therefore BTM effect could potentially explain the IV effect found earlier. Under normal circumstances, small capitalization stocks generate higher returns compared to high capitalization stocks. Our results show that the equal-weighted portfolio has a higher return compared to the value-weighted portfolio. This is consistent with Whited and Wu's (2006) results.

Controlling for Size

The results for the portfolio return controlling for size are shown on the second row in Table 5.14. The equal and value-weighted size effect alphas in all the sub-periods are insignificant. Therefore, it is concluded that SIZE effect can explain the IV effect.

Table 5.14: Sub-period Analysis for Returns on Stocks Sorted by Idiosyncratic Volatility After Controlling for SIZE, BTM and MOM.

Period: 1/1980-12/1985			
Panel A: Value-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low IV	1.5149	0.9593	0.9612
2	1.0761	1.0361	1.2969
3	0.9090	1.0418	0.9670
4	0.7212	1.0298	1.0616

High IV	1.0143	1.0907	0.2205
High-Low	-0.5006	0.1314	-0.7407
	(-1.4328)	(0.5920)	(-1.9816)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low IV	1.5095	0.9603	0.9988
2	1.0774	1.0625	1.3172
3	0.9102	1.0706	0.9913
4	0.7213	1.0353	1.0539
High IV	1.0219	1.1175	0.2016
High-Low	-0.4876	0.1572	-0.7972
	(-1.1125)	(0.6399)	(-2.4721)

Period: 1/1986-12/1990

Panel A: Value-weighted portfolios

Quintile	SIZE	BTM	MOM
Low IV	2.0401	1.3547	1.3372
2	1.1404	1.0295	1.4320
3	1.0090	0.9193	1.2556
4	0.8368	0.8331	1.0341
High IV	0.5539	1.1027	-0.0710
High-Low	-1.4862	-0.2520	-1.4082
	(-3.9913)	(-0.8789)	(-3.7216)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low IV	2.0184	0.9377	1.4095
2	1.1413	1.0677	1.4869
3	1.0108	0.8491	1.2911
4	0.8382	0.6527	1.0286

High IV	0.5653	0.8464	-0.0460
High-Low	-1.4531	-0.0913	-1.4555
	(-3.5226)	(-0.3728)	(-3.9193)

Period: 1/1991-12/2000

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	-0.5360	-0.8310	0.5249
2	-0.8620	-0.6310	-0.2480
3	-1.0760	-0.6010	-0.7840
4	-0.7670	-0.7370	-1.2010
High IV	-0.3950	-0.5400	-1.9130
High-Low	0.1410	0.2910	-2.4379
	(0.5381)	(0.7768)	(-6.1162)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	-0.5200	-0.5690	0.5533
2	-0.8630	-0.6820	-0.2340
3	-1.0770	-0.7260	-0.7800
4	-0.7660	-0.7130	-1.2420
High IV	-0.3990	-0.6400	-1.9700
High-Low	0.1210	-0.0710	-2.5233
	(0.4639)	(-0.2993)	(-6.6486)

Period: 1/2001-12/2007

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.8959	0.3502	0.4950
2	0.6687	0.3866	0.6245
3	0.4130	0.4643	0.5152

4	0.4484	0.4392	0.6514
High IV	0.2317	0.5065	0.2058
High-Low	-0.6642	0.1563	-0.2892
	(-1.7953)	(0.5241)	(-0.6727)
Panel B: Equal-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.9066	0.4643	0.5555
2	0.6687	0.4539	0.6286
3	0.4141	0.4950	0.6054
4	0.4512	0.4909	0.6658
High IV	0.2422	0.7829	0.2276
High-Low	-0.6644	0.3186	-0.3279
	(-1.8118)	(0.8304)	(-0.7256)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting the stocks based on idiosyncratic volatility (IV) after controlling for size, book to market and momentum.
In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on idiosyncratic volatility.
Quintile 1 is (Low IV) and quintile 5 is (High IV).
The table shows the average return across the five control quintiles to produce quintile portfolios with dispersion in IV but with similar levels of the control variable.
"Return difference" is the difference in average monthly returns between High IV and Low IV portfolios.
The regression is performed for Japanese stocks for four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007.
Newey West (1987) adjusted t-statistics are reported in parentheses.

Table 5.15: Sub-period Analysis for Alphas on Stocks Sorted by Idiosyncratic Volatility After Controlling for SIZE, BTM and MOM.

Period: 1/1980-12/1985			
Panel A: Value-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.0460	-0.3618	-0.0515
2	-0.2351	-0.2173	0.0233

3	-0.2716	0.0443	-0.3023
4	-0.4159	-0.2193	-0.2173
High IV	0.0883	-0.0401	-1.1139
High-Low	0.0423	0.3217	-1.0624
	(0.3061)	(2.2922)	(-3.8050)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.0339	-0.3241	-0.0401
2	-0.2337	-0.2117	0.0193
3	-0.2703	0.0565	-0.3011
4	-0.4173	-0.2320	-0.2487
High IV	0.0915	-0.0439	-1.1597
High-Low	0.0576	0.2802	-1.1196
	(0.5541)	(1.9914)	(-3.9271)

Period: 1/1986-12/1990

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.8537	0.3498	1.2084
2	0.1430	0.6924	0.9920
3	0.0814	0.0000	0.7263
4	0.3141	-0.0803	0.5324
High IV	0.3166	0.3488	-0.8258
High-Low	-0.5371	-0.0010	-2.0342
	(-1.6003)	(-0.1821)	(-4.4408)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.8134	0.2474	1.2489

2	0.1429	0.7102	1.0258
3	0.0830	-0.1000	0.7460
4	0.3150	-0.3117	0.5118
High IV	0.3213	0.0000	-0.8180
High-Low	-0.4921	-0.2474	-2.0669
	(-1.3845)	(-0.8292)	(-4.6925)

Period: 1/1991-12/2000			
Panel A: Value-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.1024	-0.3940	1.2314
2	-0.2892	-0.7186	0.2267
3	-0.6348	-0.6757	-0.4211
4	-0.4339	-0.8256	-0.9028
High IV	-0.1839	-0.6216	-1.5884
High-Low	-0.2863	-0.2276	-2.8198
	(-0.7003)	(-0.7170)	(-5.4408)
Panel B: Equal-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.1208	-0.2800	1.2560
2	-0.2905	-0.2088	0.2509
3	-0.6345	-0.3185	-0.4145
4	-0.4325	-0.3125	-0.9441
High IV	-0.1899	-0.2835	-1.6447
High-Low	-0.3107	-0.0035	-2.9007
	(-0.7845)	(-0.2292)	(-5.6925)

Period: 1/2001-12/2007			
Panel A: Value-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**

Low IV	0.5682	-0.2856	0.6390
2	0.3424	-0.2018	0.4475
3	0.1705	-0.0865	0.1988
4	0.2700	-0.1336	0.2990
High IV	0.1844	-0.0883	-0.0715
High-Low	-0.3838	0.1973	-0.7105
	(-0.8169)	(0.6660)	(-1.4208)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low IV	0.5618	0.3557	0.6716
2	0.3428	0.1540	0.4442
3	0.1704	0.2149	0.2707
4	0.2720	0.1670	0.2349
High IV	0.1915	0.4993	-0.0840
High-Low	-0.3703	0.1436	-0.7556
	(-0.7442)	(0.5895)	(-1.2945)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on idiosyncratic volatility after controlling for size, book to market ratio and momentum.
In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on idiosyncratic volatility.
Quintile 1 is (Low IV) and quintile 5 is (High IV).
Table 5.17 presents the alphas across the five control quintiles to produce quintile portfolios with dispersion in IV but with similar levels of the control variable.
"Alpha difference" is the difference in alphas between High IV and Low IV portfolios. The regression is performed for the Japanese stocks t during four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991- 12/2000, and 1/2001-12/2007. Newey West (1987) adjusted t-statistics are reported in parentheses.

5.5.2 MAX Effect

5.5.2.1 Sub-period Analysis

We further test the maximum daily return (MAX) puzzle in more detail. The whole sample period is divided into four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. These sub-periods are chosen according to trends in the Japanese economy. The period 1/1980-12/1985 is known as “the recovered economy”, 1/1986-12/1990 “the bubble economy”, 1/1991-12/2000 “the depressed economy” and 1/2001-12/2007 “Koizumi era”. A detailed discussion of each period is provided in Chapter 3. We then check which year during the sample period from 1980 to 2007 dominates the results.

First, we check each sub-period by estimating the Fama-French alpha for each MAX sorted portfolio. Further, we report the value-weighted and the equal-weighted average monthly returns. Secondly, we examine the cross-sectional effects of the book to market ratio, momentum and the size on MAX. Thirdly, we use the Fama and Macbeth regressions to analyze the relationship between idiosyncratic risk, the maximum daily return and cross-sectional returns. Finally, we determine which sub-periods dominate the research results in our study.

5.5.2.2 Single Sorting Method to Test the Relationship between Maximum Daily Returns and Stock Returns

We examine the relationship between maximum daily returns and stock returns for the whole sample period from January 1980 to December 2007. There are four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. The results are reported in Table 5.14.

Portfolio 1 (low MAX) consists of stocks with the lowest maximum daily returns during the previous month, and portfolio 5 (high MAX) of stocks with the highest maximum daily returns during the past month. The highest value-weighted average raw return difference between portfolio 5 (high MAX) and portfolio 1 (low MAX) is in sub-period of 1/1986-12/1990 with an average raw return of 0.13% and it is insignificant. It shows that there is no MAX effect based on value-weighted returns in the period 1/1986-12/1990. Table 5.16 also reports the average raw returns, the intercepts from the regression of the value-weighted portfolio returns on a constant, the excess market return, a size factor (SMB) and a book to market factor (HML) from the Fama and French three factor alphas. In sub-period 1/1986-12/1990 the alpha is positive and statistically significant at the 5 percent level for the high MAX and the low MAX portfolios. The difference between the high and low MAX portfolio alphas is 0.46% positive and statistically significant at t-statistic 2.17% (see Table 5.16). The results document that there is a significant MAX effect in the sub-period 1/1986-12/1990. When we look at the value-weighted average returns and the alphas across quintiles, the results showed that if MAX returns increase, the average return will increase as well.

The equal-weighted portfolios columns in Table 5.16 are all statistically insignificant. The highest average raw return difference between the low MAX and the high MAX is the sub-period of 1/1986-12/1990 with an average raw return of 0.28% but it is insignificant. In general, the results for the sub-periods are inconsistent with Bali et al. (2011) that investors preferred to pay more for stocks that showed high extreme positive returns that eventually earned lower expected returns. As indicated in Table 5.16, the alpha difference between high max and low max value-weighted portfolios were mostly statistically insignificant except the sub-period 1/1986-12/1990. However, our results show the relation between the expected returns and the maximum daily return in the Japanese stock market to increase over time from portfolio 1 to portfolio 5 for all sub-periods. The finding can be termed as “puzzling” where the maximum daily return does increase but the amount is not significantly large to have a huge impact on the stock returns. When the full sample period has no MAX effect, a scenario such as negative MAX effect should not occurs in the sub-periods. A possible reason that could explain this is the behaviour of the stocks in the sub-periods group is remarkably different due to the economic trend and business cycles. Chang et al.'s (1995) study results showed at times investors in the Japanese stock market overreact to economic crisis. One of the reasons for the overreaction would be due to abnormal economic activity that take place during the crisis period and the stock market may not be fully efficient during that period. On the other hand, our research results showed for those stocks that experience a significant MAX effect the return earned in sub-period 1/1980 to 12/1985 is insignificant and inconsistent with the sub-period 1/1986 to 12/1990 that has no MAX effect and significant stock returns.

Table 5.16: Sub-period Analysis for Returns and Alphas on Stocks sorted by MAX

Period: 1/1980-12/1985				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low MAX	0.88	0.02	0.91	0.03
2	1.10	-0.12	1.10	-0.16
3	1.11	-0.36	1.11	-0.38
4	1.04	-0.12	1.08	-0.12
High MAX	0.97	-0.23	1.01	-0.21
High-Low	0.09	-0.25	0.10	-0.24
	(0.42)	(-1.83)	(0.46)	(-1.80)

Period: 1/1986-12/1990				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low MAX	0.82	0.18	0.87	0.22
2	0.98	0.34	1.04	0.37
3	1.06	0.79	1.13	0.86

4	0.96	0.58	0.99	0.59
High MAX	1.09	0.64	1.15	0.67
High-Low	0.13	0.46	0.28	0.45
	(0.55)	(2.17)	(0.69)	(2.06)

Period: 1/1991-12/2000				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low MAX	-0.69	-0.26	-0.71	-0.26
2	-0.75	-0.33	-0.74	-0.30
3	-0.81	-0.44	-0.81	-0.43
4	-0.80	-0.33	-0.82	-0.34
High MAX	-0.57	-0.16	-0.59	-0.16
High-Low	0.12	0.10	0.12	0.10
	(0.53)	(0.82)	(0.51)	(0.81)

Period: 1/2001-12/2007				
	VW Portfolios		**EW Portfolios**	
Quintile	**Average return**	**Three-factor alpha**	**Average return**	**Three-factor alpha**
Low MAX	0.42	0.19	0.46	0.20
2	0.45	0.28	0.52	0.32
3	0.53	0.28	0.56	0.29
4	0.47	0.27	0.50	0.28
High MAX	0.59	0.40	0.64	0.44
High-Low	0.17	0.21	0.18	0.24
	(0.32)	(1.92)	(0.33)	(1.98)

Note: VW =Value-weighted and EW =Equal-weighted

Note: The quintile portfolios are formed every month from January 1980 to December 2007 by sorting the stocks based maximum daily returns (MAX).
Table 5.16 reports the value-weighted (VW) and equal-weighted (EW) average monthly returns, the three factor Fama and-French alphas on the value-weighted and equal-weighted portfolios.
The last two rows show the differences in monthly returns and the differences in alphas with respect to the three factors Fama and French model between portfolios 5 and 1and the corresponding t-statistics.
The regression is performed for the Japanese stock during four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007.
The average raw and risk-adjusted returns are given in percentage terms. The t-statistics are reported in parentheses.

5.5.2.3 Double Sorting Method to Test Various Cross-sectional Effects

We examine the relationship between idiosyncratic volatility, maximum daily returns and cross-sectional stock returns using four sub-periods to test the robustness of the results in this section. The sub-periods are: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. We conduct a test by controlling for other potential cross-sectional asset pricing effects such as MOM, SIZE and BTM and compare which sub-period dominates in the research results.

Controlling for Momentum

Similarly, to test the portfolio return controlling for momentum, we first sort the portfolio according to momentum and then sort the stocks into quintiles based on MAX within each momentum quintile. Table 5.17 shows the results for the portfolio return controlling for momentum on the last row. Table 5.18 reports the results for portfolios double sorted on MOM; the low and high MAX alpha spreads are significant in 1/1980 to 12/1985, 1/1986 to 12/1990 and 1/1991 to 12/2000, for the value and equal-weighted portfolios. Similarly, Table 5.18 shows the highest equal-weighted alpha spreads difference between the low MAX and the high MAX quintiles MOM effect is significant at -2.8947% per month in sub-period of 1/1991 to 12/2000. The evidence suggest that the MOM effect is highly significant on MAX and research results suggested that MOM cannot explain the relationship between the MAX and risk-adjusted returns during sub-period 1/1980 to 12/2000 where the MAX effect disappears during sub-period 1/1980 to 12/1985 and 1/2001 to 12/2007 based on returns in Table 5.18 1/1980 to 12/1985 value-weighted and equal weighted portfolios returns are insignificant with t-statistics -1.7377 and -1.8865 respectively. The 1/2001 to 12/2007 value-weighted and equal-weighted portfolios returns are insignificant with t-statistics of -0.7922 and -0.8571, respectively.

Controlling for Book-to-Market Ratio

To test the portfolio return controlling for BTM, we first sort the portfolio according to BTM. Following this, we sort the stocks into quintiles based on MAX within each BTM quintile. The results for the portfolio return controlling for BTM are reported on the second last row in Table 5.17. The low MAX and the high MAX difference for the value-weighted average raw return for BTM is insignificant (see Table 5.17). Similarly, the alpha for the low MAX and the high MAX difference for the value-weighted BTM is insignificant (see Table 5.18). The same scenario occurs during the sub-period 1/2001 to 12/2007 for the equal-weighted average raw return difference between the low MAX and the high MAX.

When comparing the results for the equal-weighted and value-weighted portfolio return controlling for book-to-market ratio, the results are quite similar. Therefore, we can conclude that the market capitalization does not fluctuate much during our sample period. We also find a monotonically increasing relation between maximum daily return and expected returns.

Controlling for Size

We control for size by first forming the quintiles portfolios based on market capitalization. Following this, we sort the stocks into quintiles portfolios based on MAX within each size quintile. The results for the portfolio return controlling for size are reported in the first row of Table 5.18. The low MAX and the high MAX difference in alphas for SIZE are negative and significant at the 5 percent level for the equal and value-weighted only in the sub-period 1/1986 to 12/1990 with t-statistics of -2.7761 and -2.7288 respectively. The evidence suggests that the SIZE effect cannot explain the relationship between the MAX and risk-adjusted returns during the sub-period 1/1986 to 12/1990 where the MAX effect disappears during other sub-periods such as 1/1980 to 12/1985, 1/1991 to 12/2000 and 1/2001 to 12/2007. However, our research finding shows that bigger firms tend to have higher returns compared to smaller firms. This could explain why low maximum daily return stocks earn higher returns as they tend to be big firms. Hence, we find that the relationship between expected returns and maximum daily returns became weak over time.

Table 5.17: Sub-period Analysis for Returns on Stocks Sorted by MAX after Controlling for SIZE, BTM and MOM.

Period: 1/1980-12/1985			
Panel A: Value-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	1.5014	1.0869	0.9572
2	1.0836	0.9997	1.2939
3	0.8817	0.9343	0.9694
4	0.7685	0.9316	1.0544
High MAX	0.9857	1.1648	0.2112
High-Low	-0.5157	0.0779	-0.7460
	(-1.4692)	(0.3080)	(-1.7377)
Panel B: Equal-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	1.4841	1.0967	0.9965
2	1.0847	1.0306	1.3161
3	0.8814	0.9641	0.9906
4	0.7701	0.9503	1.0482
High MAX	0.9890	1.1702	0.1979

High-Low	-0.4951	0.0735	-0.7986
	(-1.3881)	(0.2973)	(-1.8865)

Period: 1/1986-12/1990

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	1.9443	1.0753	1.3350
2	0.9774	0.9730	1.4250
3	0.9557	1.0003	1.2608
4	0.8099	0.8678	1.0336
High MAX	0.4638	1.0413	-0.0520
High-Low	-1.4805	-0.0340	-1.3870
	(-3.6113)	(-0.1592)	(-3.4766)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	1.9542	1.1277	1.4103
2	0.9810	1.0173	1.4855
3	0.9572	1.0534	1.2956
4	0.8120	0.9036	1.0320
High MAX	0.4741	1.0830	-0.0430
High-Low	-1.4801	-0.0447	-1.4533
	(-3.6077)	(-0.1752)	(-3.9501)

Period: 1/1991-12/2000

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	-0.5560	-0.6820	0.5226
2	-0.8910	-0.7040	-0.2470
3	-1.0600	-0.7410	-0.7770
4	-0.7730	-0.7540	-1.1840

High MAX	-0.3960	-0.7430	-1.8840
High-Low	0.1600	-0.0610	-2.4066
	(0.3722)	(-0.2034)	(-5.8957)
Panel B: Equal-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	-0.5380	-0.6970	0.5528
2	-0.8910	-0.7020	-0.2330
3	-1.0602	-0.7440	-0.7780
4	-0.7731	-0.7660	-1.2400
High MAX	-0.4020	-0.7550	-1.9650
High-Low	0.1360	-0.0580	-2.5178
	(0.3218)	(-0.1883)	(-6.2439)

Period: 1/2001-12/2007			
Panel A: Value-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.8967	0.4127	0.5099
2	0.6673	0.4647	0.6567
3	0.4122	0.5250	0.5454
4	0.4487	0.5060	0.6128
High MAX	0.2340	0.5657	0.2084
High-Low	-0.6627	0.1530	-0.3015
	(-1.8356)	(0.4829)	(-0.7922)
Panel B: Equal-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.9051	0.4692	0.5559
2	0.6676	0.5047	0.6279
3	0.4141	0.5718	0.6054
4	0.4512	0.5373	0.6658

High MAX	0.2422	0.6002	0.2276
High-Low	-0.6629	0.1310	-0.3283
	(-1.8444)	(0.4278)	(-0.8571)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on maximum daily return after controlling for size, book to market ratio and momentum.
In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on maximum daily return.
Quintile 1 is (Low MAX) and quintile 5 is (High MAX).
Table 5.17 displays the average return across the five control quintiles to produce quintile portfolios with dispersion in MAX but with similar levels of the control variable.
"Return difference" is the difference in average monthly returns between High MAX and Low MAX portfolios.
The regression is performed for the Japanese stocks during four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007.
Newey West (1987) adjusted t-statistics are reported in parentheses.

Table 5.18: Sub-period Analysis for Alphas on Stocks Sorted by MAX after Controlling for SIZE, BTM and MOM.

Period: 1/1980-12/1985

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.0271	-0.1809	-0.0589
2	-0.2393	-0.3448	0.0156
3	-0.3075	0.0549	-0.3061
4	-0.3661	-0.3873	-0.2312
High MAX	0.0506	0.0195	-1.1247
High-Low	0.0235	0.2004	-1.0658
	(0.3857)	(0.7623)	(-2.7155)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	0.0000	-0.2063	-0.0447
2	-0.2381	-0.3315	0.0117
3	-0.3074	0.0694	-0.3047
4	-0.3655	-0.3865	-0.2584
High MAX	0.0518	0.0000	-1.1545
High-Low	0.0518	0.2063	-1.1098
	(0.7844)	(0.7980)	(-3.0417)

Period: 1/1986-12/1990

Panel A: Value-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	1.2199	0.6296	1.2068
2	0.3088	0.7581	0.9806
3	0.3970	0.2920	0.7307
4	0.4743	0.3199	0.5314
High MAX	0.2890	0.5936	-0.8061
High-Low	-0.9309	-0.0360	-2.0129
	(-2.7288)	(-0.5516)	(-4.2160)

Panel B: Equal-weighted portfolios

Quintile	SIZE	BTM	MOM
Low MAX	1.2324	0.6764	1.2493
2	0.3123	0.7835	1.0225
3	0.3981	0.3258	0.7493
4	0.4769	0.3245	0.5133

High MAX	0.2997	0.6163	-0.8140
High-Low	-0.9327	-0.0601	-2.0633
	(-2.7761)	(-0.9640)	(-4.9811)

Period: 1/1991-12/2000

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.0836	-0.3034	1.2187
2	-0.3338	-0.2014	0.2202
3	-0.6055	-0.3038	-0.4189
4	-0.4448	-0.3495	-0.8896
High MAX	-0.1795	-0.3637	-1.5690
High-Low	-0.0959	-0.0603	-2.0129
	(-0.8731)	(-0.9652)	(-4.6447)

Panel B: Equal-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.0732	-0.3074	1.2542
2	-0.3343	-0.1874	0.2508
3	-0.6054	-0.2844	-0.4143
4	-0.4437	-0.3464	-0.9431
High MAX	-0.1846	-0.3687	-1.6405
High-Low	-0.2578	-0.0613	-2.8947
	(-1.0355)	(-0.9699)	(-5.3330)

Period: 1/2001-12/2007

Panel A: Value-weighted portfolios

Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.5373	0.3363	0.6510
2	0.3417	0.2243	0.4684
3	0.1699	0.3124	0.2230

4	0.2697	0.2283	0.2067
High MAX	0.1915	0.3559	-0.0749
High-Low	-0.3458	0.0196	-0.7259
	(-1.2541)	(0.3370)	(-1.8624)
Panel B: Equal-weighted portfolios			
Quintile	**SIZE**	**BTM**	**MOM**
Low MAX	0.5608	0.3648	0.6722
2	0.3424	0.2424	0.4439
3	0.1704	0.3470	0.2707
4	0.2720	0.2470	0.2349
High MAX	0.1851	0.3918	-0.0840
High-Low	-0.3757	0.0270	-0.7562
	(-1.3912)	(0.4698)	(-1.9830)

Note: Double sorted, value-weighted (Panel A) and equal-weighted (Panel B) quintile portfolios are formed every month from January 1980 to December 2007 by sorting stocks based on maximum daily return after controlling for size, book to market ratio and momentum.
In each case, we first sort the stocks into quintiles using the control variable, then within each quintile, we sort stocks into quintile portfolios based on maximum daily return.
Quintile 1 is (Low MAX) and quintile 5 is (High MAX).
Table 5.18 shows the average return across the five control quintiles to produce quintile portfolios with dispersion in MAX but with similar levels of the control variable.
"Alpha difference" is the difference in average monthly returns between High MAX and Low MAX portfolios.
The regression is performed for the Japanese stocks during four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. Newey West (1987) adjusted t-statistics are reported in parentheses.

5.5.3 Firm Level Cross-sectional Regressions (IV&MAX Effect)

We examine the firm level cross-sectional regressions for the whole sample period from January 1980 to December 2007. The four sub periods include: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007. We then check the cross-sectional variables impact for each sub period. The results of the cross-sectional Fama and Macbeth regressions are reported in Table 5.19. In it, there are nine different models estimated with different choices of firm characteristics, labeled as Model (1) through Model (9), respectively. The results provide several interesting findings:

1. IV effect: Table 5.19 results show IV is insignificant in all the sub-periods which include 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000 and 1/2001-12/2007. Therefore, there was no IV effect throughout the firm level cross-sectional study.

2. MAX effect: Table 5.19 results show MAX is insignificant in all the sub-periods which include 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000 and 1/2001-12/2007. Therefore, there was no MAX effect throughout the firm level cross-sectional study.

3. BTM effect: The BTM premium is significantly positive in all the models and the sub-periods. However, the BTM coefficient is highest in sub-period 1/1986-12/1990 and positively significant at the 5% level in Model 9. This indicates that a 1% change in BTM causes monthly stock excess return to change by 0.031% positively (see Table 5.19). When we compare the BTM coefficient with the SIZE effect coefficient, this displays a very significant contrast. This shows that the BTM effect is stronger compared to the SIZE effect in the Japanese stock market. Chou et al.'s (2009) finding shows that the BTM premium is significantly positive for the whole sample period. But their sub-period results indicate that the BTM effect is only significant for the sub-period 1991-2006 which is different from our sub-period 1991-2000. Therefore, Chou et al.'s (2009) finding is similar to our study and can be used as reference but is not compatible. Our results are consistent with Zhang (2005) who pointed out that the premium value would be higher during bad times because investors face higher risk by holding stocks. Campbell and Cochrane's (1999) research findings showed that investors are more risk averse in recessions, when their consumption is low relative to past aggregate consumption. They are less risk averse in booms, when their consumption is high, and so gambling feels less threatening. The

countercyclical movement in risk aversion implies that investors want to be compensated more for holding risky assets such as stocks during recessions which result in value (high BTM) firms being riskier than growth (low BTM) firms. For example, a firm with uncertain prospects would normally have small market capitalization. However, firms with small market capitalization sometimes might have a high BTM ratio with a significant amount of equity from past accumulated profits. Therefore, such firms are risky and priced by the market to reflect that investors demand a high expected return for holding stocks from high BTM firm.

4. Size effect: The firm size coefficient is negative for both sub-periods 1/1980-12/1985 and 1/1986-12/1990. But sub-period 1/1980-12/1985 is more efficient in Model 9 compared to 1/1986-12/1990. A closer look at the sub-period results showed that the small firm effect is the highest for the first sub-period. The firm size coefficient is positive during sub-period 1/1991-12/2000 but insignificant. The size effect becomes weak over time when other firm characteristics such as MOM, BTM, MAX and IV are included in Model 9.

5. Momentum effect: The momentum effect coefficient in sub-periods 1/1986-12/1990 and 1/1991-12/2000 is negative and statistically significant at the 5 percent level. This indicates that the higher the monthly excess returns, the lower the impact of momentum. For sub-periods 1/1986-12/1990, in Model 4, a 1% change in MOM causes the monthly stock excess return to change by -0.052% (see Table 5.19). Moreover, the momentum effect becomes weak over time especially during sub-period 1/2001-12/2007 in model 9 due to the post-Asian financial crisis and it is difficult for the investors to predict the intermediate term momentum while investing in the stocks. The significantly negative coefficients for the sub-periods 1986-12/1990 and 1/1991-12/2000 are consistent with the Chou, Wei and Chung's (2007) study where their findings on the Japanese stock market exhibit negative autocorrelation in both long and short return intervals.

In general, the results indicate that BTM and MOM are the two major variables that price the stock returns over the four sub-periods. The dominate sub-period is 1/1991-12/2000 with a significantly high negative coefficient for the momentum effect and a significantly high positive coefficient for the BTM. The premium pattern for the firm characteristics in the Japanese stock markets differ from the US stock markets. This is because the Japanese stock markets are inefficient when controlling for IV, MAX and Size. The cross-sectional effects such as BTM and momentum are significant and investors expect their premiums to be significant over different sub-periods. The BTM effect is significantly high after 1990. This is because the BTM effect reflects the compensation for holding the risky assets where excess returns should be captured by the asset pricing models. On the other hand, the momentum effect is negative and significant during sub-period 1/1986-12/2000 (See Section 4.6). The momentum effect used in this study is based on the assumption that the stock market is inefficient. The performance of the momentum effect can explain whether the investors are overacting to the news. Moreover, investors that used the momentum effect assume extra risk and therefore should be compensated with higher returns.

Table 5.19: Fama-Macbeth Regressions of Stock Returns on Idiosyncratic Volatility and Maximum Daily Return

Period: 1/1980-12/1985

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Intercept	-0.013	-0.011	-0.014	-0.010	0.003	-0.013	-0.019	-0.018	0.004
	(-3.64)	(-2.97)	(-3.47)	(-2.94)	(0.21)	(-3.74)	(-6.04)	(-5.75)	(0.32)
IV	0.043					0.043	0.062	0.056	0.053
	(1.14)					(1.15)	(1.96)	(1.72)	(1.55)
MAX		0.005				0.006	0.006	0.006	0.006
		(0.56)				(0.7)	(0.64)	(0.6)	(0.69)
BTM			0.010				0.011	0.010	0.010

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			(2.4)				(3.02)	(2.92)	(3.67)
MOM				-0.047				-0.048	-0.050
				(-2.92)				(-3.18)	(-3.58)
SIZE					-0.001				-0.002
					(-0.93)				(-1.65)
R^2	3.88%	8.00%	3.70%	5.57%	6.64%	4.50%	5.96%	9.30%	11.51%

Period: 1/1986-12/1990

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-0.004	-0.006	-0.014	-0.007	0.016	-0.005	-0.017	-0.018	0.003
	(-0.44)	(-0.57)	(-1.31)	(-0.63)	(0.53)	(-0.48)	(-1.58)	(-1.50)	(0.10)
IV	-0.034					-0.034	-0.006	-0.010	0.023
	(-0.82)					(-0.82)	(-0.13)	(-0.22)	(0.61)
MAX		0.009				0.010	0.010	0.010	0.010
		(1.00)				(1.10)	(1.03)	(1.08)	(1.20)
BTM			0.027				0.030	0.028	0.031
			(3.66)				(4.07)	(4.19)	(5.95)
MOM				-0.052				-0.052	-0.060
				(-3.34)				(-3.45)	(-4.09)
SIZE					-0.002				-0.002
					(-0.83)				(-0.89)
R^2	4.60%	2.92%	5.43%	4.74%	6.84%	5.23%	7.42%	7.71%	10.43%

Period: 1/1991-12/2000

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-0.007	-0.013	-0.023	-0.015	-0.022	-0.008	-0.019	-0.018	-0.037
	(-1.56)	(-1.92)	(-3.52)	(-2.1)	(-1.23)	(-1.68)	(-4.25)	(-3.99)	(-2.57)
IV	-0.078					-0.078	-0.055	-0.075	-0.046
	(-1.52)					(-1.52)	(-1.03)	(-1.32)	(-1.05)
MAX		0.008				0.011	0.009	0.008	0.009
		(1.56)				(1.89)	(1.69)	(1.49)	(1.58)
BTM			0.016				0.015	0.013	0.014
			(7.47)				(6.43)	(5.61)	(7.88)
MOM				-0.099				-0.097	-0.098
				(-8.39)				(-9.39)	(-9.83)
SIZE					0.001				0.001
					(0.77)				(1.44)
R^2	4.80%	7.57%	6.31%	5.59%	6.54%	4.92%	5.59%	7.05%	8.80%

Period: 1/2001-12/2007

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	0.010	0.005	-0.003	0.006	0.014	0.010	-0.000	0.001	-0.005
	(2.65)	(0.80)	(-0.47)	(0.80)	(0.85)	(2.72)	(-0.13)	(0.16)	(-0.42)
IV	-0.060					-0.059	-0.032	-0.043	-0.032
	(-1.01)					(-1.00)	(-0.52)	(-0.68)	(-0.58)
MAX		0.000				-0.001	-0.001	-0.001	-0.000
		(0.02)				(-0.22)	(-0.10)	(-0.11)	(-0.07)
BTM			0.009				0.008	0.008	0.009
			(6.38)				(5.60)	(5.35)	(8.22)
MOM				-0.029				-0.029	-0.031
				(-2.25)				(-2.41)	(-2.68)
SIZE					-0.001				0.000
					(-0.79)				(0.34)
R^2	7.60%	5.50%	6.18%	6.12%	7.18%	7.68%	8.93%	9.97%	11.42%

Note: Table 5.19 shows the time-series average slopes in cross-sectional regressions using the standard Fama and Macbeth (1973) methodology.
The sample period is from January 1980 to December 2007. The regression is performed for the Japanese stocks t during four sub-periods: 1/1980-12/1985, 1/1986-12/1990, 1/1991-12/2000, and 1/2001-12/2007
The dependent variable is monthly stock excess return in percentage. We estimate the idiosyncratic volatility (IV) of each firm for each month as the standard deviation of market model regression residuals using daily returns.
Maximum daily returns (MAX) are estimated for each month. The (BTM) book to market ratio at the end of month t is computed as the book value at month t-6 divided by market value of equity at the end of month t.
Momentum (MOM) is estimated for each stock in month t and is defined as cumulative return on the stock over the previous 11 months starting 2 months ago.
Size is measured by the logarithm of the market value of equity (the number of total shares outstanding multiplied by market share price on the date for each stock).
We report the average coefficients according to the sub-period monthly cross-sectional regressions.
Numbers in parentheses are t-statistics based on Fama and-Macbeth (1973) standard errors.

CHAPTER 6

Summary and Conclusions

This chapter summarizes the research. Section 6.0 presents a summary of the research objectives, the data and the methodology, and the major findings. The implications of the research findings are discussed in Section 6.1. Section 6.2 discusses the research limitations and Section 6.3 provides recommendations for future research.

6.0 Summary and Major Findings

The topic of what determines the effects of idiosyncratic volatility on stock markets has been researched quite extensively in the U.S. However, there is limited research on the Japanese stock market. Idiosyncratic risk (often known as diversifiable risk) refers to risk due to firm specific events. The CAPM suggests that idiosyncratic risk can be eliminated without cost by holding a fully diversified portfolio; therefore, there should be no compensation for bearing idiosyncratic risk. In other words, idiosyncratic risk should not be priced into a firm's expected returns.

The role of idiosyncratic volatility on asset pricing has become a debatable topic since the study by Campbell et al. (2001). They examined the volatility of the US stocks at the market, industry and firm levels from 1962 to 1997 and found market and industry level volatilities to be quite stable while the average firm-level volatility showed a strong positive deterministic trend. Various studies have been conducted to examine the relationship between idiosyncratic risk and return on both the time series basis and the cross-section basis. Moreover, the results have been different which is due to the methodology selected to measure idiosyncratic risk. On the other hand, Ang et al. (2006) found that stocks with high idiosyncratic volatility have low average returns both in the US and the G7 countries. The negative cross-sectional relationship puzzled the researchers. This is because the result contradicts the basic fundamentals of finance where high risk is presumed to generate high returns.

This research determines the effects of idiosyncratic volatility in the Japanese stock market. It describes and explains the time series behaviour of idiosyncratic volatility in the Japanese stock market. Furthermore, it also tests if idiosyncratic volatility is priced in the Japanese stock market. Consequently, the findings of this research enrich the existing literature on idiosyncratic volatility in the Japanese stock market. Secondary data were obtained from Thomson Financial Datastream and the sample period is from January 1980 to December 2007 with 2414 firms. The data used in this study includes daily and monthly stock prices, return indexes, book to market ratio (BTM) and market capitalization for individual firms from the Japanese stock market.

To examine whether or not an idiosyncratic volatility trend exists in the Japanese stock market, a T-dan test developed by Bunzel and Vogelsang (2005) is employed to test whether there is an idiosyncratic volatility trend in our sample size. This study determines what factors lead to time series behaviour of idiosyncratic volatility in the Japanese stock market. The Ang et al. (2006) method is used to measure the idiosyncratic risk for estimating the market return model. In addition, the Ang et al. (2006) lagged method is used to test whether idiosyncratic volatility is priced in the Japanese stock market. Momentum, book to market, size and extreme return are used to test whether they explain the cross sectional variation of the expected returns in the Japanese stock market.

Table 6.1 summarizes the results of the empirical models. In summary, the results on the effect of idiosyncratic volatility in Japanese stock market show the following:

- Equal-weighted and value-weighted volatility move together and they reached their peaks during 1999 and 2000 during the world economic crisis. Since then they have exhibited a downward trend (See Figure 5.1). The research results showed a negative and a significant idiosyncratic risk trend in the Japanese stock market. Our result is similar to Chang and Dong's (2006) results who found a downward trend in idiosyncratic volatility during the post bubble period in the Japanese stock market.
- Generally researchers would find an upward trend in idiosyncratic volatility due to reasons such as declining firm age, poor profitability, rising product market competition and increasing capital market development. However, this is not the case for the Japanese stock market where our result showed a negative trend in idiosyncratic volatility.
- There is a negative relationship between idiosyncratic volatility and excess returns. The robustness test shows 1986 to dominate the results for the equal-weighted IV. The research results are not able to forecast the one month ahead market excess return for the equal-weighted idiosyncratic volatility, the value-weighted idiosyncratic volatility or the market volatility. The t-values are not greater than 1.4527 and R-squares are not more than 0.46 percent which is not significant. The results coincided with Brockman and Yan (2006) who found no evidence of forecasting ability in their research findings. Our research contributes to the controversy on the predictive ability of volatilities.
- There is a positive cross-sectional relationship between maximum daily returns and excess returns. The robustness test shows 1986 dominating the results for equal-weighted and value-weighted MAX. The research results are able to forecast one month ahead

market excess returns for equal-weighted idiosyncratic volatility and value-weighted idiosyncratic volatility.

- According to Ang et al. (2006), high idiosyncratic volatility will lead to low subsequent returns. However, in terms of maximum daily returns, Bali (2010) documented no surprise that stocks with extreme positive returns also have high idiosyncratic volatility and can be used as a substitute for idiosyncratic volatility.
- Table 5.5 shows there is a negative relationship between the stock returns and both the value weighted and the equal weighted idiosyncratic volatility. Our research results are similar to Guo and Savickas (2006) who also revealed a negative relationship in their research findings. However, Bali's (2010) results show a positive relationship with idiosyncratic volatility where the author explains that the poorly diversified investor dislikes idiosyncratic volatility viewing it as similar to lottery payoffs influencing prices and future returns.
- Table 5.6 shows the alpha return for maximum daily return being positive but statistically insignificant. Due to preference for upside potential, investors may be willing to pay more for and accept lower expected returns on an asset with extremely high positive returns. However, this is not the case in our research. Our research findings showed that there is a small portion of investors with poorly diversified portfolios yet risk averse that preferred small stocks with extreme positive returns, overpaying for these stocks and in the process leading to lower future returns.
- There is a negative relationship between firm size and the cross-section of future stock returns. The robustness test shows 1986 to dominate the results for equal-weighted and value-weighted firm size. The research results are consistent with Fama and French (1993)

who suggested that small firms with a size effect have high average returns. However, our results contradict with Fu's (2009) results where large firms have high average returns. In addition, Merton (1987) points out the size effect are due to idiosyncratic risk and the investor base.

- There is a positive relationship between book to market and the cross-section of future stock returns. The robustness test shows 1980 to dominate the results for equal-weighted and value-weighted book to market. However, our research results are not statistically and economically significant. The positive relationship shows that the value firms tend to have higher returns than the growth firms. Our results are consistent with Fu's (2009) study who found a positive relationship between book to market and future stock returns.
- There is a negative relationship between momentum and the cross-section of future stock returns. The robustness test shows 1986 to dominate the results for equal-weighted and value-weighted firm momentum. Jegadeesh and Titman (1993) show that past returns tend to predict future returns. Fu (2009) also found positive returns on momentum. However, our results are inconsistent with the literature which exhibited negative returns whereby past losers on average continue to outperform past winners and this result is a puzzle.
- There is a negative relationship between firm size and the cross-section of maximum daily returns.
- There is a negative relationship between momentum and the cross-section of future maximum daily returns.

- The results in Table 5.19 based on the Fama Macbeth model showed only two significant variables -- book to market and momentum. The result is consistent with the double sorting method.
- The results in Table 5.19 also show idiosyncratic volatility to have a negative relationship with stock returns while maximum daily returns have a positive relationship. It clearly showed that book to market is priced in the cross-section of future stock returns but the negative momentum is inconsistent with previous literature (see Jegadeesh and Titman, 1993; Fama and French, 1996; Obreja, 2010; Novak and Petr, 2010). The negative momentum showed stocks that had relatively high returns over the past two to eleven months should generate returns to investors below average returns over the next two to eleven months. This is more evidence that the investor's under-reaction is the key to explain the negative momentum profit. Our research result is consistent with Chae (2009) who found a negative momentum profit in the Korean stock market.

Table 6.1: Summary of Research Results

Hypothesis	Expected relation formulation of hypothesis	Empirical Evidence Summary of key findings
H1	Japanese stock market exhibits significantly upward trend in idiosyncratic volatility	**Reject**. We found downward trend in equal-weighted and value-weighted idiosyncratic volatility. Downward trend occurs since early 2000.
H2	There is a positive cross-sectional relationship between idiosyncratic volatility and excess return	**Reject**. There is a negative relationship between idiosyncratic volatility and excess return. The robustness test shows 1986 to dominate the results for equal-weighted IV.
H3	There is a positive cross-sectional relationship between maximum daily returns and excess return	**Do not reject**. There is a positive cross-sectional relationship between maximum daily returns and excess returns. The robustness test shows 1986 to dominate the results for equal-weighted and value-weighted MAX.
H4	There is a negative relationship between firm size and the cross-section of future stock returns	**Do not reject**. There is a negative relationship between firm size and cross-section of future stock returns. The robustness test shows 1986 to dominate the results for equal-weighted and value-weighted firm size.
H5	There is a positive relationship between book to market and the cross-section of future stock returns	**Do not reject**. There is a positive relationship between book to market and cross-section of future stock returns. The robustness test shows 1980 to dominate the results for equal-weighted and value-weighted book to market.
H6	There is a positive relationship between momentum and the cross-section of future stock returns	**Reject**. There is a negative relationship between momentum and cross-section of future stock returns. The robustness test shows 1986 to dominate the results for equal-weighted and value-weighted firm momentum.

6.1 Implications of the Research Findings

The findings of this research have important implications for academics and investors. The *academics* have long been interested in the trends of stock market volatility. The Ang et al. (2009) research results revealed that high idiosyncratic volatility is associated with low returns and this occurs when the stock market declines. Our research findings showed negative and significant idiosyncratic volatility trends in the Japanese stock market. The downward trend of idiosyncratic volatility in the Japanese stock markets in our result is consistent with Hamao et al.'s (2003) study where they found statistically significant downward trend in idiosyncratic volatility from 1975 to 1999. Their results show in the 1990s, after the collapse of the bubble, the correlations increase significantly. The correlation tells important characteristics about the Japanese stock market where during the financial crisis, stocks in the Japanese stock market lost their individuality and started to move together; making it more difficult to differentiate the good firms from the bad firms. When the investors are not able to differentiate the stocks from each other, this may prevent the capital from flowing into good companies to support their innovations and make them competitive, thus weakening the Japanese stock markets' ability to sustain the economic shocks and may have led to higher stock market volatility.

Another contribution of this study to the literature is the results relating to the interaction of the idiosyncratic volatility and excess returns. Our research results showed there is a negative relationship between idiosyncratic volatility and excess returns. On the other hand, there is a positive relationship between maximum daily return and excess returns. The research finding for maximum daily return generating excess returns is consistent with Gao et al.'s (2010) findings but different from Bali et al.'s (2006) US stock market study. However, the opposite scenario was reported for idiosyncratic volatility and excess returns. Moreover, our research findings showed idiosyncratic volatility was not priced in the Japanese stock market. This is consistent with our expectations on capital asset pricing model (Sharpe, 1964) where only systematic risk is priced in the stock market while the unsystematic risk or idiosyncratic risk can be diversified using the portfolio selection method.

Another significant contribution to the literature was the finding that the book-to-market is the only variable which is significant or useful in the context of the multi factor asset pricing model in explaining the asset returns in the Japanese stock market compared to the Fama-French three factor model or the CAPM model. Our research findings contradict recent studies conducted by Fu (2009) and Jegadeesh and Titman (1993) where they found a positive relationship between size and momentum with idiosyncratic volatility. However, our research results will extend the current literature with the puzzling results.

The research results also have important implications for the *investors* in portfolio risk management. The investors will have a better understanding of idiosyncratic risk and extreme returns when they need to hold more stocks in their portfolios in order to achieve their diversification objectives. Moreover, our research findings on the idiosyncratic risk trends would help investors to take into consideration the idiosyncratic risk when trading in turbulent market conditions as well as stable times.

In addition, our study focuses on how the benefits received from the diversification of idiosyncratic volatility have changed over time for different size, momentum and book to market portfolios. The empirical methodology used in our research follows the Ang et al. (2009) method and the findings showed that high book to market firms for example have higher idiosyncratic volatility or higher maximum daily returns. Therefore, investors would have to invest in stocks that have a high book to market in order to get high returns.

One of the practical implications for investors is that those who are willing to bear a higher risk in their portfolio will invest in the extremely volatile stock markets such as those in Japan and the US. Since the sub-prime lending crisis and the Euro zone debt crisis, investors have expected higher returns when they invest in higher risk stocks in their portfolio. For example, investors who invest in the Japanese stock market would choose to invest in stocks that have high maximum daily returns in order to obtain excess returns. Kondor (2009) research results showed that additional business sector characteristics that affect return volatility include systematic and idiosyncratic risks.

6.2 Research Limitations

There are a number of limitations in this research related to data and estimation techniques. These include:

- The scope of this research is restricted to Japan only so making generalizations of the findings is limited. In addition, the sample period used in this research covered twenty seven years from January 1980 to December 2007 of the Tokyo Stock Exchange. We choose the sample period from January 1980 to December 2007, since it is the best available data on April 2008. However, it would be better to use an extended sample of daily stock returns for example from 1950 to 2010 to improve the robustness of the empirical results. Lakonishok and Shapiro (1986) argued that even sample periods of 20-30 years may not be sufficiently long to enable the use of ex post returns as proxies for expectations. The sample should include countries such as China, India and Taiwan to extend the findings broadly to Asia.
- This research uses book-to-market, momentum and size to test the relationship with a cross-section of future stock returns in the Japanese stock market. However, the control

variables such as earnings per share, return on equity, leverage, illiquidity and institutional ownership could be added to improve the research findings further. Unfortunately, such control variables have not been addressed in our research.

- Our research adopts the methods used in Ang et al. (2006) which use the Fama and French three factor model to measure the idiosyncratic volatility, and the lagged method to measure expected volatility. However, Fu (2009) pointed out that the Ang et al. (2006) method should not be used to test the relationship between expected returns and idiosyncratic risk. Fu (2009) used the EGARCH model to estimate the expected idiosyncratic volatilities and the author's research findings are both economically and statistically significant and robust using different testing methods. Therefore, the Fu (2009) method should be used in our research to compare it with the Ang et al. (2006) method to eliminate biases in the research results and to provide a more generalizable effect of the idiosyncratic volatility on the Japanese stock market. However, we did not used Fu (2009) method for our robustness test because Huang et al. (2010) argued that there is an omitted variable bias when stock returns in the previous month are used in EGARCH models to estimate idiosyncratic volatility. Lundblad (2007) also argues that the conditional volatility has almost no explanatory power for future realize returns. Based on the above reasons, our study employs Ang et al's (2006) method.
- This research uses the Fama and French (1993) method to compute the book to market ratio with the book value of common equity at fiscal year ending t-1 divided by the market value of the equity at the fiscal year ending t-1. However, Drew et al. (2003) uses the book value of common equity at December year t-1 divided by the market value of

the equity at December year t-1 as the book to market ratio. These differences might affect the relationship between firm size and book to market ratio and the average returns.

- In our research, the data were obtained from Datastream and it contained both tradable and inactive shares in testing the Fama and French three factor model. The large number of inactive shares might not reflect the true market value of the firm. If the inactive shares could be traded actively the stock price would be different from the current price.

  Another limitation in our research is the number of stocks in our study is lower than in the Fama and French's (1993) study. The number of firms included in our research is 2414 companies compared to average of 3100 listed firms per year in Fama and French's sample. We were able to sort the data into 25 portfolios, but the smaller number of stocks may result in a low degree of variation in case of the stock excess returns. The low adjusted R-squared value that we obtained in our research suggests that the three factor model can only explain a limited amount of variation of stock returns.

6.3 Recommendations for Future Research

To make research findings more generalizable, the research scope should be enlarged to include a research sample of other emerging markets such as China, India, Korea and Taiwan and the sample size should be increased accordingly. Furthermore, a number of control variables can be added to the models to improve the performance of the models. This includes earnings per share growth rate (see Malkiel and Xu 2002; Bekaert et al., 2009), return on equity (see Wei and Zhang 2006; Pastor and Veronesi 2002), trading volume (see Lo and Wang, 2000; Andersen, 1996); institutional ownership (see Sias, 1996; Dennis and Strickland, 2004) and leverage (see Dennis and Strickland, 2004; Kang et al., 2011).

To provide a comprehensive understanding of idiosyncratic volatility in the Japanese stock market, alternative measures of idiosyncratic volatility should be conducted. This may include using the EGARCH method to measure idiosyncratic volatility and the results can be compared with our research. The research implications would be more extensive if a different method were to be used. For example Fu (2009), who used the EGARCH method found a positive relation between the estimated conditional idiosyncratic volatilities and the expected returns and suggests that the Ang et al.'s research findings can be explained by the return reversal of a subset of small stocks with high idiosyncratic volatilities.

Berrada's (2010) study reveals that market segmentation generated by the incomplete information can be one of the variables responsible for the relationship between idiosyncratic risk and returns. Moreover, the magnitude of the difference between idiosyncratic risk premia of neglected stocks can be used as a proxy for the degree of market segmentation which can be used for future research.

To understand the implications for portfolio management, trading strategies and financial asset pricing theory, the variance decomposition proposed by Campbell et al. (2001) should be conducted to examine the relation between market volatility, idiosyncratic volatility and average correlation. Besides that, a time series test can be used to test the existence of long term trends. In regards to the short run dynamics, market variance and idiosyncratic variance can be used to forecast the variance series. As we suggested, there could be significant findings and implications for asset pricing. Therefore, future research can test the implications for asset pricing.

Another future research could study the trends in average variance and correlation series constructed from weekly returns and compare with our research results. In addition, it would be useful to study the variance series in various industries to identify the trends and the correlation series between those industries. Further, a robustness test could be carried out by comparing the industry level variance with the Datastream industry indices. If the industry variance has a significant variation, then further investigation on the root cause would be needed to make sure there is consistency in the data quality.

Future research on the conditional asset pricing model and the conditional factor pricing models could be used to explain why high volatility stock have low returns. According to Hansen and Richard (1987), even if the conditional asset pricing model holds period by period, the unconditional model will still fail to give a valid description of the average returns. Moreover, a Huang (2010) study used short term regressions, the monthly portfolios sorting method and unconditional alphas to test whether or not the portfolio returns are abnormal. They found that short term return reversals can explain that no robust and significant relation exists between idiosyncratic risk and expected returns. Therefore, under the assumption that the short horizon regression capture important time-variation in factor loadings that is not captured by the full sample unconditional factor loadings, it is possible that the unconditional alphas on the idiosyncratic volatility sorted portfolios are highly significant. Therefore, it might be possible that the conditional factor pricing models describe the returns on the idiosyncratic volatility better.

Finally, longer time series should be used to improve the efficiency or accuracy of impact estimation. Moreover, if longer time series are used, it may increase the statistical accuracy of risk estimates. However, to study volatility over an extended period of time is a data intensive task that requires substantial computational power. Therefore, these issues should be resolved in the future research with additional study on the factors of correlations among individual stock returns.

Appendix 1.1: Main Events Affecting the Japanese Financial System

Dec, 1980	Revised Foreign Exchange and Foreign Trade Control Law enforced.
Apr, 1982	New Banking Law enforced.
Apr, 1983	Banks begin to distribute public bonds.
Jun, 1983	Short-term Euroyen loans to non-residents permitted.
Aug, 1983	Banks begin to close business on second Saturday every month.
Apr, 1984	Purchase of foreign CDs and CPs permitted for residents.
Apr, 1984	Foreign exchange forward contracts without actual demand are allowed.
Apr, 1984	Medium-term loans to non-residents are deregulated.
Apr, 1984	Foreign banks are allowed to join the Government Bond Underwriting Syndicate.
May, 1984	Report of Japan-US Yen-Dollar Committee released.
Jun, 1984	Regulation of conversion of foreign currency into yen is liberalized.
Jun, 1984	Short-term Euroyen loans to residents are deregulated.
Jun, 1984	Banks start dealing in public bonds.
Dec, 1984	Overseas branches of Japanese banks and foreign banks are allowed to issue six-month Euroyen CDs.
Dec, 1984	Non-residents are allowed to float Euroyen bonds.
Feb, 1985	Foreign exchange brokers are allowed to engage in international broking.
Mar, 1985	MMCs are introduced.
Mar, 1985	Medium-term and long-term Euroyen loans to non-residents are deregulated.
Apr, 1985	Residents are allowed to float Euroyen convertible bonds.
Jun, 1985	Yen-denominated BA market is established.
Jul, 1985	Banks are allowed to issue foreign currency denominated bonds in overseas markets.
Jul, 1985	Uncollateralized call transactions are introduced.
Aug, 1985	First shogun bond issued by World Bank.
Oct, 1985	Bond futures market established.
Oct, 1985	Interest rates on non-negotiable large-sum time deposits are deregulated.
Oct, 1985	Foreign banks are allowed to establish trust subsidiaries in Japan.
Nov, 1985	Residents are allowed to float Euroyen straight bonds.
Dec, 1985	Less than 50 percent affiliates of foreign banks establish Tokyo branches for securities business.
Feb, 1986	Government issues TBs in discount form.
Feb, 1986	Six foreign securities firms obtain regular membership at Tokyo Stock Exchange.
Jun, 1986	Foreign banks are allowed to issue Euroyen bonds.
Aug, 1986	Banks close business on third Saturday every month.
Oct, 1986	Government begins to offer super long-term (20 year) government bonds.

Nov, 1986	Investment Advisory Law is enforced.
Dec, 1986	Japan Offshore Market is established.
Feb, 1987	Overseas branches of Japanese banks are allowed to underwrite foreign CPs.
Apr, 1987	Banks are allowed to issue convertible bonds in the domestic market.
May, 1987	Banks, securities firms, and insurance companies are allowed to trade in overseas financial futures.
Jun, 1987	Osaka Stock Exchange begins to trade "Osaka Stock Futures 50".
Sep, 1987	Auction for super long-term government bonds is implemented.
Nov, 1987	Auction for long-term government bonds is partially implemented.
Nov, 1987	Domestic CP market is established.
Nov, 1987	Foreign firms are allowed to issue Euroyen CPs.
Jan, 1988	Foreign firms are allowed to issue domestic CPs (samurai CPs).
Apr, 1988	Maximum term of Euroyen CDs is extended to two years.
Sep, 1988	Stock index futures are started (TOPIX and NIKKEI-225).
Dec, 1988	MoF sets new capital to assets ratio in response to BIS accord.
Jan, 1989	City banks introduce new formula for prime lending rate.
Feb, 1989	Fifty-two mutual banks are converted into commercial banks.
Feb, 1989	Banks close business every Saturday.
Apr, 1989	Bond option trading is started.
May, 1989	Medium- and long-term Euroyen loans to residents allowed.
Jun, 1989	Super MMCs are introduced.
Jun, 1989	Tokyo Financial Future Exchange is established.
Jul, 1989	Overseas deposits by residents are deregulated.
Dec, 1989	US Treasury bond market is established.
Mar, 1990	Banks allowed selling securitized corporate loans to institutional investors.
May, 1990	TSE launches options on government bond futures.
Jun, 1990	Banks allowed issuing subordinated debt.
Jul, 1990	Non-bank residents allowed holding deposits of up to 30 million Yen with banks overseas without prior authorization. Authorization for amounts up to 100 million Yen virtually automatic.
Oct, 1990	Several foreign securities companies given a license to conduct investment trust business.
Jun,1991	Securities companies discovered to have compensated clients for losses.
Mar,1992	Toyo Shinkin Bank split up, and business transferred to Sanwa Bank.
Jul,1992	Securities and Exchange Surveillance Commission formed.
Apr,1993	Financial System Reform Law comes into effect (permitting financial service companies to engage in other financial services through subsidiaries).
May,1993	Major banks announce figure for non-performing loans (8,455.3 billion Yen for top 11 banks) for the first time.
Jan,1995	Bank of Japan and consortium of commercial banks set up Tokyo Kyodo Bank in an operation to rescue Tokyo Kyowa Credit Union and Anzen Credit Union. Sumitomo Bank declares a loss as a result of writing off all its non-performing loans.
Jul,1995	Tokyo Metropolitan Government issues a cease-and-desist order to Cosmo Credit union not to take any new deposits or extend any new loans.

Aug,1995	Hyogo Bank and Kizu Credit union fail.
Sep,1995	Daiwa Bank's New York branch discovered to have suffered huge trading losses.
Aug,1996	Government decides to use taxpayer money to rescue housing loan companies.
Nov,1996	Prime Minister Hashimoto announces his "big bang" program of financial reform. Ministry of Finance orders Hanwa Bank to cease business.
Mar,1997	Major banks and securities companies discovered to have helped racketeers to make illicit profits. Ministry of Finance and Bank of Japan announce support for Japan Credit Bank.
Apr,1997	Ministry of Finance orders Nissan Life to cease business.
Oct,1997	Kyoto Kyoei Bank fails, and business is transferred to Kofuku Bank.
Nov,1997	Sanyo Securities files for reorganization. Hokkaido Takushoku Bank fails, and business is transferred to North Pacific Bank. Yamaichi Securities decides to cease business. Tokuyo City Bank fails, and business is transferred to Sendai Bank.
Feb,1998	Bridge Bank Law passed, allowing public funds to be used to support the banking system.
Mar,1998	Examination Board of Financial Crisis Management (Deposit Insurance Corporation) decides to sue taxpayer money to support 21 (major and regional banks).
Jun,1998	Financial Supervisory Agency formed.
Jul,1998	Government announces "Comprehensive Plan for Financial Revitalization".
Oct,1998	Financial Reconstruction Law and Early Strengthening Law come into effect. Long-Term Credit Bank under "special public administration".
Dec,1998	New Financial System Reform Laws ("Big Bang Laws") come into effect. Financial Reconstruction Commission set up Japan Credit Bank under "special public administration".
Apr,1999	Financial Reconstruction Commission allows Kokumin Bank to fail.
May,1999	Kofuku Bank applies to cease business.
Jun,1999	Toho Life and Tokyo Sowa Bank fail.
Aug,1999	Namihaya Bank fails.
Sep,1999	Government decides to transfer Long-Term Credit Bank's business to Ripplewood Holdings.
Dec,1999	Introduction of pay-off system postponed for a further year.
Mar, 2000	Hiroshima and Niigata stock exchanges merge into Tokyo Stock Exchange.
May, 2000	Opening of Tokyo Stock Exchange (TSE) ARROWS.
Apr, 2001	Reformist Junichiro Koizumi is nominated prime minister by the ruling coalition in an attempt to fight the 10-year old stagnation.
Nov, 2001	Tokyo Stock Exchange, Inc. established after demutualization of (TSE).
Jan, 2003	Commencement of operations at Japan Securities Clearing Corporation.
Mar, 2003	The Japanese NIKKEI stock market average bottoms up at 7699 after falling 80% from its 1989 peak, and skyrockets 41% from April to October.
Jan, 2005	The unemployment rate falls to 4.4% from a peak of 5.4%.
Sep,2005	Japan's Prime Minister Junichiro Koizumi stages a landslide victory in elections, boosting support for his economic reform

Dec, 2006	China becomes Japan's largest trading partner.
Dec, 2006	The USA has a trade deficit of $90 billion with Japan and one dollar is worth 119 yens.
Feb, 2007	World stock markets collapse.
Aug, 2007	Japan signs a free-trade agreement with ASEAN.
Aug, 2007	Tokyo Stock Exchange, Inc. established.
Sep, 2007	Crash of the stock markets worldwide, triggered by the crisis of USA sub-prime mortgage lenders, with the Nikkei's worst downfall since September 2001.
Oct, 2007	Establishment of Tokyo Stock Exchange regulation.
Nov, 2007	Commencement of operations at Tokyo Stock Exchange regulation.
Sep, 2008	Crash of the stock markets worldwide, triggered by the collapse of USA banks.
Oct, 2008	Japan's stock market plunges 9.4% in one day and then 9.6% a few days later, the biggest one-day drops since the 1987 market crash, as the economy enters its longest recession since World War II.
Dec, 2008	Japan's GDP shrinks 12.7% in the last quarter, the steepest decline since 1974, with industrial production plunging at the steepest pace in 55 years.
Jan, 2009	Japan's exports fall more than 45% in January and 49% in February to the lowest figure ever recorded.
Jan, 2009	One USA dollar is worth 90 yen.
Jul,2009	None of the 10 largest companies by market capitalization is based in Japan.
Aug,2009	Japan's recession ends but exports fall 36% compared with a year earlier and unemployment reaches a record 5.7%.
Dec,2010	China (GDP of $5.75 trillion) overtakes Japan (GDP of $5.39 trillion) as the world's second largest economy after the USA, although China's GDP per head ($4,500) is only 11% of Japan's ($40,000).
Mar,2011	An earthquake and a tsunami kill 18,000 people and cause a nuclear disaster in Fukushima.

Source: www.scaruffi.com on the article “A time-line of Japan”.

Reference List

Allen, Franklin and Douglas Gale. (2001). Comparing Financial Systems. Cambridge, MA.: MIT Press.

Anderson, D., A.W. Lynch, and N. Mathiou. (1990). Behaviour of CAPM anomalies in smaller firms. *Australian Journal of Management*, 15, 1, June, 1–38

Andersen. Torben G. (1996). Return Volatility and Trading Volume: An Information Flow. Interpretation of Stochastic Volatility. *Journal of Finance* 51:1, 169-204.

Andreas Andrikopoulos & Timotheos Angelidis. (2008). Idiosyncratic risk, returns and liquidity in the London Stock Exchange: a spillover approach. *Working Papers* 0017, University of Peloponnese, Department of Economics.

Ang, A., Hodrick, R., Xing, and X. Zhang (2004). The cross-section of volatility and expected returns. *Journal of Finance.* Forthcoming.

Ang, A., Hodrick, R. J., Xing, Y., & Zhang, X. (2006). The cross-section of volatility and expected returns. *The Journal of Finance*, 61(1), 259-299.

Ang, A., R. Hodrick, Y. Xing, and X. Zhang. (2008). High idiosyncratic volatility and low returns: International and further U.S. evidence. *Journal of Financial Economics*, 91, 1-23.

Ang, A., Hodrick, R. J., Xing, Y., & Zhang, X. (2009). High idiosyncratic volatility and low returns: International and further US evidence. *Journal of Financial Economics*, 91(1), 1-23.

Angelidis, T. (2008). Idiosyncratic risk, returns and liquidity in the London Stock Exchange: a spillover approach. *Working Papers 0017*, University of Peloponnese, Department of Economics.

Arena, M. P., Haggard, K. S., Yan, Xuemin,. (2008). Price Momentum and Idiosyncratic Volatility. *The Financial Review 43*, 159-190.

Arnott, R. D., Hsu, J. and Moore, P. (2005). Fundamental Indexation. *Financial Analysts Journal*, 61(2), 83–99.

Association for Asian Research. (2004*). The Japanese Roots*. Retrieved 28th July 2010, from http://www.asianresearch.org/articles/2349.html

AZSECC.com. (2008). *Why it's important to diversify your investment?*. Retrieved 3rd February 2011, from http://www.azsecc.com/why-its-important-to-diversify-your-investment.html

Baba, Naohiko and Takamasa Hisada. (2002). Japan's financial system: its perspective and the authorities' roles in redesigning and administering the system. *Monetary and Economic Studies*, 20 (2), Institute for Monetary and Economic Studies, Bank of Japan, 43-93.

Bali, T. G., Cakici, N., Yan, X. S., & Zhang, Z. (2005). Does idiosyncratic risk really matter? *Journal of Finance, 60*(2), 905-929.

Bali, T. and Nusret, C. (2006). Idiosyncratic Volatility and the Cross-Section of Expected Returns. *Journal of Financial and Quantitative Analysis* 4(4).

Bali, T., Cakici, N. (2008). Idiosyncratic Volatility and the Cross-Section of Expected Returns. *Journal of Financial and Quantitative Analysis* 43, 29-58.

Bali, T. G., & Cakici, N. (2009). Idiosyncratic volatility and the cross-section of expected returns. *Journal of Financial and Quantitative Analysis*, 43(01), 29-58.

Bali, T.G., & Liu Ren, Wu. (2010). The Role of Exchange Rates in Intertemporal Risk-Return Relations. Journal of International Money and Finance, 29(8), 1670-1686.

Bali, T. G., Cakici, N., & Whitelaw, R. (2011). Maxing out: Stocks as lotteries and the cross-section of expected returns. *Journal of Financial Economics. 99(2),* 427-446.

Bank of Japan. (2002).Payment Systems in Japan. Retrieved on 16th May 2010 from http://www.boj.or.jp/en/siryo/stat/sjgb0302_f.htm.

Bank of Japan. (2011). *Financial markets report*. Retrieved 16th February 2011, from http://www.boj.or.jp/en/research/brp/fmr/index.htm/

Bank of Japan. (2011). *Regular derivatives market statistics in Japan*. Retrieved 16th February 2011, from http://www.boj.or.jp/en/statistics/bis/yoshi/deriva.htm/

Bank of Japan Monthly Report of Recent Economic and Financial Developments. (2011).*Financial markets report*, February.

Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of Financial Economics*, 9(1), 3-18.

Barber, B., T. Odean & L. Zheng. (2005). Out of Sight, Out of Mind: The Effects of Expenses on Mutual Fund Flows. *The Journal of Business,* 78**,** 2095-2120.

Barberis, Nicholas, Andrei Shleifer and Robert Vishny. (1998). A model of investor sentiment. *Journal of Financial Economics* 48, 307-343.

Barberis, Nicholas C., and Ming Huang. (2001). Mental accounting, loss aversion, and individual stock returns. *Journal of Finance* 56, 1247–1292.

Baum, Harald and Hayakawa, Masaru. (1994). Die rechtliche Gestaltung des japanischen Finanzmarktes, in: Baum, Harald and Drobnig, Ulrich (eds): Japanisches Handels- und Wirtschaftsrecht, Berlin: Walter de Gruyter.

BBC.co.(2011). *Japan's industrial output and household spending rise*. Retrieved 9th February 2011, from http://www.bbc.co.uk/news/14336966

Beedles, William L., Peter Dodd, and P.R. Officer,. (1988). Regularities in Australian share returns, *Australian Journal of Management* 13, 1-29.

Bekaert, G., Hodrick, R. J., & Zhang, X. (2009). *Is there a trend in idiosyncratic volatility?* Paper presented at the AFA 2009 San Francisco Meetings, San Francisco.

Bekaert, G., Hodrick, R. J., & Zhang, X. (2010). Aggregate Idiosyncratic Volatility. *Unpublished Working Pape*r. Columbia University.

Benartzi, S. (2001). Excessive Extrapolation and the Allocation of 401k Accounts to Company Stock. *The Journal of Finance*, Vol 56, No.5, 1747-1764.

Bennett, James A., Richard W. Sias, and Laura T. Starks. (2003). Greener Pastures and the Impact of Dynamic Institutional Preferences. *Review of Financial Studies* 16,1203-38.

Bennett, J., Sias, R. (2006). Why company-specific risk changes over time?. *Financial Analysts Journal* 62, 89-100.

Bergbrant, Mikeal C. (2011). Is Idiosyncratic volatility really priced?. *Working paper*. University of South Florida.

Berk, J.B., Green, R.C., Naik, V. (1999). Optimal investment, growth options, and security returns. *Journal of Finance* 54, 1553–1607.

Berrada, T., and Hugonnier, J. (2010). Incomplete information, idiosyncratic volatility and stock returns. Swiss Finance Institute *Research Paper* Series N°08 – 23.

Bhootra, A., Hur, J.(2011). High Idiosyncratic Volatility and Low Returns: A Prospect Theory Based Explanation. *Working Paper*. California State University, Fullerton.

BIS Study Group on Fixed Income Markets. (2001). The changing shape of fixed income Markets. *BIS Papers*, 5, October.

Bloomfield, R., R. Libby, and M. Nelson. (1999). Confidence and the welfare of less-informed investors. *Accounting, Organizations & Society* 24(8), 623-647.

Blume, Marshall E. & Stambaugh, Robert F.(1983). Biases in computed returns: An application to the size effect. *Journal of Financial Economics*, Elsevier, vol. 12(3), 387-404, November.

Boquist, A. (2010). Idiosyncratic volatility, liquidity and extreme returns. *Working Paper*. University of Wisconsin-Madison.

Boyer, Brian, Todd Mitton and Keith Vorkink. (2008). Expected idiosyncratic skewness. Working Paper, Brigham Young University.

Boyer, B., T. Mitton, and K. Vorkink.(2009). Expected idiosyncratic skewness, *Review of Financial Studies*, 23(1):169–202.

Brandt, M., Brav, A., Graham, J, and Kumar, A. (2005) .The idiosyncratic volatility puzzle: time trend or speculative episodes?.*Working Paper*, Fuqua School of Business.

Brandt, M. W., A. Brav, J. R. Graham, and A. Kumar.(2008).The idiosyncratic volatility puzzle: Time trend or speculative episodes?.*Working paper*, University Station.

Breen, William, Lawrence R. Glosten, and Ravi Jagannatan.(1989).Economic Significance of Predictable Variations in Stock Index Returns. *Journal of Finance* 44, 1177-1189.

Brennan, M. J., & Subrahmanyam, A. (1996). Market microstructure and asset pricing: on the compensation for illiquidity in stock returns. *Journal of Financial Economics*, 41(3), 441-464.

Brockman, P., and M. Schutte. (2007). Is idiosyncratic volatility priced? The international evidence. *Working paper*, University of Missouri-Columbia.

Brockman, P., & Yan, X. (2006).The time-series behavior and pricing of idiosyncratic volatility: Evidence from 1926-1962. *Working paper*, University of Missouri.

Brockman, P., & Yan, X. S. (2008). The time-series behavior and pricing of idiosyncratic volatility: Evidence from 1926 to 1962. *Unpublished Working Paper*. University of Missouri - Columbia.

Brockman, P., D. Chung, and C. Prignon.(2009). Commonality in liquidity: A global perspective, *Journal of Financial and Quantitative Analysis*, 33:333–352.

Brown, G., and N. Kapadia. (2006). Firm-specific risk and equity market development, *Journal of Financial Economics*, 358-388

Brown, Philip, Donald B.Keim, Allan W. Kleidon and Terry A. Marsh.(1983). Stock return seasonalities and the 'tax-loss selling' hypothesis: Analysis of the arguments and Australian evidence. *Journal of Financial Economics*, 12

Bunzel, H. and T.J. Vogelsang. (2005). Powerful Trend Function Tests That Are Robust to Strong Serial Correlation, with an Application to the Prebisch-Singer Hypothesis. *Journal of Business and Economic Statistics*, 381-394.

Bystrom, Hans N. E. (2005). Extreme value theory and extremely large electricity price changes. *International Review of Economics & Finance*, Elsevier, vol. 14(1), 41-55.

Campbell, J.Y & John H. Cochrane, (1999). Explaining the Poor Performance of Consumption Based Asset Pricing Models. NBER Working Papers 7237, National Bureau of Economic Research, Inc.

Campbell, J. Y., Lettau, M., Malkiel, B. G., & Xu, Y. (2001). Have individual stocks become more volatile? An empirical exploration of idiosyncratic risk. *Journal of Finance*,56(1-43)

Cao, Jie and Bing Han. (2009). Cross-Section of Stock Option Returns and Stock Volatility Risk Premium. *Working Paper*, University of Texas at Austin

Cargill, Thomas F. and Takayuki Sakamoto. (2008). Japan Since 1980. New York: Cambridge University Press.

Chae, J., & Wang, A. (2009). Determinants of trading profits: The liquidity provision decision. *Emerging Markets Finance and Trade*,45, 33–56.

Chan, K., Hameed, Allaudeen and Wilson Tong. (2000). Profitability of momentum strategies in the international equity markets. *Journal of Financial and Quantitative Analysis Vol 35, No.2,* 153-172.

Chang, E. C., & Dong, S. (2006). Idiosyncratic volatility, fundamentals, and institutional herding: Evidence from the Japanese stock market. *Pacific-Basin Finance Journal, 14*, 135-154.

Chichernea, D., N. Miller, J. Fisher, M Sklarz and B. White. (2008). A Cross Sectional Analysis of Yields by MSA. *Journal of Real Estate Research*, 30(3), 249-292.

Chordia, T., A. Subrahmanyam, and V.R. Anshuman, (2001). Trading Activity and Expected Stock Returns. *Journal of Financial Economics* 59, 3-32.

Chordia, T., Shivakumar, L. (2002). Momentum, business cycle, and time-varying expected returns. *Journal of Finance* 57, 985–1019.

Chordia, T., S. Huh, and A. Subrahmanyam. (2005). The cross-section of expected trading activity. *Review of Financial Studies 20,* 709-741.

Chou, R.Y., Wu, C.C., Liu, N. (2009). Forecasting time-varying covariance with a range-based dynamic conditional correlation model. *Review of Quantitative Finance and Accounting, Volume 33, Issue 4,* 327-345.

Chou, P., Wei, K., and Chung, H. (2007). Sources of contrarian profits in the Japanese stock market. *Journal of Empirical Finance*. 14, 261–286

Chui, Andy C.W., and K.C. John Wei. (1998). Book-to-market, firm size, and the turn-of-the-year effect: Evidence from Pacific-Basin emerging markets, *Pacific-Basin Finance Journal 6(3-4)*, 275-93.

Chui, Andy, Sheridan Titman, and K. C. John Wei. (2000). Momentum, ownership structure , and financial crises: An analysis of Asian stock markets. *Working paper*: University of Texas at Austin.

Cochrane, John H. (1999). New facts in finance. *Economic Perspectives*, Federal Reserve Bank of Chicago, issue Q III, pages 36-58.

Cochrane, John H. (2001). Long term debt and optimal policy in the fiscal theory of the price level. *Econometrica,* Econometric Society, vol. 69(1), 69-116, January.

Cochrane, John H. (2005). The risk and return of venture capital. *Journal of Financial Economics*. Elsevier, vol. 75(1), 3-52, January.

Coleman, W. (1997). The French State, Dirigisme and the Changing Global Financial Environment, in Underhill, G. (ed) The New World Order in International Finance (Houndmills:MacMillian), 274-293

Conrad, J., and Kaul, G.(1998). An anatomy of trading strategies. *Review of Financial Studies*, 11, 489-519.

Crombez, J. (2001). Momentum, Rational Agents and Efficient Markets. *The Journal of Psychology and Financial Markets, 2, 190-200.*

Damodaran, A. (2010). Equity Risk Premiums: Determinants, Estimation and Implications, Stern School of Business.

Daniel, Kent, and Sheridan Titman. (1997). Evidence on the characteristics of cross-sectional variation in stock returns. *Journal of Finance* 52, 1-33.

Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam. (1998). Investor psychology and security market under- and overreactions. *Journal of Finance* 53, 1839-1885.

Daniel, K., Titman, S. (1999). Market efficiency in an irrational world. *Financial Analysts Journal* 55, 28–40.

Daniel, K.D., Titman, S., Wei, J. (2001). Cross-sectional variation in common stock returns in Japan. *Journal of Finance* 56, 743–766.

Datar, V.T., N.Y. Naik and R. Radclife. (1998). Liquidity and stock returns: an alternative test. *Journal of Financial Markets,* 1, 203-219.

Davis, James L. (1994).The Cross-Section of Realized Stock Returns: The Pre-COMPUSTAT Evidence," *Journal of Finance 49 :1579-1593.*

De Brouwer, G. (2003). Discussion on it takes more than a bubble to become Japan. *Asset Prices and Monetary Policy*. JS McMillan Printing Group, Sydney, Australia, 250-9.

De Veirman, E. & Andrew Levin. (2009). Measuring Chnages in Firm-Level Volatility: An Application to Japan. *Reserve Bank of New Zealand Discussion Paper Series*. DP2009/20, Reserve Bank of New Zealand.

Dennis, P., Strickland, D. (2004). The determinants of idiosyncratic volatility. *Unpublished working paper*, University of Virginia.

Dickey, D., & Fuller, W. (1979). Distribution of the estimator for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74, 427-431.

Djajadikerta. H, and Nartea. G. (2005). The Size and Book to Market Effects and the Fama-French Three Factor Model in Small Markets: Preliminary Findings from New Zealand. School of Accounting, Finance and Economics& FIMARC *Working Paper Series, Edith Cowan University.*

Doran, James S., Danling Jiang, and David R. Peterson. (2008). Gambling in the New Year? The January idiosyncratic volatility puzzle. *Working paper*, Florida State University.

Douglas, George W. (1969). Risk in the equity markets: An empirical appraisal of market Efficiency. *Yale Economic Essays* 9, 3–45.

Drew, M. E., & Veeraraghavan, M. (2002). Idiosyncratic Volatility and Security Returns: Evidence from the Asian Region. *International Quarterly Journal of Finance, 2(1-4).* 1-14.

Drew, M. E., Naughton, T., & Veeraraghavan, M. (2003). Firm size, book-to-market equity and security returns: Evidence from the Shanghai Stock Exchange. *Australian Journal of Management*, 28(2), 119.

Drew, M. E., Mallin, M., Naughton, T., & Veeraraghavan, M. (2006). Equity premium: Does it exist? Evidence from Germany and United Kingdom. *Studies in Economics and Finance, V23(2),*.80 – 93.

Economist.com. (2007). *Fishing for a future*. Retrieved 15th May 2010, from http://www.economist.com/node/9417036

Eiling, E. (2006). Can non-tradable assets explain the apparent premium for idiosyncratic risk? The case of industry-specific human capital. *Unpublished working paper*, Tilburg University, Netherlands.

Eulerhermes.com. (2011). *Weekly Export Risk Outlook*. Retrieved 9th February 2011, from http://www.eulerhermes.com/economic-research/economic-news.aspx#

Faff, Robert (2001). A Multivariate test of dual-Beta CAPM: Australian evidence. *The Financial Review*. Eastern Finance Association, vol. 36(4), 157-74, November.

Fama, E.F.(1970). Efficient capital markets: a review of theory and empirical work. *Journal of Finance* 25,383–417.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *Journal of Finance*, 427-465.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Finance Economics*, 33(1), 3-56.

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

Fama, E. F., & French, K. R. (1996). The CAPM is Wanted, Dead or Alive. *The Journal of Finance, 51*(5), 1947-1958.

Fama, E.F., & French, K.R. (2008). Average returns, B/M and Share issues. *Journal of Finance*. American Finance Association, vol. 63(6), 2971-2995, December.

Fama, E. F., & Macbeth, J. D. (1973). Risk, Return, and Equilibrium: Empirical tests. *Journal of Political Economy*, 81(3).

Fischer, S. (2010). Central bank lessons from the financial crisis. *Lecture at CEPR/ESI* Conference

Fink, J., Fink, K.E., Grullon, G., Weston, J. (2006). Firm age and fluctuations in idiosyncratic risk. *Working paper*, Rice University.

Flath, David. (2000). The Japanese Economy. Oxford: Oxford University Press.

Franklin Allen & Richard Herring. (2001). Banking Regulation versus Securities Market Regulation. *Center for Financial Institutions Working Papers* 01-29, Wharton School Center for Financial Institutions, University of Pennsylvania.

Fransman, Martin. (1995). Japan's Computer and Communications Industry: The Evolution of Industrial Giants and Global Competitiveness. Oxford University Press, Oxford.

Fu, F. (2009). Idiosyncratic risk and the cross-section of expected stock returns. *Journal of Financial Economics*, 9(1), 24-37.

Gao, X., Yu, J., Yuan, Y. (2010). Investor sentiment and idiosyncratic risk puzzle. *Working*

Paper. University of Hong Kong, Hong Kong.

Garrett, Thomas A. & Sobel, Russell S. (1999). Gambles favor skewness, not risk: Further evidence from United States lottery games. *Economics Letters,* Elsevier, vol. 63(1), 85-90, April.

Gaunt, C., P. Gray and J. McIvor. (2000). The Impact Of Share Price On Seasonality And Size Anomalies In Australian Equity Returns. *Accounting and Finance* 40, 33-50.

Goetzmann, W., Kumar, A. (2004). Why do individual investors hold under-diversified portfolios?. *Unpublished working paper*, Yale University.

Goyal, A., and P. Santa-Clara. (2003). Idiosyncratic risk matters!. *Journal of Finance* 58,975-1007.

Guo, H., and R. Savickas. (2006). Idiosyncratic Volatility, Stock Market Volatility, and Expected Stock Returns. *Journal of Business and Economics Statistics*, 24, 43-56.

Hall, Maximilian J.B. (1993). Banking Regulation and Supervision - A Comparative Study of the UK, USA and Japan, Aldershot: Edward Elgar.

Halliwell, J.,J.Heaney and J.Sawicki. (1999). Size and book to market effects in Australian share markets: a time series analysis. Accounting Research Journal, 12, 122-137.

Hamao, Y., Mei, J., & Xu, Y. (2003). Idiosyncratic Risk and Creative Destruction in Japan. *Unpublished Working Paper*. NBER.

Hamao, Y., Mei, J., & Xu, Y. (2007). Unique Symptoms of Japanese Stagnation: An Equity Market Perspective. *Journal of Money, Credit and Banking*. Blackwell Publishing, vol. 39(4), pages 901-923, 06.

Hameed, A., and Y. Kusnadi.(2002) Momentum strategies: Evidence from Pacific basin stock markets. *The Journal of Financial Research* 25, 383-397.

Hansen, L. P., and Scott F. Richard. (1987). The Role of Conditioning Information in Deducing Testable Restrictions Implied by Dynamic Asset Pricing Models. *Econometrica: Journal of the Econometric Society*, *55*(3), 587-613.

Hawawini, G., Keim, D.B. (1995). On the predictability of common stock returns: world-wide evidence. In: Jarrow, R.A., Maksimovic, V., Ziemba, W.T. (Eds.), Finance, Handbooks in Operations Research and Management Science, North Holland, Amsterdam, 497–544 (Chapter 17)

Herring, Richard and Nathporn Chatusripitak. (2001). The Case of the Missing Market: the Bond Market and Why It Matters for Financial Development, Wharton Financial Institutions Center *Working Paper* 01-08, Heston, Steven L., K. Geert Rouwenhorst, and Roberto E. Wessels. (1995). The structure of International stock returns and the integration of capital markets. *Journal of Empirical Finance* 2, 173-97

Hiroshi Ono. (2008). The Japanese Employment System: Adapting to a New Economic Environment. *Economica* , London School of Economics and Political Science, vol. 75(298), 397-398, 05.

Hirshleifer, David. (2001). Investor psychology and asset pricing. *Journal of Finance* 56, 1533-1597.

Hong, Harrison, and Jeremy Stein. (1999). A unified theory of underreaction, momentum trading, and overreaction in asset markets. *Journal of Finance* 54, 2143-2184.

Hong, Harrison, Terence Lim, and Jeremy Stein. (2000). Bad news travels slowly: Size, analyst coverage, and the profitability of momentum strategies. *Journal of Finance* 55, 265-295.

Hoshi, Takeo and Anil K Kashyap. (2004). Japan's Financial Crisis and Economic Stagnation. *Journal of Economic Perspectives*, 18(1), Winter 2004, 3-26

Hou, Kewei and Tobias Moskowitz. (2005). Market frictions, price delay, and the cross-section of expected returns. *Review of Financial Studies* 18, 981-1020.

Hsin, C. (2010). Idiosyncratic Risk and Stock Price Informativeness in Emerging Markets. The Annual Meeting of Southwestern Finance Association, Dallas, Texas, US.

Huang, W., Q. Liu, G. Rhee, and L. Zhang. (2007). Return Reversals , Idiosyncratic Risk and Expected Returns. *Working Paper*, University of Hawaii at Manoa.

Huang, W., Liu, Q., Rheee, S.G., & Zhang, L. (2010). Return reversals, idiosyncratic risk, and expected returns. *Review of Financial Studies, 23(1),* 147-168

Huberman, G. (1999). Familiarity breeds investment. *Working Paper*, 97-04, Columbia University.

Hull, J and Alan White. (2008). Dynamic Models of Portfolio Credit Risk: A Simplified Approach, *Journal of Derivatives*, 15, 4 (Summer 2008),9-28.

Imber articles. (2012). History of the Japanese stock market. Retrieved on 22 February 2012 from (http://imber-articles.blogspot.co.nz/2012_02_01_archive.html)

Inoue, Hirotaka. (2003). The Structure of Government Securities Markets in G10 Countries: Summary of Questionnaire Result. Retrieved on 16th May 2010 from http://www.bis.org/publ/cgfs11ino_a.pdf.

Investopedia.com. (2010). *Risk*. Retrieved 14th May 2010, from http://www.investopedia.com/terms/r/risk.asp#axzz1sqhXopYN

Irvine, P., and J. Pontiff. (2005). Idiosyncratic volatility, cash flows, and product market competition. *Working paper*, University of Georgia.

Itskevich, Jennifer. (2002). *What caused the stock market crash of 1987?*. Retrieved 18th July 2010, from http://www.hnn.us/articles/895.html

Iwasawa, S. (2003), Essays in Financial Economics: Empirical Research on the Japanese Stock Market, PhD thesis, Harvard University, Department of Economics.

Japanese Bankers Association. (2001). Analysis of financial statements of all banks. Tokyo: Japanese Bankers Association.

Japan Securities Research Institute. (2000). Securities Market in Japan 2001, Tokyo: Japan Securities Research Institute.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: implications for stock market efficiency. *Journal of Finance*, 48(1), 65-91.

Jiang,G., Xu,D., and Yao,T.(2007).The information content of idiosyncratic volatility. *The Journal of Financial and Quantitative Analysis*, 2007.Forthcoming.

Jiang, X., & Lee, B-S. (2006). On the dynamic relation between returns and idiosyncratic volatility. *Financial Management*, 35, 43-65.

Kahneman, Daniel, and Amos Tversky. (1979). Prospect Theory: An Analysis of Decision under Risk", *Econometrica*, XLVII, 263-291.

Kang, Min Jeong, Antonio Rangel, Mickeal Camus, and Colin F.Camerer. (2011). Hypothetical and real choice differentially activate common valuation areas. *The Journal of Neuroscience* 31, 461-468.

Kassismatis K. (2002.) Financial liberalization and stock market volatility in selected developing countries. *Appl Financ Econ* 12 (6): 389-394

Kobayashi, Keiichiro & Inaba, Masaru. (2006). Business cycle accounting for the Japanese economy. *Japan and the World Economy*,Elsevier, vol. 18(4), 418-440, December.

Kondor, P. (2009). Risk in dynamic arbitrage: the price effects of convergence trading. *Journal of Finance* 64/2, 631-655.

Krugman, Paul R. (1998). It's Baaack: Japan's Slump and the Return of the liquidity trap. *Brookings Papers on Economic Activity*, Economic Studies Program, The Brookings Institution, vol. 29(2), 137-206.

Kumar, A. (2009). Who gambles in the stock market?. *The Journal of Finance*, 64(4), 1889-1933.

Kuratani, Masatoshi and Yukihiko Endo. (2000). Establishing New Financial Markets in Japan. Retrieved on 15th May 2010, from http://www.nri.co.jp/english/report/papers/2000/pdf/np200006.pdf.

Kuroda, Akio. (2003). Financial Reform in Japan, in: Maximilian J.B. Hall (ed.): The International Handbook of Financial Reform, Cheltenham: Edward Elgar, 156-191.

Lakonishok, Josef and Alan C. Shapiro. (1986). Systematic risk, total risk and size as determinants of stock market returns. *Journal of Banking and Finance* 10, 115-132.

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarians investment, extrapolation and risk. *The Journal of Finance, 49*(5), 1541-1579.

Lee, C. M. C., & Swaminathan, B. (2000). Price momentum and Trading Volume. *Journal of Finance, 60*(5), 2017-2069.

Lehmann, B. N. (1990). Fads, martingales, and market efficiency. *The Quarterly Journal of Economics*, 105(1), 1-28.

Lessard, D. A. (1976). International Diversification. *Financial Analyst Journal*, 32, 32-38.

Levy, H. (1998). Stochastic Dominance: Investment Decision Making under Uncertainty. Boston, MA: Kluwer Academic Publishers.

Liang, Woan-lih and Hsiou–wei Lin. (2006). Earnings Manipulation and Anti-dilution Protection in Venture Capital Contracts. *The 5-th Best S&F Paper Award*.

Lincoln, Edward J. (1988). Japan, facing economic maturity, Brookings Institution (Washington, D.C.)

Lintner, J. (1965). The Valuation of risk asset and the selection of risk investments in stock portfolios and capital budgets. *The Review of Economics and Statistics, 47*(1), 13-37.

Lo, Andrew W., & Jiang Wang. (2001). Trading Volume: Implications of an intertemporal capital asset pricing model. *NBER Working Papers* 8565, National Bureau of Economic Research, Inc.

Longin F. (1996). The Asymptotic Distribution of Extreme Stock Market Returns. *Journal of Business*, 63, 383-408.

Longstaff, F.A., Santa-Clara, P., Schwartz, E. (1999). Throwing away a billion dollars: the cost of suboptimal exercise strategies in the swaptions market. *Working Paper*, No. 8-00, Anderson School, UCLA.

Malkiel, B. G., & Xu, Y. (1997). Risk and Return Revisited. *The Journal of Portfolio Management, Spring*, 9-14.

Malkiel, B and Xu, Y. (2001). Idiosyncratic risk and security returns. *Working paper*, University of Texas at Dallas.

Malkiel, B. G., & Xu, Y. (2002). Idiosyncratic risk and security returns. *Working Paper*.The University of Texas at Dallas.

Malkiel, Burton, and Yexiao Xu. (2003). Investigating the Behavior of Idiosyncratic Volatility. *Journal of Business* 76, 613-44.

Malkiel, B., Xu, Y. (2004). Idiosyncratic Risk and Security Returns. *Unpublished working paper*. Princeton University and University of Texas at Dallas.

Malkiel, B. G. , and Y. Xu. (2006). Idiosyncratic Risk and Security Returns. *Working Paper*, School of Management, University of Texas at Dallas.

Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *Journal of Finance, 42*, 483-510.

Miller, E. (1977). Risk, Uncertainty, and Divergence of Opinion. *Journal of Finance* 32, 1151-1168.

Moskowitz, T. J., and M. Grinblatt. (1999) Do industries explain momentum?. *The Journal of Finance* 54, 1249-1290.

Mundell, R.A.,. (2000). A reconsideration of the Twentieth century. *The American Economic Review* Vol.90, No.3, 327-340.

Nartea, G.V., & Ward, B.D. (2009). Does idiosyncratic risk matter? Evidence from the Philippine stock market. *Asian Journal of Business and Accounting, 2(1&2),* 47-67

Nartea, G.V., Wu, J., & Yao, L.J. (2010). Idiosyncratic volatility in the Chinese stock market. *Unpublished working paper*. Lincoln University. 38 pages

Nations Encyclopedia.(2012). *Encyclopedia of the Nations*. Retrieved 3th January 2012, from http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/index.html

Nelson, D. (1991). Conditional Heteroskedasticity in Asset Returns: A new Approach. *Econometrica*, 59, 347-370.

Newey, W. and K. West. (1987). A simple positive semi-definite, heteroskedasticity and auto-correlation consistent covariance matrix. *Econometrica,* 55, 703-708.

Nguyen, Duc Khuong, Arouri, M., Jouini, J. (2011). Volatility Spillovers between Oil Prices and

Stock Sector Returns: Implications for Portfolio Management. *Journal of International Money and Finance* 30(7), 1387-1405.

Novak, J., & Dalibor Petr (2010). CAPM Beta, Size, Book-to-Market, and Momentum in Realized Stock Returns. *Czech Journal of Economics and Finance,* Charles University Prague, Faculty of Social Sciences, vol. 60(5), 447-460, December

Nowman, K.B. (2003). A note on Gaussian estimation of the CKLS and CIR models with feedback effects for Japan. *Asia Pacific Financial Markets* 10:275-279.

Obreja, I.(2010). Book-to-market Equity, Financial Leverage and the Cross-Section of Stock Returns, Revise and Resubmit at *Review of Financial Studies*.

Ogawa, Eiji. (2003). Tokyo Financial Market as Financial Centers in Asia, paper presented at the workshop on A New Financial Market Structure for East Asia: How to Promote Regional Financial Market Integration, Big Island, Hawaii, 7-8 February.

Ohlson, J., Rosenberg, B. (1982). Systematic Risk of the CRSP Equal-Weighted Common Stock Index: A History Estimated by Stochastic Parameter Regression. *Journal of Business*, 55, 121-145.

Pastor, L. and R.F. Stambaugh. (2003). Liquidity risk and expected stock returns. *Journal of Political Economy*, 111, 642-685.

Pástor, Luboš & Veronesi, Pietro. (2002). Stock Valuation and Learning about profitability. *CEPR Discussion Papers* 3410, C.E.P.R. Discussion Papers.

Patel N.R and Marti G. Subrahmanyam. (1978). Utility Theory and Participation in Unfair Lotteries, *Journal of Economic Theory*, December

Poon, S-H., Rockinger, M., and Tawn, J. (2003). Modelling Extreme-Value Dependence in International Stock Markets. *Statistica Sinica*, 13, 929-953.

Preis, Tobias; Stanley, H. Eugene. (2010). Switching Phenomena in a System with No Switches. *Journal of Statistical Physics* 138: 431–446.

Pukthuanthong-Le, K., & Visaltanachoti, N. (2009). Idiosyncratic volatility and stock returns: a cross country analysis. *Applied Financial Economics, 19,* 1269-1281.

Rajgopal, S., and M.Venkatachalam. (2005). Financial Reporting Quality and Idiosyncratic Return Volatility over the Last Four Decades. *Working Paper*, University of Washington and Duke University.

Reinganum, M. R. (1981). Misspecification of capital asset pricing: empirical anomalies based on earnings‟ yields and market values. *Journal of Financial Economics*, 9(1), 19-46.

Reszat, Beate. (1998). The Japanese Foreign Exchange Market, London: Routledge.

Rietz, T.A. (1998). Enforcing arbitrage restrictions in experimental asset markets. *Working paper* University of Iowa.

Roll, R. (1977). A critique of the asset pricing theory's tests, Part 1: On past and potential testability of the theory. *Journal of Financial Economics* 4: 129-176

Roll, R. (1981). A possible explanation of the small firm effect. *Journal of Finance*, 36(4), 879-888.

Rosenberg, B., & Reid, K. R. Lanstein (1985). Persuasive evidence of market inefficiency. *Journal of Portfolio Management*, 11(3), 9-16

Rouwenhorst, K. Geert. (1998). International momentum strategies. *Journal of Finance* 53, 267-284

Sabelhaus, John, and Jae Song. (2009). Earnings Volatility across Groups and Time. *National Tax Journal,* vol. 62, no. 2, 347-364.

Santillán, Javier, Marc Bayle and Christian Thygesen. (2000). The Impact of the Euro on Money and Bond Markets, *European Central Bank Occasional Paper* No. 1, July.

Saryal, F.S. (2009). Rethinking idiosyncratic volatility: Is it really a puzzle? *Unpublished Working paper*. University of Toronto.

Schaede, U. (1996). The 1995 Financial Crisis in Japan', the University of California: *Working Paper* 85, February

Schwert, G. W. (1989). Why does stock market volatility change over time. *Journal of Finance, 44*(5), 1115-1153.

Schwert, G.W. (2001). Anomalies and market efficiency. In: Constantinides, G., Harris, M., Stulz, R. (Eds.), Handbook of the Economic of Finance. North-Holland, Amsterdam (Chapter 17), 939-974.

Scott, J., M. Stumpp, and P. Xu. (2003). News, not trading volume, builds momentum. *Financial Analysts Journal* 59, 45-54.

Sehgal, S., Tripathi, V. (2005). Size Effect in Indian Stock Market: Some Empirical Evidence. *Journal of Business Perspective*, Vol. 9, 27-42.

Seiichiro Iwasawa. (2003). Essays in Financial Economics: Empirical Research on the Japanese Stock Market: UMI.

Sharpe, W. F. (1964). Capital Asset Prices: A Theory of Market Equilibrium under

Conditions of Risk. *Journal of Finance, 19*(3), 425-442.

Shu J. and J.E. Zhang. (2003). The relationship between implied and realized volatility of S&P 500 index. *Wilmott Magazine*, 83-91.

Sias, Richard W. (1996). Volatility and the Institutional Investor, *Financial Analysts Journal*, March/April, Vol.52, No.2:13-20.

Siddiqui, Rizwana. (2009).Human Capital vs Physical Capital: A Cross-Country Analysis of Human Development Strategies. *PIDE Working Papers* 2009:51, Pakistan Institute of Development Economics.

Silva, A., & Mendes, B. (2003). Value-at-risk and extreme returns in Asian stock markets. *International Journal of Business*, 8, 17−40.

Smith, Patrick. (1998). Japan: A Reinterpretation, Harpercollins.

Sooperarticles.com. (2011). *History of the Japanese Stock Market*. Retrieved 10th July 2011, from http://www.sooperarticles.com/finance-articles/stocks-articles/history-japanese-stock-market-368868.html

Speigel, M.I., and X. Wang. (2005). Cross-Sectional Variation in Stock Returns: Liquidity and Idiosyncratic Risk, Working Paper, Yale School of Management.

Statistics Bureau, Director-General for Policy Planning & Statistical Research and Training Institute. (2010). *Chapter 3 Economy*. Retrieved 15th May 2010, from http://www.stat.go.jp/english/data/handbook/c03cont.htm

Study Group on Fixed Income Markets. (2001). The changing shape of fixed income markets. *BIS Papers No.5*., Bank for International Settlements, Basel, Switzerland.

Thaler, R. H., & Ziemba, W. T. (1988). Anomalies: Pari-mutuel betting market: racetracks and lotteries. *The Journal of Economics Perspectives*, 2(2), 161-174.

The Free Dictionary.com. (2010). *Idiosyncratic risk*. Retrieved 15th May 2010, from http://financial-dictionary.thefreedictionary.com/Idiosyncratic+Risk

The New York Times. (1989). *Japan denies intent to raise interest rates*. Retrieved 29th August 2010, from http://www.nytimes.com/1989/04/22/business/japan-denies-intent-to-raise-interest-rates.html

The New York Times. (2012). *Japan-Earthquake, Tsunami and Nuclear crisis*. Retrieved 13th January 2012, from http://topics.nytimes.com/top/news/international/countriesandterritories/japan/index.html

Tokyo Stock Exchange. (2001). *About TSE History*. Retrieved 20th January 2011, from http://www.tse.or.jp/english/about/history.html

Tokyo Stock Exchange. (2009). *Tokyo Stock Exchange* . Retrieved 20th January 2011, from http://www.tse.or.jp/english/

Tokyo Stock Exchange. (2010). *Arrowhead*. Retrieved 20th January 2011, from http://www.tse.or.jp/english/rules/equities/arrowhead/pamphlet.html

Tomita, Toshiki. (2003). The Risk Premium Warning on Japanese Government Bonds, *NRI Paper* No. 61, February.

Trading Economics.com. (2010). *Japan stock market*. Retrieved 14th May 2010, from http://www.tradingeconomics.com/japan/stock-market

Umutlu Mehmet, Akdeniz Levent and Altay-Salih Aslihan. (2010). The degree of financial liberalization and aggregated stock-return volatility in emerging markets. *Journal of Banking and Finance*, vol 34, no. 3, 509-521

Vogelsang, Timothy J. (1998) Trend Function Hypothesis Testing in the Presence of Serial Correlation. *Econometrica* 66, 123-48.

Wang, Zhen Yu & Werner.(1994). Portfolio characterization of risk aversion, *Economic Letters*, Elsevier, vol. 45(2), 259-265, June.

Wei, Steven X., and Chu Zhang. (2004). Why did individual stocks become more volatile?. *Journal of Business*, *79(1),* 259-292.

Wei, S. X. and Zhang, C. (2006). Why did individual stocks become more volatile?. *Journal of Business* 79(1): 259-292

Wikinvest.com. (2010). *Tokyo Stock Exchange*. Retrieved 26th September 2010, from http://www.wikinvest.com/wiki/Tokyo_Stock_Exchange

Wohlmannstetter, Gottfried. (1991). Finanzplatz Tokio, Frankfurt am Main: Fritz Knapp Verlag.

Wood, J. (1991). A Cross-Sectional Regression Test of the Mean-Variance Efficiency of an Australian Value-Weighted Market Portfolio. *Accounting and Finance* 31, 96-109.

Wright, Maurice. (2002). Japan's Fiscal Crisis – The Ministry of Finance and the Politics of Public Spending, 1975-2000, Oxford: Oxford University Press.

Wu Yujun and Ju Fang. (2002). Understanding the volatility pattern in China stock market - An empirical test of the volatility components. *Working Paper*. Nanyang Technological University.

Yahoo.com. (2010). *Major World Indices*. Retrieved 16th May 2010, from http://finance.yahoo.com/intlindices?e=asia

Zhang, L. (2005). Efficient estimation of stochastic volatility using noisy observations: A multi-scale approach. *Working paper.* University of Illinois.

Zheng, Lu and Deng, Xiang. (2009). The Historical Evolution and Evaluation of Development Policies for Western China. *MPRA Paper* 33873, University Library of Munich, Germany.

Zielenziger, M. (2001). 2nd Mad cow discovery cripples beef sales in Japan. The Honolulu Advertiser.