An Empirical Examination of Price Behavior on the Hong Kong Stock Market

by

Enyang Guo

Dissertation submitted to the Faculty of the

Virginia Polytechnic Institute and State University

in partial fulfillment of the requirements for the degree of

Ph. D.

in

Finance

APPROVED:

Arthur J. Keown, Chairman

Vittorio A. Bonomo

Robert S. Hansen

Raman Kumar

George E. Morgan

Dilip K. Shome

July 18, 1990

Blacksburg, Virginia

An Empirical Examination of Price Behavior on the Hong Kong Stock Market

by

Enyang Guo

Arthur J. Keown, Chairman

Finance

(ABSTRACT)

This dissertation examines stock price behavior on the Hong Kong stock market in terms of normality of returns and the efficiency of that market. The results reveal that the Hong Kong stock market is efficient, although the degree of efficiency is somewhat different from what has been found for securities traded in the U.S. market. Moreover, it was found that as a small but active stock market, the Hong Kong market is sensitive and highly vulnerable to international events.

The study also analyzes the relationship among different national equity markets, i.e., the U.S., the U.K., Japan, and Hong Kong. The results show that a substantial amount of multi-lateral interaction is present among national equity markets. In addition, some common seasonal patterns of stock price movements appear across the different national markets, and innovation transmissions from market to market are significant and efficient. The study provides added support to the hypothesis of an integrated world financial market.

Acknowledgements

I would like to thank the members of my committee for their advice and guidance to accomplish this study. I am deeply grateful to my chairman, Dr. Keown, for his total commitment to this dissertation. He contributed incredible amount of time, ideas, and support. His sincere concernment will always remain in my memories. I am also grateful to Dr. Morgan and Dr. Shome, our Ph. D. program directors, whose encouragement and guidance are most appreciated. My thanks also go to Dr. Hansen, Dr. Kumar, and Dr. Bonomo.

I am indebted to my classmates Nilanjan Sen, Jack Broughton, and Greg Noronha for their friendship and support throughout the course of this program. The life in Blacksburg, which is not without difficulties but full of joy, is printed in my memory. I will miss it all my life.

I wish to thank my parents for the concern and the support they have given me through the years. Particularly, I wish to express profound appreciation to my husband, Jin, whose understanding, encouragement, and support made it all possible.

I would like to dedicate this study to my country, China. I sincerely wish her progress and prosperity.

Table of Contents

List of Illustrations

List of Tables

Chapter 1

Introduction

Efficient markets imply that security prices fully reflect all available information. Operationally, this means that changes in stock prices are unpredictable from one day to the next, and the return earned by a stock is characterized as being independently and identically distributed over time. Furthermore, the difference in expected return among different stocks can be attributed to their own risks as measured by beta, a covariance measure of security risk with market risk.

While some empirical studies support the theory of efficient markets, a growing body of literature has appeared that questions this efficient market view of stock price movements. The challenges to this view of the market are centered in two areas. First, Basu [1977], Banz [1981], Reinganum [1981], and Roll [1981] document the existence of differences in average rates of return among securities which can not completely be explained by their betas. A striking finding in this literature is the firm size effect, i.e., a firm's market capitalization seems to be an additional factor that is related to a firm's future return. Second, Rozeff and Kinney [1976], Keim [1983], Banz [1981], Reinganum [1981] [1983] and Roll [1983] document the fact that stock returns are not identically distributed over time. Stock returns, in fact, follow some systematic pattern which appears to vary with calendar periods. As of yet, the cause of these seasonal effects has not been convincingly explained.

The search for explanations of such "stock anomalies" leads to the investigation of the stock pricing behavior in international markets, and the development of the assumption of an integrated world financial market draws a good deal of attention to the relationships and the mutual influences among different national market. This dissertation will examine price behavior on the Hong Kong stock market, a small but active market in Asia, and study the stock price co-movement in the United States, the United Kingdom, Japan, and Hong Kong. Although the stock market in Hong Kong is small relative to the U.S. market, Hong Kong has one of the largest financial and investment markets in Asia. Hong Kong started its stock market last century and has seen rapid development in recent years. Today, the stock market provides an important source of capital for local enterprises, with growing interest from both local and overseas investors. There were 306 companies, with a total market capitalization of $74.8 billion (in U.S. dollar), listed on the Hong Kong Stock Exchange at the end of 1988. This made the Hong Kong Stock Exchange the largest stock market in Asia outside Japan.

In spite of its size and importance, the Hong Kong market has not been empirically explored. As such, this dissertation will provide an initial examination of this market. The dissertation is composed of two parts. The first part is the examination of stock price movement on the Hong Kong market, including the tests of weak-form efficient market and semi-strong form efficient market. The random walk model is tested in the weak-form efficient market hypothesis, and the results will manifest if the stock return on the Hong Kong market is independently and identically distributed. The semi-strong form efficient market hypothesis tests the efficiency of the Hong Kong market's reaction to major public announcements. The study will examine the announcement effect of dividends and bonus issues. The results from the efficient market tests explore the risk and return parameters on the Hong Kong market, and should shed light on the features of small but active stock markets.

The second part of the dissertation concerns the assumption of the integrated world market. The study compares the stock price movement on the Hong Kong, the U.S., the U.K., and Japanese market, and investigates the international transmission mechanism of stock market movement by estimating a four-market vector autoregression (VAR) system. The study will reveal the degree of interdependence among those markets, and how innovations are transmitted from one market to the other, providing added understanding of the relationship between the eastern markets and the western markets. Furthermore, it will examine whether it is possible for investors to diversify their portfolios internationally in an integrated world market, with a reduced risk opportunity. The study will discuss portfolio diversification, from the views of a Hong Kong investor and a U.S. investor, in the U.S., the U.K., and Asian stock markets. The study will reflect the value of the Hong Kong and/or the Asian market to the U.S. investors and the value of the international diversification to the Hong Kong investors.

The dissertation would be organized as following: Chapter II is literature review. The third chapter will introduce Hong Kong financial market. Chapter IV presents the test of weak-form efficient market on the Hong Kong stock market. Chapter V discusses the announcement effect of dividends and bonus issues on the Hong Kong market, providing some evidence of semi-strong form efficiency applied in an equity market outside of the U.S. market. Chapter VI compares the stock price movement on the Hong Kong, the U.S., the U.K., and the Japanese market, and investigates innovation transmissions among those equity markets. The results provide support to the hypothesis of an integrated world financial market. Based upon the study of the stock price movements on the Hong Kong market and the interdependence among national markets, Chapter VII explores the potential benefit of international diversification in the U.S. market, the U.K. market, and the Asian markets. The last chapter will give a summary.

Chapter 2

Literature Review

Introduction

The purpose of this chapter is to review the literature dealing with efficient capital markets, including the theory and the application. The theory deals with the theoretical models and the definitions of efficient market, and the applications present the empirical evidence related to the efficiency of capital markets.

2.1. A Review of Theory: Capital Market Efficiency

Fama [1970] reviews the theoretical and empirical literature on the efficient market model. He indicates that a market in which prices always "fully reflect" available information is called "efficient". He defines three types of market efficiency, and each of them deals with the condition with which relevant information subset is related in stock price.

(i) *Weak-form Efficiency:* No investor can earn excess returns by developing trading rules based on past price or return information. This definition defines the information set as historical prices and volumes.

(ii) *Semi-strong-form Efficiency:* Prices efficiently adjust to information that is publicly available. Thus, no investor can earn excess returns from trading rules based on publicly available information.

(iii) *Strong-form Efficiency:* Prices efficiently adjust to all information whether it is publicly available or not. Thus, investors can not earn excess returns even if they have access to inside or monopoly information.

To make the theory empirically testable, Fama develops three efficient market models based upon the return generating theories. Fama shows that, conditional on some relevant information set, the equilibrium expected return on a security is a function of its "risk". Thus, different return generation theories would differ primarily in how "risk" is defined. However, efficient market theory is based upon the idea that the information set is fully used in determining equilibrium expected returns.

1. *Fair Game Model*

Efficient market theory states that conditions of market equilibrium can be stated in terms of expected returns with equilibrium expected returns fully reflecting all available and relevant information. Thus, returns in excess of the equilibrium expected profit or returns can not be generated by trading systems based upon relevant information.

Explicitly, the model can be expressed as:

$$X_{j,t+1} = P_{j,t+1} - E\,(P_{j,t+1} \mid \Phi_t) \tag{2.1}$$

where $X_{j,t+1}$ is the excess market value of security j at time $t + 1$.

$$E(r_{j,t+1} \mid \Phi_t) = \frac{\{E(P_{j,t+1} \mid \Phi_t) - P_{j,t}\}}{P_{j,t}} \tag{2.2}$$

where $r_{j,t+1}$ is the return of security j at time t + 1.

$$Z_{j,t+1} = r_{j,t+1} - E(r_{j,t+1} \mid \Phi_t) \tag{2.3}$$

where $Z_{j,t+1}$ is the excess return of security j at time t + 1, and Fair Game implies that:

$$E(X_{j,t+1} \mid \Phi_t) = E(Z_{j,t+1} \mid \Phi_t) = 0 \tag{2.4}$$

This states that the sequence $\{X_{j,t}\}$ or $\{Z_{j,t}\}$ is a "fair game" with respect to the information sequence $\{\Phi_t\}$. In other words, investors can not continuously earn excess returns because relevant information is fully reflected in the price. Hence, only "fair game" exists in efficient markets.

The following are the two special cases of the fair game model.

2. *The Martingale and Submartingale Model*

The submartingale model states that the expected value of next period's price (return), as forecasted using all available relevant information, is equal to or greater than the current price (return). That is:

$$E(P_{j,t+1} \mid \Phi_t) \geq P_{j,t} \tag{2.5}$$

or

$$E(r_{j,t+1} \mid \Phi_t) \geq 0 \tag{2.6}$$

For the martingale model

$$E(P_{j,t+1} \mid \Phi_t) = P_{j,t} \tag{2.7}$$

or

$$E\,(r_{j,t+1} \mid \Phi_t) = 0 \tag{2.8}$$

This model implies that expected returns conditional on the information set are non-negative. The implication of this is that trading systems based only on information in Φ_t that have expected profits or returns can not dominate the trading systems based upon a buy and hold strategy.

The submartingale model is based upon the "fair game" model, and is different from the "fair game" model only in the sense of dynamic definition. In effect, the submartingale model makes the efficient market theory acceptable in the real world.

3. *The Random Walk Model*

Two hypotheses constitute the random walk model:

a. Successive price changes, or successive one-period returns, are independent;

b. Successive changes (returns) are identically distributed.

Explicitly, it can be stated as:

$$f(r_{j,t+1} \mid \Phi_t) = f(r_{j,t+1}) \tag{2.9}$$

Equation (2.9) indicates that the conditional and marginal probability distributions of an independent random variable are identical. Because the entire distribution is independent of the previous information set, Φ_t , the sequence (or the order) of the past returns is of no consequence in assessing distributions of future returns.

The random walk model is an extension of the "fair game" efficient market model, making a more detailed and strict statement about the economic environment. The "fair game" model says only that the conditions of market equilibrium can be stated in terms of expected returns, saying little about the details of the stochastic return generating process. The random walk model not only states that the mean of distribution of the expected return at time t + 1 is independent of the information available at time t, but also it states that the entire distribution is independent of the information set. That is, return distributions repeat themselves over time so successive price changes are identically distributed.

2.2. Application: Empirical Evidence

2.2.1. Weak Form Test of the Efficient Market Model

In his 1965 paper, Fama tests the empirical validity of the theory underlying the random walk model. He uses the daily price data from the thirty stocks comprising the Dow-Jones Industrial Average over the period from the end of 1957 to the end of 1962, and tests for independence and identical distribution of stock price changes.

To test the hypothesis of identically distribution of stock price changes, Fama examines the normality and stability of the price changes of those thirty stocks. The results of normality tests reveal that the tails of the frequency distributions of the thirty stocks are longer than those of the normal distribution, and the central bells of the empirical frequency distributions are higher than those of a normal distribution. Thus, these results indicate that distribution for price changes of the thirty stocks depart from normality, having a high peak, with a long and thick tail distribution.

On the other hand, his tests of the stability and independence of the distribution of price change returns lent support to the random walk model. By definition, if the sum of variables (the distribution of weekly or monthly price changes) has the same distribution as the individual summands (the distribution of daily price changes), then the distribution is stable. Fama's results show that the characteristic exponent of the weekly and monthly distributions remains constant as the characteristic exponent of the distribution of daily price changes, indicating the stability of the distribution of stock returns. Therefore, the hypothesis of identical distribution is supported. However, the characteristic exponent α, which measures the height of the extreme tail areas of the distribution, is in the interval $1 < \alpha < 2$, rather than $\alpha = 2$, as implied in normality. Hence this reflects that the distributions have finite means but infinite variances, which implies that the distributions are depart from normality.[1] In testing the hypothesis of independence of the distributions of stock price changes, Fama shows that there is little evidence, either from the serial correlations or from the various runs tests, of any large degree of dependence in different time interval price changes. However, there is some evidence that large price changes are followed by large price changes but with random sign. Nevertheless, the tendency is not particularly strong, implying that the dependence from this source is not extremely important. Therefore, the hypothesis of independence is generally supported.

In summary, Fama's tests reveal empirical support for the random walk model. The test of thirty stocks of Dow-Jones Industrial Average indicates that the successive price changes are independent and that stock price changes are identically distributed with $\alpha < 2$. Empirically, these results imply that, given the available information, actual prices at every point of time represent a good estimate of intrinsic values, and past prices can not be used to forecast prices for future profit. Because the distribution of price changes departs from normality but is stable, it reflects a market where the price of a security will often tend to jump up or down by very large amounts during very short time periods, and this is a situation quite consistent with a dynamic economy in a world of uncertainty.

---

1 Fama indicates that the characteristic exponent, α, can take any value in the interval $0 < \alpha \leq 2$. When $\alpha = 2$, the relevant stable Paretian distribution is the normal distribution. When α is in the interval $0 < \alpha < 2$, the distribution would have higher peak, flatter and thicker tail than the normal one. More important, the distributions would have finite means and finite variance only when $\alpha = 2$. When $1 < \alpha < 2$ and α is constant across different trading periods, the distributions would be stable but their variances are infinite.

2.2.2. Empirical Tests of Dividend and Stock Split Announcement

The random walk model implies that changes in stock prices are unpredictable from one day to the next, and the return earned by a stock is characterized as being independently and identically distributed over time. As such, the dividend or stock split per se does not have an impact on the value of firms. Instead, it serves as a message from management about the expectation of the firm's future cash flows which is immediately and unbiasedly reflected in the security's price. Thus, no trader can consistently earn excess returns, based on the historically and publicly available information, if the hypothesis of semi-strong form efficient market is supported.

The effect of dividend and stock split announcement has received a good deal of attention, with the majority of studies focusing upon the U. S. equity market. For the most part, the evidence seems to support the efficient market hypothesis. The first study examining dividend announcement effect on the value of the firm dealt with stock splits and was performed by Fama, Fisher, Jensen and Roll [1969]. They found that when a split announcement was associated with a dividend change, there was an increase in the adjusted share price for the group associated with a dividend increase, while a decrease was detected in the share price for the group associated with a dividend decrease. Furthermore, they found that positive abnormal returns occurred before the split but not afterward. Fama et al. thereby hypothesized that stock splits might be interpreted as a message about dividend increases, because the managers of firms anticipated a permanent increase in the level of future cash flows. Their results confirm the hypothesis that the market made unbiased dividend forecasts from stock split, since stocks with dividend increases following the split had a slightly positive return while stocks with dividend decreases following the split suffered a price decline.

Pettit [1972] examined the impact of changes in dividends on security prices using both monthly and daily data. He investigated the abnormal performance index of firms that had dividend changes of -1% to -99%, 1% to 10%, 10% to 25%, and over 25% using the market model. The results revealed that the market reacted to changes in dividends on either the announcement date or the following day, and the effect of the announcement was completely impounded into security prices on the day following the announcement. Furthermore, stock prices increased substantially when dividends increased between 10% to 25%, and prices decreased significantly when dividends declined or were omitted. Thus, the results of Pettit's study provide evidence that a considerable amount of information is conveyed by the changes in dividends.

Kwan [1981] extended Pettit's testing by forming portfolios based on unexpected dividend changes rather than the observed dividend changes. He defined an annualized quarterly dividend as the market expectation, and constructed a prediction interval filter to eliminate the noise problem. His results were consistent with those of Pettit, finding statistically significant abnormal returns when firms announce unexpectedly large dividend changes.

Aharony & Swary [1980] examined the information content of dividends, and attempted to determine whether quarterly dividend changes provided information beyond that already provided by quarterly earnings numbers. They used a naive expectation model, which forecasts no change in dividends from one quarter to another, to measure the unexpected changes in dividends, and separated the announcement effects of earnings and dividends by identifying whether dividend announcements preceding or following earnings announcements. Their results suggest that there was no significant effect when dividends did not change, and positive abnormal returns for dividend increases and negative abnormal returns for dividend decreases, with most of the statistically significant returns occurring during the day before the announcement and the day of the announcement. Furthermore, they found that the significant effect upon the announcement of dividend changes did not reflect a diffusion or a leakage of the information conveyed by earnings numbers but, rather, additional information generated by the dividend announcement.

Grinblatt, Masulis and Titman [1984] examined both stock splits and stock dividends using daily data covering the period from 1967 to 1976. They formed two subsamples with no other announcements being made over the three-day period surrounding the split announcement or stock dividend announcement. They found a statistically significant announcement return, 3.44%, associated with "pure" split announcements, and a 5.89% return associated with a "pure" stock dividend announcement. They interpreted the announcement of the stock split as a favorable signal indicating that the firm is expecting high cash flows in the future, while the large positive announcement effect associated with stock dividends conveys the management confidence concerning the firm's future performance. Because a stock dividend would reduce the firm's retained earnings and increase potential future dividends, only those firms that have optimistic prospects would announce a stock dividend.

The empirical studies have established that, on average, there is an immediate and significant increase in the stock price at the announcement of a dividend increase, while there is an immediate and significant decrease in the stock price at the announcement of a dividend decrease. A stock split conveys a message about a permanent dividend increase, implying that the managers of the firm feel confident that the firm can maintain a higher level of future cash flows. Specifically, past studies have found the information content to be quickly compounded into stock's price without bias, with a one- or two-day period of adjustment, providing support for the semi-strong form efficient market hypothesis in the U.S. equity market.

2.2.3. Systematic Patterns in Stock Returns

The results from empirical tests for dividend and stock split announcements support the hypothesis of semi-strong form efficient capital market, however, the evidences of systematic patterns in stock returns have severely challenged the theory of efficient market. In scrutinizing the data more and more closely, researchers find that stock price changes are not independently and identically distributed, but follow some systematic patterns which vary with certain calendar periods. The systematic patterns in stock returns are against the theory of efficient capital market because it allows speculators or short-term stock holders to make profit due to a predictable price pattern.

Those systematic patterns can be referred to as the turn of the year effect, the turn of the month effect, and the turn of the week effect, etc.. The turn of the year effect is commonly referred to as the "January effect". As early as 1976, Rozeff and Kinney [1976] reported the existence of seasonal effects on New York Stock Exchange. They examined aggregate rates of return on the New York Stock Exchange for the period January 1904 through December 1974. With the exception of the 1904-1929 period, they found that there were statistically significant differences in mean returns among months due primarily to large January returns, and the differences among the variances of monthly returns were not pronounced. Thus, the return pattern in monthly means was not caused by the simple volatility of the prices. Furthermore, skewness measures revealed that there were no departures from symmetry and the characteristic exponent seemed invariant among months. Thus, they suggested there was a seasonal pattern in stock returns which was undetectable with any clarity in the autocorrelation function of the returns. Keim [1983] finds that the daily abnormal return distribution in January has a large mean relative to the remaining eleven months, and that the relationship between abnormal return and firm size is negative, becoming more significant in January than in other months. This fact persists even in the period when large firms outperformed small firms. Keim also shows that while small firms earn larger risk-adjusted return than large firms, the effect is not even throughout the year. Almost half of the effect occurs in January, and more than 50% of the January premium is attributable to large abnormal returns during the first week of trading in the year, particularly on the first trading day. In January, the returns of small firms surge ahead of those of large firms. Reinganum [1983], Roll [1983] also indicate that no period except the period around early January displayed an exceptional premium for small firms.

The turn of the month effect reflects the pattern of returns earned by firms within a trading month. Some of the earliest work was performed by Ariel [1987], who investigated monthly effect in stock returns. Ariel employs the CRSP value-weighted and the equally-weighted stock index return during the years 1963 through 1981. He finds that stocks seem to earn positive average returns only during the first half of calendar months, and zero average returns during the second half. Both the value-weighted and equally-weighted stock index returns consistently reflect this pattern of stock returns although the pattern of the equally-weighted index is much stronger than that of the value-weighted index. In addition, he shows that this effect is not just a manifestation of the January effect. Ariel shows that while the semi-month effect is reduced it still remains significant after removing January from the sample. Pettengill and Jordan [1988] find that the order of weeks within the trading month also generates a stock return pattern. They use S&P 500 as a proxy for returns on large firms, and the equally weighted CRSP excluding the 500 largest firms as a small firm return index. They find that the return on the S&P 500 in the first week of the month is 2.5 times larger than the total of the remaining three weeks, and the return for the second week is also relatively high while the return for the third week is negative. For the small firm index, the first week return is significantly higher than the rest of the weeks with the second and fourth week return also significantly higher than the third week return. Hence there is a clear pattern with the first week generally having the highest return and the third week the lowest.

The turn of the week effect can also be referred to as "the day of the week effect", or "weekend effect". This effect concerns the unusual behavior of stock prices from the close of trading on Friday to the close on Monday. French [1980] uses the daily return of the S&P composite portfolio from 1953 to 1977, to examine the returns for different days of the week. His results reveal that Monday returns are consistently negative, with negative returns for 20 out of 25 years. French tests for several anomalies such as a calendar time effect, a trading time effect, a closing market (holiday) effect and a weekend effect. It seems only weekend effect is supported. French further calculates that if an investor sold the security on each Friday, holding cash during weekend, and bought the security on each Monday, the annual average return would be 13.4% before considering transaction costs. Keim and Stambaugh [1984] further investigate the weekend effect on stock returns. They use a longer time period and find the existence of average negative Monday returns back though 1928. To examine the possibility of a contemporaneous size effect, they form ten additional portfolios ranked by the securities' market value. The results indicate that Monday returns are consistently negative across all size portfolios. The average returns of all portfolios tend to increase as the week progresses with the Friday returns being the largest of the week. Thus, the weekly pattern of stock returns seems persistent regardless of firm size. However, the tendency for returns to increase during the week is more pronounced for small firms, with Friday returns strongly related to size. In a related study, Rogalski [1984] finds that weekend effect reflects both the size effect and a January effect. His results suggest that, in January, all firms have average positive returns on Monday regardless of size. However, small firms have larger returns on Mondays in January, and this difference between small and large firms is most pronounced on the first Monday in January. On Mondays during other months, both small and large firms have consistent negative returns.

The systematic patterns in stock returns are also found on the stock market outside of the U.S.. Gultekin and Gultekin [1983] empirically examine stock market seasonality in 18 industrialized countries. The stock returns in the study are computed from indices reported in Capital International Perspective (CIP), a publication which provides monthly stock market indices based on 1100 stocks listed on the stock exchanges of 18 countries. The CIP indices, all of which are value-weighted, represent different proportion of the total market value in each country varying from 47% to 80%. Thus, the indices are regarded as approximately representative for those markets. The results of their study reveal that month-to-month mean returns on the CIP indices vary substantially. The null hypothesis that stock returns are time invariant is rejected for 12 out of 17 countries at the 10% significant level. In addition, the results show that there is a strong pattern of seasonality in all 18 countries. With the exception of the U. K. and Australia, all countries exhibit a January effect. The results confirm the existence of seasonality in the international market, with the seasonality more strongly reflected in January. Brown, Keim, Kleidon and Marsh [1983] investigate stocks listed on the Australian Stock Exchange during the period 1958-1981. The Brown et. al. study reveals several interesting points: First, the U. S. stocks display a large size effect dominated by a premium for small firms in January, while Australia stocks also reflect a size effect, i.e., small firms earn average 4% monthly premium through the year. However, the premium for Australian stocks appear to be fairly constant across months. Second, the seasonal pattern in Australia displays two peaks through the year -- December-January and July-August, with the largest effect in January and July. Tinic, Barone-Adesi and West [1987] analyze return of Canadian stock over the period 1950-1980. Their test results indicate that returns in Canadian stocks also present a strong seasonal effect in January as a whole and in particular for small firms. Reinganum and Shapiro [1987] investigate stock returns on the London Stock Exchange. Reinganum and Shapiro employ the monthly data in the London Stock Exchange over the period 1956-1980. Their results reveal that there is no seasonality in stock returns before 1965. However, there are persistently positive abnormal returns in January and April after 1965. Kato and Schallheim [1985] examine seasonal and size anomalies on the Japanese stock market. The Japanese data is also found to exhibit strong seasonality in stock returns, with the largest monthly returns occurring in January and June. In addition, there is also a negative relationship between stock returns in January and firm capitalization. Small firms reflect larger positive excess returns in January while large firms exhibit negative excess returns in January. The authors indicate that the January-size effect in Japan is very sensitive to the choice of the market index. They find the January size effect is significantly reduced when it is tested by a equal-weighted index. The authors suggest that the anomalies in the Japanese market are similar to those found in the U.S. market although the two markets are very different in terms of their economic and geographic environment. Jaffe and Westerfield [1985] investigate the weekend effect in stock returns of four countries: Japan, Canada, Australia, and the U. K.. Their study finds that while there is a weekend effect in each country, the patterns are somewhat different from those found in the U.S.. For example, on the Japanese and Australian stock markets, the lowest mean returns occur on Tuesday. To detect if there is any correlation of patterns between the U.S. and other countries, this study exams the cross correlational relationship between the U.S. and each other country in both contemporaneous correlation and lead 1 correlation. Here it finds that the highest correlation is between the U.S. and Canada. In addition, it finds that the different weekend patterns between the U.S. and the Australian market can be explained by difference in time zones. In order to shed further light on whether the weekend effect in those countries is related to the U.S. weekend effect, the authors test the returns in each market after accounting for common effects of the American market. The results confirm that the weekend effect in each country is independent of the weekend effect in the U.S..

Therefore, the empirical study reveals that systematic patterns in stock returns exist in both the U.S. market and the international markets, although they appear different somewhat from country to country. The systematical patterns in stock returns present a challenge to the traditional view of market efficiency.

2.2.4. Integrated International Capital Market and International Diversification

As the development of science and technology, the relationships between different national capital market become closer, and the mutual influences appear more important. The hypothesis of an integrated international capital market is more and more accepted in current studies. Agmon [1972] analyzes the relationship among four equity markets, i.e., the U.S., the U.K., Germany, and Japan, and demonstrates that the prices of capital assets in those four capital markets behave as if there is one multinational perfect capital market. He examines the price of risk in the four-country equity market using the market model. The results show that the slope and intercept of the risk-return line are similar for all markets. He then further examines the simultaneity of price changes among these four national markets. If the hypotheses of the integrated international market and efficient capital market hold, equity prices in the non-US countries should respond immediate to changes in the U.S. stock prices, or vice versa. His results indicate that, on a monthly basis, there was no significant lagging, and responses to price changes on the international equity market were mostly immediately. Therefore, Agmon's study reveals a consistent price of risk and a substantial amount of relationship among the four equity markets, indicating the hypothesis of an integrated international market being supported.

Eun and Shim [1989] extended Agmon's testing by investigating the international transmission mechanism of stock market movements using a nine-market vector autoregression (VAR) system. The study examines the interactions among the nine national equity markets, and traces out the dynamic responses of one market to innovations in another. Their results reflect that there exists a substantial amount of contemporaneous correlation among the nine national equity markets, and the intra-regional correlations tend to be higher than the inter-regional correlations. Their results also reveal that the stock price movements in the U.S. market exert a large influence on the international equity markets since innovations in the U.S. market are rapidly transmitted to other markets in a clearly recognizable fashion, whereas no single foreign market can significantly explain the U.S. market movements. Furthermore, their results support the efficient capital market theory because information transmissions and dynamic responses among the different national equity markets are mostly immediate and without delay. However, since the results from the VAR system are sensitive to the order of the orthogonalization with the variables in the model, and the setting of this order in Eun and Shim's study appears random and does not appropriately identify the contemporaneous correlations among the markets, there should be some limit in the results.

Under the assumption of the integrated financial world market, it is possible for investors to diversify their portfolios in the international equity market. Portfolio theory suggests that effect of random fluctuations in the rates of return of capital assets can be reduced by forming diversified portfolios. However, fluctuations in the returns of the portfolios as a whole, or the portfolios' risk, can not be completely eliminated. This unlimited fluctuation, called "systematic risk", can be ascribed to factors which affect all capital assets, through to a different degree. In an integrated world market, international diversification can create investment opportunities with a lower degree of unlimited fluctuation in portfolio returns, resulting in potential gains from international diversification.

Empirical studies since last two decades have demonstrated the possibility and benefit from international diversification. Joy, Panton, Reilly and Martin [1976] examine the co-movements in the returns in 12 major international equity markets by weekly exchange-rate adjusted and unadjusted stock market rates of return during a ten-year period from 1963 to 1972. Their results indicate that most of the correlations are very low and thus there are substantial risk reduction possibilities through international diversification, and the effect of the exchange rate on the returns of diversified portfolio is small. In terms of stability of the correlations over time and between various pairs of countries, their results suggest that the time effect and the country effect are significant. That is, the specific relationships between the alternative national markets make a large difference in the international investment, and these relationships continuously change over time. Therefore, a frequent readjustment of international portfolios over time is necessary. Furthermore, the time trend of the correlation of the alternative national markets increases over time, and the increase is very gradual. Grubel [1968] analyses the monthly rates of return for 11 major countries in Asia, Europe, and North America during the period from 1959 to 1966. An international diversified portfolio is simulated in the study, which provides substantially higher rates of return or lower variance than that can be attained with a portfolio of only the U. S. stocks. Grubel and Fadner [1971] further indicate that the correlation between the national markets is positively related to the holding period. The longer the holding period, the larger the correlation would tend to be, and the less the power of international diversification, because the common valuation factors, in the long run, would overpower those unique characteristics of different national markets. Levy and Sarnat [1979] examine the potential gains from international diversification using annual returns of 28 countries and comparing the gains among different efficient sets of portfolios including all 28 countries, 16 high income countries, 5 European common market countries, and 9 developing countries. Their results reveal that there is a continuous reduction in variance as the opportunity set is broadened until the best frontier is achieved when all 28 countries are considered. However, the analysis of the market opportunity line shows that only 9 national markets are selected in at least one optimal portfolio at the alternative level of risk free rate, although 28 countries are considered. The selected national markets present the features of low correlation, preferable mean return or standard deviation. A study of exchange risk surprises by Adler and Simon [1986] indicates that the exposures of foreign stock market index to exchange risk have generally risen since October 1979 compared to the earlier period. On October 6, 1979, the U.S. Federal Reserve announced a shift in its monetary policy targets from interest rates to money supply growth rates, and thus the relationship between exchange rates and U.S. - foreign nominal interest rate differentials since has turned positive instead of negative. Their study covers the period from Jan. 1976 to Dec. 1982, and tests the exposure of foreign stock marekt indices to exchange rate risk in pre- or post-Oct. 1979 periods. Their results show an significant shift in exchange risk since 1979. Before October 1979, the foreign currency returns of foreign stocks were generally independent of exchange rate change, so that the exposure of diversified portfolios to currency risk during this period was not important. Since October 1979, however, exchange risk exposures have become significant to diversified portfolios of foreign stock indices because some major world currencies behaved differently due to the shift of the U.S. monetary policy target. Therefore, the currency risk is not negligible anymore.

2.3. Summary

While some of empirical works support the theory of efficient capital market, the evidence of a growing number of 'anomalies' appeared both on the U.S. market and the non-US markets presents a severe challenge to the traditional view of efficient capital market. The capital market plays a primary role to allocate the ownership of the economy's capital stock, and the efficiency of the capital market provides an accurate function for resource allocation. These puzzling phenomena or inefficiencies of the market are the reasons for researchers to intensively cultivate and explain the real world.

Chapter 3

An Introduction to the Economic Environment in Hong Kong

3.1. Overview

Hong Kong is one of the most important international financial center in Asia. It possesses all the necessary ingredients for a successful financial center, and some of which are unique in a world market economy. The following discussion outlines the features of the financial market in Hong Kong:

A Liberal Government Policy Towards Business

Hong Kong pursues an economic policy of limited government intervention. The Hong Kong government adheres to a balanced budget in its fiscal policy and the amount of government debt outstanding is very small. Thus, the tax environment in Hong Kong is favorable. The tax rate in Hong Kong is considerably lower than the corresponding rate in most other countries. Furthermore, there is no control on foreign exchange and capital flows, which significantly motivates both local and overseas investors. This free-enterprise market-disciplined system is the major force behind Hong Kong's economic success.

A Sound Financial System

There is no central bank in Hong Kong, and government intervention in banking is minimal. There are three types of active financial institutions (i.e., licensed banks, licensed deposit-taking companies, and registered deposit-taking companies) composing Hong Kong's financial system. The local banking regulations focus on preventive measures. In addition, there are developing capital, equity and futures markets with relatively low transaction costs. However, owing to its small and open nature, the financial market in Hong Kong is vulnerable to external factors.

An International Financial Center

As an important international financial center, Hong Kong enjoys some noteworthy advantages. The favorable geographical position of Hong Kong provides a bridge in the time gap between North America and Europe, in addition it provides a strong link with China and the southeast Asian countries. The unique free-port policy in Hong Kong gives impetus to the development of economic markets, and excellent world-wide transport and communications link the Hong Kong market with other world markets. Moreover, the international population and widespread Chinese and English language ability in Hong Kong ease communications between the East and the West. These advantages have helped Hong Kong to develop into a significant international financial market.

This chapter will briefly introduce economic environment in Hong Kong and will cover areas of public finance and the financial markets, respectively.

3.2. Public Finance

With the limited government function, the influence of the public finance in the financial sectors in Hong Kong is not significant. This section will discuss two areas of public finance which are closely related to financial market: money supply and tax system.

3.2.1. Money Supply

Unlike other countries, Hong Kong has no central bank. Most of the functions which might normally be performed by the central bank are carried out by different government offices under the Monetary Affairs Branch of the Government Secretariat or by selected commercial banks.

Hong Kong has its own independent currency, the Hong Kong dollar. The government set up an Exchange Fund in 1935. The Exchange Fund holds the backing to this currency, and the bulk of the government's financial assets. One principal function of the Exchange Fund is the day-to-day management of those assets, and its statutory role is to influence the exchange value of the Hong Kong dollar. Another function related to the Exchange Fund is the supply of notes and coins to the banking system. Except for a very small fiduciary issue, which is backed by securities guaranteed by the British or Hong Kong government, currency notes in every day circulation are only issued by two private commercial banks, the Hong Kong and Shanghai Banking Corporation and the Standard Chartered Bank Limited. These currency notes are issued against the holdings of certificates of indebtedness issued by the Exchange Fund.

Prior to June 1972, the Hong Kong dollar was pegged to sterling and certificates of indebtedness were issued against and redeemed in sterling at a fixed exchange rate. Between June 23, 1972 and November 24, 1974, when the Hong Kong dollar was pegged to US dollar, and between November 25, 1974 and October 15, 1983, when the Hong Kong dollar was floating, such payments were made in the Hong Kong dollars. On October 17, 1983, the government abandoned the official floating policy and announced a policy of pegging the Hong Kong dollar at HK$7.8 per US dollar. Henceforth, the certificates of indebtedness are issued and redeemed only against payment in US dollars, at a fixed exchange rate of US$1 = HK$7.8.

Because of the absence of any exchange control, the key determinants of the growth of the money supply in Hong Kong are the demand for credit and the net acquisition of foreign currency assets by the financial institutions in the local financial market. Between 1973 and 1978, the Hong Kong dollar appreciated on average against the other 15 foreign currencies as a group. After that, the Hong Kong dollar depreciated and remained weak. However, the inflation rate, which is measured by the consumer price indices, was not stable during the past decade. It was 5.8% in 1978, 15.1% in 1980, 10.6% in 1982, 2.2% in 1986 and 5.5% in 1987.

3.2.2. Tax System

The tax system was first introduced in Hong Kong in 1947, and was based on the same principles used by many of the commonwealth countries. The original system has remained substantially unaltered.

There are several unique features to the Hong Kong tax system. The first is that the income tax liability is dependent on the 'source' rather than the 'residence' of the taxpayer. This means that only income 'arising in or deriving from' Hong Kong is taxable. Income from non-Hong Kong sources received by a resident in Hong Kong is excluded. The second features is that the tax is levied on four separate sources, i.e., profits, salaries, interests and properties. As a general principle each of the taxes is assessed separately and a person may have assessments with respect to all four taxes. The third feature of the tax system in Hong Kong is the low level of tax rates and the lack of progressiveness, which implies that the tax system contains little or no disincentive effect on work effort, investment and enterprise. However, it also reflects that the system does not achieve a more equitable distribution of income and wealth.

Hong Kong does not tax dividend income, and there is no capital gain tax, nor any other form of tax on capital gains. However, the repeated realization of gains through the regular buying and selling of assets on the grounds that such transactions constitute a trade in those assets is subjected to profit tax. Thus, capital gains are taxed as profits. In addition, loss incurred may be carried forward indefinitely (but not back) for application against any assessable profits of any trade of the same company or person.

The current tax rate for profit is 18 percent in the case of corporation and 16.5 percent for unincorporated business, and the standard tax rate for salaries, or properties is also 16.5 percent, before the deduction of personal and other allowances. The tax year ends on March 31, and the new tax year begins on April 1.

3.3. Financial Markets

3.3.1. Money Market

Hong Kong has a well-established and active money market, in which wholesale Hong Kong dollar deposits and foreign currency deposits (mainly in US dollars) are traded both between deposit-taking institutions in Hong Kong and between local and overseas institutions. The market is mainly for short-term money. The maturity range is from overnight up to six month for the Hong Kong dollar, and from overnight up to twelve months for the US dollars. As an indication of the size of the market, at the end of 1987, the Hong Kong dollar interbank liabilities constituted 33 percent of the total liabilities of the banking sector which were denominated in the local currency; the foreign currency interbank liabilities accounted for 80 percent of the total liabilities of the banking sector in foreign currency.

3.3.2. Foreign Exchange Market

The foreign exchange market in Hong Kong is extremely sophisticated. The favorably geographic location helps Hong Kong link with other major overseas centers and enable foreign exchange dealing to continue 24 hours a day around the globe. The absence of exchange control, a highly advanced telecommunications system, and large number of international banks located in Hong Kong contribute significantly to the volume of trade on that market. There are seven major currencies traded on the Hong Kong market, which are the US dollar, Deutschemark, Yen, Sterling, Swiss franc, the Australian dollar and the Hong Kong dollar.

There are no official statistics for the trade volume of the Hong Kong foreign exchange market. Market estimates, however, indicate an average daily turnover of around US$25 billion in foreign exchange in all currencies. This is equivalent to some six per cent of the daily turnover of the world foreign exchange market.

3.3.3. Capital and Equity Market

History

Stock trading in Hong Kong has a long history. The first stock exchange was established in 1891. This was the Association of Stockbrokers in Hong Kong, which changed its name to Hong Kong Stock Exchange in 1914. A second exchange, the Hong Kong Stockbrokers Association, started in 1921. These two exchanges were merged into the Hong Kong Stock Exchange in 1947.

For a long time, the Hong Kong Stock Exchange did not play a major role in the capital market. Bank lending is the main source of finance for corporations. Up to 1962, there were only 65 companies listed on the exchange.

The development of the securities industry and the establishment of statutory regulation took place in the last two decades. The Far East Stock Exchange was opened in December 1969, which introduced the London-style investment practices and established rules suited to the Chinese business community. The Far East Stock Exchange very soon surpassed the Hong Kong Stock Exchange in terms of trading volume. Its success encouraged the establishment of further exchanges. The Kam Ngan Stock Exchange was opened in March 1971, and its membership was connected with the long established Gold and Silver Trading Society. In addition, the Kowloon Stock Exchange started its business in January 1972. Thus, there were four stock exchanges in operation on the Hong Kong stock market and the equity market expanded rapidly after 1970. During 1973 alone, there were 53 public offers and 48 placements of shares on the exchanges, bringing the total number of listed companies to 296 at the end of 1973. In addition, several Hong Kong companies are listed and traded on the London stock exchange. In turn, some foreign companies are listed and traded on the Hong Kong stock market with most of them being Japanese companies.

With the development of the regulatory framework, the security industry in Hong Kong needed a joint body to represent the brokerage profession. The Hong Kong Federation of Stock Exchanges was formed in July 1974, which represented the interests of the brokerage community. In 1980, the new unified exchange, Stock Exchange of Hong Kong Limited (HKSE) was incorporated, under the jurisdiction of the Stock Exchange Unification Ordinance. The HKSE started trading on 2 April 1986.

The Stock Exchange of Hong Kong publishes its own indices of stock prices. One is Hang Seng Index and the other is Hong Kong Index. The Hang Seng Index was launched in November 1969, and based on the daily market values of 33 leading stocks selected on the basis of their capitalization. The Hong Kong Index was initiated on April 2nd 1986 when the unified exchange was opened. The Hong Kong Index comprises 45 leading stocks which collectively represent some 87 percent of the total trading volume, and about 85 percent of the total capitalization. The market capitalization by sectors at the end of 1987 are listed as follows:

Finance	16.30%
Utilities	17.47%
properties	26.11%
Consolidated Enterprises	29.61%
Industrials	6.38%
Hotels	4.08%
Others	0.05%
Total	100.00%

There are now about 320 stocks listed on the Hong Kong market. At the end of 1988, the total market capitalization was around US$ 74.8 billion, with average US$12 million daily trading volume.

Legislation

The securities industry in Hong Kong is governed by (1) The Companies Ordinance; (2) The Securities Ordinance; (3) The Securities (Stock Exchange Listing) Rules 1986 (which is subsidiary legislation under the Securities Ordinance); and (4) The Protection of Investors Ordinance.

The Companies Ordinance contains provisions to ensure disclosure in documents relating to invitations by or on behalf of a company to the public to subscribe or purchase shares or debentures of a company.

The Securities Ordinance regulates stock exchange operations. It protects investors in securities by requiring registration of brokers. It also provides for the investigation of malpractices and for the establishment of a Stock Exchange Compensation Fund to compensate clients of defaulting stock brokers. Compensation is entirely within the discretion of the Securities Commission. The maximum compensation is HK$ 1 million. Brokers are required to pledge HK$ 50,000 per seat towards the Compensation Fund.

The Protection of Investors Ordinance aims at protecting investors by prohibiting the use of fraudulent or coercive means to induce investors to buy or sell or to take part in investment arrangements and it regulates the issues of related publications.

The Securities Commission, established in 1974 under the Securities Ordinance, takes steps to safeguard the interests of persons who invest or propose to invest in securities and suppresses illegal, dishonorable and improper practices in relation to dealings in securities.

There are no special regulations toward foreign exchange, and no restrictions on the movement of capital and repatriation of profits. Foreign companies listed on HKSE enjoy equal rights with local companies.

Stock Market Intermediaries

Stock market intermediaries in Hong Kong include dealers (member of stock exchange and non-member of stock exchange), investment advisors, and their representatives. The intermediaries are required to be registered with the Office of the Commissioner for Securities and Commodities Trading. However, only members of the HKSE are permitted to trade as stock brokers. Each member is allowed to hold a seat as an individual or a limited company. In fact, most of the larger brokerages have more than one seat. Each seat entitles a member broker to allocate two traders on the exchange floor.

Tradeable Instruments

There are five main categories of tradeable instruments on the Hong Kong capital and equity market, which are as follows:

1. Ordinary Shares

Ordinary shares are stocks which are registered, participate in the distribution of profits and have a right to vote in company shareholder meetings.

2. Preference Shares

Preference shares are stocks which are registered and have a preference over ordinary shares in the remuneration of the capital.

3. Bonds

Most of the bonds traded in Hong Kong are issued by foreign companies. The volume of domestic debt securities trading is relatively insignificant. The two main type of debt instruments traded on the market are certificates of deposit (CDs) issued by deposit-taking institutions and Commercial Paper (CP) or bond issued by other type of companies.

4. Index Futures

The index futures contract traded in Hong Kong is the 33 stock Hang Seng Index.

Trading in Hang Seng Index futures began in May 1986. A futures contract is worth HK$50 times the prevailing HSI. Thus, each one point movement in the index presents a HK$50 change in the value of this futures contract.

The current margin required for each futures contract is HK$12,500. When HK$6,000 or more is lost, the investor is required to top his margin up HK$12,500. Futures contracts are traded for delivery until the second to last business day of the spot month and the next two consecutive months. Thus, there are three trading periods for each month. Contracts are seldom held until maturity. Most traders prefer to take profits or cut losses according to actual market movement.

5. Securities Issuance Abroad

Securities issuance abroad are used to raise capital in the U. S., and are also referred to as American Depository Receipts (ADRs).

ADRs are issued by a U. S. depository (usually a bank) in place of underlying Hong Kong or foreign shares. A number of ordinary shares are deposited in a custodian bank overseas as collateral for the ADRs. A U. S. investor holds the ADRs instead of the Hong Kong or foreign shares and can exchange the ADRs for his ordinary share equivalent at any time.

There were 21 stocks listed on the HKSE participating ADR program at the end of April 1987.

Listing and Issuing

Stock listing and issuing in Hong Kong are regulated by the Companies Ordinance. It requires that companies stay public and release a formal prospectus description about the shares to be offered and details of corporate finance and earnings performance. A minimum initial aggregate market capitalization, HK$ 50 million, is required for each listing, and at least 25% of the listed security must be offered to the public.

The general regulations regarding the listing of securities of domestic companies are also applicable to overseas companies, excepting the minimum initial aggregate market value is HK$ 20 million for a foreign company, and the minimum percentage of public offering is also determined by the listing committee in each instance in its absolute discretion and thus 25% requirement will not apply.

Public offerings and private placements are the two main methods for the flotation of new stocks. Public offerings are commonly used in the first listing on the stock exchange, while private placements are popular thereafter. The issue price in private placements is generally lower than the market price.

A company can issue capital stock with approval of a general meeting of shareholders. In this case, new shares are allotted to existing shareholder in accordance with the number of share held. The issuance of capital stock is also called bonus issue or stock dividend.

An offering of common stock is usually handled by investment bankers who act as managers and co-managers and offer the shares to the public. A group of underwriting banks and brokers back the issue and guarantee a minimum price for the stock.

Dealing Procedures

Trading on the HKSE is dealt in units known as 'broad lots' which vary for each company. For example, shares in Hong Kong Bank are traded in broad lots of 400 while shares in the Hang Seng Bank are traded in lots of 100.

Four types of orders are prevailing on the Hong Kong stock market, which are very similar to those of New York stock market:

1. At Market: Orders that specify the number of shares to be bought/sold. The order is to be executed at prevailing market prices.

2. Discretionary: Orders that specify the maximum number of shares to be bought/sold. However, the actual number and price paid is left to the discretion of the broker.

3. Limit Order: Orders that specify the number of shares to be bought/sold as long as it does not exceed the ceiling-purchase/floor-selling price.

4. Value Order: Orders that specify the amount, in HK$ value term, to be bought/sold. May or may not have price limits.

Trading on the exchange is broker to broker with virtually all transactions being handled by automated dealing systems. Though computer terminals, floor traders can post buy/sell orders, cancel orders, make enquiries about buy/sell orders and completed deals and input completed deals.

The HKSE operates on a 24-hour settlement basis. There is no central clearing house in Hong Kong. Thus, the buying or selling broker is responsible for good delivery of the payment or the share scrip together with the proper instrument of transfer within the following trading day.

Transaction costs are 0.025% on the consideration of each contract note, payable by both buyer and seller.

When an investor intends to buy/sell stocks on the Hong Kong market, he needs only to find a broker with custodian service in Hong Kong, and open a current account and a security account to handle security trading, dividends, interest and other transactions.

Brokers in Hong Kong offer securities services to both domestic and overseas investors, which including nominee and safe custody services, collecting dividends and bonus issue, buying and selling securities, providing recommendations on specific investments, and subscribing to new share issues on the investor's behalf by handling the application and payment. Thus, the services brokers offer eliminate the trouble of administering investment and handle all transaction deeds. The competition among brokers in Hong Kong is mainly on the services.

Disclosure of Corporate Information

The Securities Ordinance 1986 requires a public company to announce 'notifiable' transactions in the press as soon as possible. The press refers to the local newspaper such as Economic Journal or Xing Bao. The transactions include the acquisition/sale of assets with a value in excess of 15% of consolidated assets and the sale of assets which represent more than 15% of consolidated net profits before taxation.

The Securities Ordinance 1986 requires that public companies must have their accounts audited by certified public accountants in compliance with the Hong Kong Companies Ordinance. An unaudited summary of profit and loss accounts and dividends are required to be released at the interim stage, and the final dividend and consolidated statements are required to be announced within 6 months of the close of the company financial year-end, together with a detailed statement.

Insider trading also exists on the Hong Kong stock market although it is illegal. It is hard to be eliminated because there is no regulation concerning the inside trading. The maximum penalty associated with insider trading is criticism in the local press.

Chapter 4

The Test of Weakform Efficiency on the Hong Kong Stock Market

For the Hong kong market to be weakform efficient, stock price movements must be independently and identically distributed. In other words, stock investors in Hong Kong can not reap abnormal profit merely using the historical information if the weakform efficient market hypothesis is supported on that market. This study, therefore, examines the validity of the random walk model, including the tests for normality, stability, and independence of stock price changes.

4.1. Data and Hypotheses

The data used in this study includes stock returns for individual firms listed on the Hong Kong Stock Exchange and a market index, the Hang Seng Index. The data for the individual firms listed on the Hong Kong Stock Exchange (HKSE) was supplied by Reuters News. It contains 40 firms including names, daily prices and number of shares outstanding over the period from November

1, 1984 through November 1, 1988. The forty firms were randomly picked up among the firms listed on the HKSE. Table 1 provides the names of the forty firms. The market index, the Hang Seng Index (HSI), is provided by HSI services Ltd. The HSI was launched in November 1969 with July 31, 1963 as the base date (using 100 as the base figure) and is the most widely quoted indicator of general price movements on the Hong Kong stock market. The index includes 33 stocks and is weighted by market value. It includes four subindices which are the financial, utilities, properties, and commercial & industrial. The index has consistently represented between 75 and 80 percent of the market in terms of both market value and trading volume on the Hong Kong stock market. Therefore, the index could be fairly regarded as representative of the market. Table 2 presents a list of the firms comprising the HSI along with their effect on the HSI both in terms of points and the percentages of the HSI market capitalization.

The test of weakform efficient market examines if the random walk model is supported by the Hong Kong stock price movement, and the hypotheses of the tests are as follows:

$H_0^{4.1}$: Successive stock price changes in the Hong Kong market are independent;

$H_0^{4.2}$: Successive stock price changes in the Hong Kong market are independently and identically distributed.

The test will examine the daily stock prices and the HSI over the period from Nov. 1, 1984 to Nov. 1, 1988. The changes of stock price are first transformed in terms of natural logarithm. It is defined as follows:

$$U_{t+1} = \ln(\text{price}_{t+1}) - \ln(\text{price}_t) \qquad (4.1)$$

4.2. Normality Test

By definition, if stock returns, i.e., the changes in ln(price) for stocks, are normally distributed, then the stock returns will have zero mean and unit variance after the returns are standardized. The normality test in this section will examine if this definition holds for the stock price behavior on the Hong Kong market. Thus, the hypothesis in the normality test is

$H_0^{4.3}$: The stock price changes on the Hong Kong market are normally distributed.

4.2.1. Frequency Distribution

One tool for examining departures from normality is the frequency distribution. If the stock returns on the Hong Kong market are normally distributed, then their frequency distribution should be consistent with a normal frequency distribution. In our study, frequency distributions for the HSI and the forty stocks in the sample are measured separately over the testing period. Table 3 through Table 7 present the results of the tests.

Table 3 shows the frequency distribution of the 40 stocks and the HSI. It lists the cumulative percentage of the frequency distribution for each stock. The bottom of the table lists the average cumulative value in each interval, the value for an unit normal, and the average difference between the empirical value and the unit normal. Table 4 presents the percentage of the frequency distributions in each interval for the 40 stocks and the HSI. The bottom of the table also gives a comparison between the unit normal and the empirical results. Table 5 shows the difference between empirical frequency distributions and unit normal distribution by each firm in terms of cumulative percentage, while Table 6 shows a comparison between the empirical and unit normal distributions in terms of percentage in each interval. Table 7 is a comparison of empirical and expected number of observations found in each interval.

The most striking feature of the tables is the presence of some degree of lepto-kurtosis and long tail for each stock. In every case the empirical distribution is more peaked in the center and has a longer tail than the normal distribution. Table 5 and Table 6 give a good illustration of the pattern of the distribution discussed above. We can see that all numbers in the second column of Table 6, i.e., 0.5 standard deviation interval, are positive, and turn to negative in the intervals of 1 standard deviation, 1.5 standard deviations, 2 standard deviations, 2.5 standard deviations, and most of 3 standard deviations, and all numbers become positive again after 4 standard deviations, reflecting the fact that the percentage of empirical frequency is largely exceeding the percentage of unit normal in the center of the distribution, shrinking in the middle, and increasing unnormally at the tail, with a shape of high peak and fat tail. On the average, there is 29.27 percent more of the distribution found in the interval between 0 and 0.5 standard deviation from the mean than expected in a unit normal distribution. In addition, 10.96 percent less than the unit normal frequency is found in the interval between 0.5 and 1 standard deviations, and 0.36 percent more in the interval between 3 and 4 standard deviations. This implies that before 1 standard deviation, the empirical distribution cuts down through the normal curve from above, and the empirical distribution again cross through the normal curve from below somewhere between 3 and 4 standard deviations from the mean. Figure 1 provides an illustration of the pattern with lepto-kurtosis and long tail.

The statistic for the goodness of fit test in Table 5 and Table 6 show that normality is rejected. Because the goodness test in cumulative percentage (Table 5) ignores the tail effect of larger than 5 standard deviation from the mean, the results in Table 5 are different from the results in Table 6, and they are somewhat downward biased. Five out of forty-one cases accept normality at the level of 5 percent in Table 5. However, normality is strongly rejected by the results in Table 6. The difference between the results in Table 5 and Table 6 reflects the large effect of tails in the normality test.

Table 7 examines the observations in each interval. Here, in 38 cases out of 41, the observations in the interval between 0 and 0.5 standard deviation are found to be one and a half times or more than the expected. Moreover, in the interval greater than 5 standard deviations from the mean, all empirical observations are found to be several thousand times larger than expected in a unit normal distribution. Those numbers clearly indicate the rejection of normality.

4.2.2. Normal Probability Graphs

Another tool for examining departure from normality is normal probability graphing. This method is developed using the definition of a normal distribution. If U, the change in ln(price) for stocks on the Hong Kong market, is a Ganssian random variable with mean μ and variance σ^2 , then the transformed variable, $Z = \frac{(U - \mu)}{\sigma}$, will be unit normal. In our test, we use daily stock returns of each firm in our sample as U against the unit normal values of Z, where Z is derived from the theoretical unit normal cumulative distribution:

$$Z = f(U) = \frac{1}{\sigma} \sqrt{(2\pi)} \exp \{ \frac{-(U - \mu)^2}{2\sigma^2} \} \tag{4.2}$$

If the stock returns on the Hong Kong market are normally distributed, the normal probability graphs should provide the following results:

(1) The sample values of u_i, the daily stock returns for security i, is linearly related to the theoretically derived value Z;

(2) The curve, or the plot of Z against U, crosses zero with the slope being approximately one.

Normal probability graphing is conducted for each of forty stocks and the HSI. From Fig. 2 to Fig. 8, we can see that all 41 curves present a S shape, and most of them have a rather steep slope, reflecting the pattern of lepto-kurtosis. Ignoring the tails of the S shape, the curves for the HSI, Allied Investors, The HongKong and Shanghai Bank, China Gas, Miramar Hotel, and Wharf appear to be closer to normality than the others. In general, the results from normal probability graphing indicate the rejection of normality.

The normality test reveals some degree of lepto-kurtosis and long tails for each stock examined in our sample. The stock returns on the Hong Kong market have a distribution pattern characterized by a high peak and long tails, which is similar to what has been found in the U.S. market. Therefore, the results from both frequency test and normal probability graphing suggest that normality has been rejected for the stock return distribution on the Hong Kong market.

Because normality on the Hong Kong market has been rejected, the hypothesis of weakform efficient market is examined separately using an independence and stability test.

4.3. Independent Test

The hypothesis for the independence test is following:

$H_0^{4.3}$: The stock price changes on the Hong Kong market are independently distributed.

The test of this hypothesis involves both return and residual correlation analysis.

4.3.1. Residual Analysis

If stock returns are independently distributed, then no systematic correlation should be found between the abnormal returns from one day to another. The residual analysis is composed of a two-step regression:

$$R_{i,t} = \alpha_i + \beta_i \ln P_{i,t-1} + \varepsilon_{i,t} \tag{4.3}$$

$$\varepsilon_{i,t} = R_{i,t} - \alpha_i - \beta_i \ln P_{i,t-1}$$

$$\varepsilon_{i,t} = \delta_{0,i} + \delta_{1,i} \ln P_{i,t-1} + \delta_{2,i}\, \varepsilon_{i,t-1} \tag{4.4}$$

where

$R_{i,t}$: daily return for security i on day t;

$P_{i,t-1}$: stock price for security i on day t-1;

Table 8 presents the results of the regression. Column (2) lists the intercept of each stock, $\delta_{0,i}$, Column (3) lists the coefficient of the one lag stock price, $\delta_{1,i}$, and column (4) lists the coefficient of the one lag residual, $\delta_{2,i}$. The values in the bracket are t statistic under the null hypothesis that the coefficient of the one lag residual equals zero.

The results show that the returns of 17 out of 40 stocks are dependent with one lag series, and the t values of those stocks are 5 percent significantly different from zero.

4.3.2. Return Correlation Analysis

The return correlation analysis is performed by one-lag regression model:

$$R_{i,t} = \beta_{0,i} + \beta_{1,i} \operatorname{Ln} P_{i,t-1} + \beta_{2,i} R_{i,t-1} \tag{4.5}$$

Table 9 presents the results of the regression. Column (2) of the table lists the intercept, $\beta_{0,i}$, column (3) lists the coefficient of the one lag price, $\beta_{1,i}$, while column (4) lists the coefficient of the one lag return, $\beta_{2,i}$. The values in the bracket are t statistic under the null hypothesis that the parameter equals zero.

The results provided in Table 9 confirm the results in Table 8. The coefficients of the same 17 firms are 5% significantly different from zero, implying that the return of the 17 stocks are dependent with a one lag series.

Therefore, 24 out of 41 cases in our sample support the hypothesis that the stock returns are independently distributed.

4.4. Stability Test

The hypothesis for the stability test is as follows:

$H_0^{4.4}$: The distributions of stock price changes on the Hong Kong market are stable, and the stock returns are identically distributed.

Two methods are used to test the stability of the distribution. One is range analysis and the other is the goodness of fit test for the distributions during different time periods.

4.4.1. Range Analysis

By definition, stable Paretian distributions are stable or invariant under addition. Hence, if successive daily stock returns follow a stable Paretian distribution, returns across longer intervals such as a week or a month will follow the stable Paretian distribution of exactly the same form of daily returns. The characteristic exponent of the distribution, α , is an index for stable distribution, reflecting the range of variances under different distributions.

Fama[1960] examined stability of stock returns on the U.S. market using a range analysis. He explained that the variance of the stock return distribution changes with the increase in the trading interval, and that the change follows a certain function if the distributions are stable. The relationship of the variances of the distributions with different intervals can be expressed as follows:

$$STD_n = n^{\frac{1}{\alpha}} STD_1 \tag{4.6}$$

$$\alpha = \frac{\log n}{\log STD_n - \log STD_1} \tag{4.7}$$

STD_n : standard deviation of the distribution with n days interval;

STD_1 : standard deviation of the distribution in daily returns;

n : the number of observations in each interval;

α : characteristic exponent of the distribution.

If the distributions are stable, then α 's should be constant across different trading intervals, with a range of $1 < \alpha < 2$. The range test is reliable provided one important condition is met, that is, successive stock returns are independent. Otherwise the results would be upward biased.

In our range analysis, α is measured for each stock in our sample by equation (4.7). Table 10 presents the results of the range analysis. Because 17 out of 40 stocks manifest dependence in their daily return, the testing sample is reduced to 24 cases, i.e., 23 stocks and the HSI. The trading intervals in the test are defined as 3 days, 5 days, 9 days and 15 days, i.e., n = 3, 5, 9, 15. Hence, there are four α 's for each case.

Column (1) to (4) of Table 10 list four α 's, and column (5) lists the average of α's for each stock. The bottom of the table lists the average of the 24 cases in different trading intervals. The results show that α 's support the hypothesis. The α's of different trading intervals for each security in our sample are constant, and all of them are close to 2. Our results are consistent with what were found by Fama, reflecting a stable distribution with finite means but infinite variances. Therefore, our results indicate the stock returns in our sample are stable in different trading intervals, with a distribution shaped as a high peak and long and think tails.

4.4.2. The Goodness of Fit Test for the Distributions during Different Time Periods

The existence of identical distributions implies that the parameters of interest in the distribution are time invariant. Explicitly, we can examine the identical distribution by testing the hypothesis for parameter time invariance as follows:

$H_0^{4.5}$: $\mu_1 = \mu_2 = ... = \mu_T = \mu$ and $\sigma_1 = \sigma_2 = ... = \sigma_T = \sigma$

against

$H_1^{4.6}$: $\mu_t >$ or $< \mu$ or $\sigma_t >$ or $< \sigma$ for any $t = 1, 2, ..., T$.

If the distribution of stock returns is identically distributed, then the parameters of the distribution, e.g., mean and variance, in different sub-testing-periods should be equal to the parameters of the distribution during the whole testing period. To test the hypothesis, the returns of the 40 stocks in the sample are divided into 4 sub-testing-periods, i.e., returns in 1984-1985, 1986, 1987, and 1988. The mean and the variance of each firm in every sub-testing-period are then compared to the mean and the variance of the whole sample period using the following equations:

$$\sum_{t=1}^{4} \frac{(\mu_{t,i} - \mu_i)^2}{\mu_i} = \chi^2, \qquad t = 1, 2, 3, 4 \qquad (4.8)$$

$$\sum_{t=1}^{4} \frac{(\sigma_{t,i} - \sigma_i)^2}{\sigma_i} = \chi^2, \qquad t = 1, 2, 3, 4 \qquad (4.9)$$

$\mu_{t,i}$ and $\sigma_{t,i}$ are the mean and the standard deviation of stock i during sub-testing-period t, and μ_i and σ_i are the mean and the standard deviation of stock i during the whole testing period. The results of the goodness of fit test should reveal if the hypothesis is supported.

To avoid the possibly biased estimating, the test ignores the period of the stock market crash from Oct. 20, 1987 to Oct. 30, 1987.

Table 11 shows the results of equation (4.8). Column (2) of the table lists the mean of each stock during the whole sample period, column (3) to (6) list the means of the sub-testing-periods, and column (7) lists the Chi-square value. The results of the goodness of fit test support the null hypothesis, that is, the mean return of stocks on the Hong Kong market are stable from year to year over the testing period.

Table 12 shows the results of equation (4.9). Column (2) of the table lists the standard deviation of each stock during the whole sample period, column (3) to (6) list the standard deviation of each stock during the sub-testing-periods, and column (7) lists the Chi-square value. The results of the goodness of fit test also show that the standard deviations of the distributions during the sub-testing-periods are not different from the standard deviation of the distributions over the whole sample period. Again, the hypothesis is supported because the parameters are stable over the testing period.

Therefore, the results of the goodness of fit test support the hypothesis of the test: stock returns on the Hong Kong market are identically distributed.

4.5. Summary

In sum, stock returns on the Hong Kong market are stable, and the returns of most stocks in the sample are independently distributed, though normality of the distribution is rejected. Therefore, the random walk model is supported. The results of the test on the Hong Kong market are similar to the results found by Fama[1960] for the U.S. stock market. Because the distributions of stock returns on the Hong Kong market are independently and identically distributed, investors can not reap abnormal profit using historical information, the hypothesis of weakform efficiency of stock market is supported on the Hong Kong market.

Table 1

Names of the Forty Hong Kong Firms

1. Allied Investors Corporation Limited
2. Amoy Properties Limited
3. Asia Insurance Company Limited
4. The Bank of East Asia, Limited
5. Burwill International Limited
6. China Light & Power Company, Limited
7. China Motor Bus Co., LTD.
8. Conic Investment Company Limited
9. The Cross-Harbour Tunnel Company, Limited
10. Essential Enterprises Company Limited
11. Far East Consortium Limited
12. Far East Hotels and Entertainment LTD.
13. The Great Eagle Company, Limited
14. Green Island Cement (Holdings) Limited
15. Hang Lung Development Company Limited
16. Hang Seng Bank, LTD.
17. Harriman Holdings Limited
18. Henderson Land Development Co., LTD.
19. The Hong Kong and China Gas Company Limited
20. The HongKong and Shanghai Banking Corporation
21. The HongKong & Yaumati Ferry Company, Limited
22. HongKong Realty and Trust Company, Limited (Class A)
23. HongKong Realty and Trust Company, Limited (Class B)
24. Hong Kong Aircraft Engineering Company Limited
25. Hong Kong Building and Loan Agency Limited
26. Hong Kong Carpet (Holdings) Limited
27. Hong Kong Electric Holdings Limited
28. The HongKong Land Company Limited
29. Hong Kong Worsted Mills, Limited
30. Hopewell Holdings Limited
31. Hsin Chong Holdings (H. K.) Limited
32. Hutchison Whampoa Limited
33. Hysan Development Company Limited
34. International Industries Limited
35. Jack Chia International Limited
36. Johnson Electric Industrial Manufactory, Limited
37. K. Wah Stones (Holdings) Ltd.
38. Miramar Hotel & Investment Co., LTD.
39. Shui On Group Limited
40. Wharf (Holdings) Limited

Table 2

Hong Seng Index Constituents (as at end April 1988)

Company	Effect on HSI (in points)	% of HSI Market Capitalisation	
The Bank of East Asia Ltd.	0.06	0.75	
Hang Seng Bank Ltd.	0.45	4.60	
The Hong Kong and Shanhai Banking Corporation	1.69	8.61	
Jardine Strategic Holdings Ltd.	0.22	1.63	
Finance			15.59
Cina Light & Power Co. Ltd.	0.75	5.29	
The Hong Kong & China Gas Co. Ltd.	0.29	1.85	
Hong Kong Electric Holdings Ltd.	0.59	3.49	
Hong Kong Telecommunications Ltd.	3.12	17.03	
The Kowloon Motor Bus Co. (1933) Ltd.	0.21	1.03	
Utilities			28.69
Cheung Kong (Holdings) Ltd.	0.71	4.08	
Hang Lung Development Co. Ltd.	0.37	1.53	
Henderson Land Development Co. Ltd.	0.47	1.94	
The Hong Kong Land Co. Ltd.	0.81	5.24	
Hongkong Realty and Trust Co. Ltd.	0.07	0.49	
Hysan Development Co. Ltd.	0.28	0.98	
New World Development Co. Ltd.	0.73	2.91	
Sun Hung Kai Properties Ltd.	0.93	3.85	
Tai Cheung Properties Ltd.	0.06	0.36	
Properties			21.38
Cathay Pacific Airways Ltd.	0.93	5.15	
Cavendish International Holdings Ltd	0.47	2.42	
Dairy Farm International Holdings Ltd.	0.21	1.42	
Green Island Cement (Holdings) Ltd.	0.07	0.38	
Hong Kong Aircraft Engineering Co. Ltd.	0.12	0.56	
The HongKong and Shanghai Hotels Ltd.	0.16	1.04	
HK-TVB Ltd.	0.27	1.61	
Hutchison Whampoa Ltd.	0.98	6.37	
Jardine Matheson Holdings Ltd.	0.40	1.93	
Mandine Matheson Holdings Ltd.	0.10	0.70	
Miramar Hotel & Investment Co. Ltd	0.15	0.85	
Swire Pacific Ltd.	1.02	6.58	
The Wharf (Holdings) Ltd.	0.56	3.04	
Winsor Industrial Corporation Ltd.	0.08	0.55	
World International Holdings) Ltd.	0.33	1.74	
Commercial & Industrial			34.34
		100.00	100.00

Table 3

Freqency Distribution of Hong Kong Firms
(in cumulative percentage)

Stocks	0.5s	1s	1.5s	2s	2.5s	3s	4s	5s	> 5s
Allied Investors	57.1	81.6	91.5	95.6	96.9	98.1	99.2	99.3	0.7
Amoy Properties	88.2	96.9	98.5	99.3	99.6	99.7	99.7	99.7	0.3
Asia Insurance Co.	79.4	89.6	93.8	97.2	98.0	98.4	99.0	99.4	0.6
Bank of East Asia	63.3	87.5	94.7	97.1	98.4	98.5	99.2	99.5	0.5
Burwill Internatl	63.1	82.1	91.3	95.6	97.6	98.0	99.1	99.5	0.5
China Light	60.2	88.5	95.0	97.9	98.9	99.1	99.2	99.5	0.5
China Motor	60.6	84.2	93.2	96.6	98.3	99.2	99.5	99.6	0.4
Conic Investment	73.2	88.0	94.7	97.2	98.2	98.9	99.2	99.4	0.6
Cross-Harbourent	60.1	86.5	93.2	96.5	97.7	98.2	98.9	99.2	0.8
Essential Enter.	70.5	83.3	90.5	94.1	96.2	97.3	99.3	99.5	0.5
Far East Consor.	66.7	87.8	93.7	96.9	98.2	98.6	99.1	99.5	0.5
Far East Hotels	68.4	85.2	92.5	95.9	97.4	98.8	99.5	99.8	0.2
Great Eagle	62.4	87.1	94.4	97.6	98.4	98.9	99.4	99.7	0.3
Green Island(Hld)	67.0	85.3	92.9	96.5	97.7	98.7	99.2	99.5	0.5
Hang Lung Devel.	66.8	91.4	97.0	98.5	99.0	99.3	99.5	99.6	0.4
Hang Seng Bank	68.1	88.7	95.4	98.0	98.5	98.9	99.4	99.5	0.5
Harriman Holdings	67.2	85.8	93.7	97.0	98.3	98.7	98.9	99.1	0.9
Henderson Land	63.0	86.3	95.7	98.0	98.5	98.9	99.3	99.6	0.4
HK China Gas	57.8	84.9	93.5	97.5	98.7	99.3	99.6	99.7	0.3
HK Shanghai Bank	59.8	81.6	92.1	96.3	98.3	98.8	99.4	99.6	0.4
HK Yaumati Ferry	57.2	82.5	92.9	96.6	97.5	98.2	98.9	99.5	0.5
HK Realty Trust 1	78.7	92.0	97.5	98.3	98.9	99.3	99.5	99.6	0.4
HK Realty Trust 2	79.2	90.7	95.3	96.9	98.0	98.6	99.1	99.4	0.6
HK Aircraft	76.3	94.3	97.8	98.9	99.4	99.6	99.6	99.7	0.3
HK Building	75.6	87.9	94.1	96.2	97.6	98.4	99.1	99.3	0.7
HK Carpet	71.5	84.6	92.2	95.8	97.2	98.1	99.0	99.6	0.4
HK Electric	59.7	82.3	92.5	96.4	97.8	98.7	99.3	99.7	0.3
HK Land Co.	57.1	85.3	93.5	96.6	97.7	98.8	99.3	99.4	0.6
HK Worsted	75.2	85.9	89.8	93.1	96.2	97.4	98.6	99.3	0.7
Hopewell Hldgste	59.1	81.7	91.6	96.4	97.9	98.6	98.9	99.6	0.4
Hsin Chong Hldgs	61.4	84.1	93.6	97.0	98.6	99.1	99.5	99.7	0.3
Hutchison Whampoa	55.7	82.8	93.2	97.1	98.5	99.8	98.8	99.5	0.5
Hysan Development	58.0	86.4	94.6	97.0	98.7	99.1	99.1	99.6	0.4
Intl Industries	83.6	90.5	93.7	95.3	96.6	97.1	97.8	99.0	1.0
Jack Chia Intl.	86.6	91.2	93.9	96.0	97.0	97.7	98.6	98.9	1.1
John Son Elec.	96.6	98.8	99.2	99.3	99.6	99.7	99.7	99.7	0.3
Ha Wah Bank	72.5	86.4	92.0	94.4	96.2	97.3	98.5	99.1	0.9
Miramar Htel	58.9	81.7	91.0	95.3	97.5	98.1	98.9	99.4	0.6
Shui-On-Group	70.0	86.7	93.8	96.6	97.6	98.6	99.3	99.6	0.4
Wharf	58.6	83.8	92.7	96.8	98.3	98.9	99.3	99.7	0.3
HSI	56.2	81.0	91.0	95.0	97.1	98.4	99.3	99.8	0.2
Average	67.57	86.66	93.74	96.69	97.97	98.63	99.16	99.495	0.505
Unit Normal	38.3	68.26	86.64	95.45	98.76	99.73	99.99	99.999	0.00006
Difference	29.27	18.40	7.10	1.24	-0.79	-1.10	-0.83	-0.504	0.505

Table 4

Freqency Distribution in Each Interval (in Percentage)

Stocks	0.5s	1s	1.5s	2s	2.5s	3s	4s	5s	> 5s
Allied Investors	57.1	24.5	9.90	4.10	1.30	1.15	1.15	0.10	0.70
Amoy Properties	88.2	8.7	1.50	0.90	0.30	0.10	0.00	0.00	0.30
Asia Insurance Co.	79.4	10.2	4.20	3.40	0.80	0.39	0.68	0.39	0.59
Bank of East Asia	63.3	24.2	7.20	2.40	1.20	0.10	0.80	0.30	0.50
Burwill International	63.1	19.0	9.20	4.30	2.00	0.40	1.10	0.40	0.50
China Light	60.2	28.3	7.28	2.10	1.05	0.20	0.10	0.29	0.48
China Motor	60.6	23.6	9.00	3.40	1.60	1.00	0.30	0.10	0.40
Conic Investment	73.2	14.8	6.70	2.50	0.96	0.67	0.40	0.20	0.59
Cross-Harbourent	60.1	26.4	6.70	3.30	1.20	0.50	0.77	0.30	0.77
Essential Enter.	70.5	12.8	7.20	3.53	2.10	1.13	2.00	0.20	0.50
Far East Consor.	66.7	21.2	5.80	3.26	1.20	0.40	0.58	0.40	0.49
Far East Hotels	68.4	16.8	7.38	3.40	1.50	1.30	0.77	0.29	0.20
Great Eagle	62.4	24.7	7.38	3.16	0.77	0.48	0.57	0.29	0.29
Green Island	67.0	18.4	7.60	3.50	1.20	0.96	0.57	0.29	0.48
Hang Lung Develop.	66.8	24.6	5.70	1.40	0.57	0.29	0.20	0.10	0.38
Hang Seng Bank	68.1	20.6	6.70	2.58	0.48	0.48	0.48	0.10	0.48
Harriman Holdings	67.2	18.6	7.86	3.40	1.20	0.40	0.29	0.20	0.87
Henderson Land	63.0	23.3	9.39	2.30	0.48	0.48	0.39	0.29	0.39
HK China Gas	57.8	27.1	8.60	4.00	1.10	0.70	0.30	0.10	0.30
HK Shanghai Bank	59.8	21.8	10.50	4.10	2.00	0.50	0.70	0.20	0.40
Hk Yaumati Ferry	57.2	25.3	10.40	3.70	0.87	0.70	0.77	0.58	0.48
HK Realty Trust 1	78.7	13.3	4.40	1.80	0.70	0.40	0.20	0.10	0.40
HK Realty Trust 2	79.2	11.5	4.60	1.60	1.06	0.58	0.58	0.30	0.58
HK Aircraft	76.3	17.9	3.50	1.10	0.60	0.20	0.10	0.00	0.30
HK Building	75.6	12.4	6.10	2.10	1.40	0.77	0.77	0.20	0.68
HK Carpet	71.5	13.1	7.70	3.50	1.40	0.87	0.97	0.60	0.40
HK Electric	59.7	22.6	10.20	3.80	1.40	0.90	0.70	0.40	0.30
HK Land Co.	57.1	28.3	8.10	3.07	1.10	1.08	0.60	0.10	0.60
HK Worsted	75.2	10.7	3.80	3.40	3.10	1.20	1.10	0.80	0.70
Hopewell Holdings	59.1	22.6	9.87	4.79	1.50	0.68	0.39	0.68	0.39
Hsin Chong Holdings	61.4	22.7	9.50	3.40	1.50	0.60	0.40	0.20	0.30
Hutchison Whampoa	55.7	27.1	10.40	3.90	1.30	0.40	0.70	0.00	0.50
Ysan Development	58.0	28.4	8.20	2.40	1.60	0.50	0.50	0.00	0.40
Intl. Industry	83.6	6.9	3.20	1.60	1.20	0.60	0.70	1.20	1.00
Jack Chia Intl.	86.8	4.4	2.64	2.14	0.90	0.80	0.90	0.30	1.10
Hohn Son Elec.	96.6	2.2	0.40	0.10	0.30	0.10	0.00	0.00	0.30
Ha Wah Bank	72.3	14.1	5.70	2.40	1.70	1.10	1.10	0.70	0.90
Miramar Hotel	58.9	22.8	9.29	4.30	2.20	0.58	0.77	0.58	0.58
Shui-On-Group	70.0	16.7	7.09	2.88	0.96	0.96	0.77	0.29	0.38
Wharf	58.6	25.2	8.90	4.10	1.40	0.60	0.50	0.40	0.30
HSI	56.2	24.8	10.0	4.08	2.06	1.30	1.00	0.40	0.20
Average	67.57	19.0	7.068	2.956	1.25	0.648	0.626	0.302	0.4976
Unit Normal	38.3	29.96	18.38	8.810	3.31	0.97	0.264	0.006	0.00006
Difference	29.27	-10.96	-11.312	-5.854	-2.06	-0.322	0.362	0.296	0.49754

Table 5

The Difference between the Empirical Frequency Distributions and Unit Normal

(In Cumulative Percentage)

Stocks	0.5s	1s	1.5s	2s	2.5s	3s	4s	5s	> 5s	χ^2
A.I.	18.8	13.34	4.86	0.15	-1.86	-1.63	-0.79	-0.69	0.69	12.18*
A.P.	49.9	28.64	11.86	3.85	0.84	-0.03	-0.29	-0.29	0.29	78.816
A.I.C.	41.1	21.34	7.16	1.75	-0.76	-1.33	-0.99	-0.59	0.59	51.437
B.E.A.	25.0	19.24	8.06	1.65	-0.36	-1.23	-0.79	-0.49	0.49	22.545
B.I.	24.8	13.84	4.66	0.15	-1.16	-1.73	-0.89	-0.49	0.49	19.170
C.L.	21.9	20.24	8.36	2.45	0.14	-0.63	-0.79	-0.49	0.49	19.406
C.M.	22.3	15.94	6.56	1.15	-0.46	-0.53	-0.49	-0.39	0.39	17.226
C.I.	34.9	19.74	8.06	1.75	-0.56	-0.83	-0.79	-0.59	0.59	38.312
C.H.	21.8	18.24	6.56	1.05	-1.06	-1.53	-1.09	-0.79	0.79	17.844
E.E.	32.2	15.04	3.86	-1.35	-2.56	-2.43	-0.69	-0.49	0.49	30.709
F.E.C.	28.4	19.54	7.06	1.45	-0.56	-1.13	-0.89	-0.49	0.49	27.276
F.E.H.	30.1	16.94	5.86	0.45	-1.36	-0.93	-0.49	-0.19	0.19	28.288
G.E.	24.1	18.84	7.76	2.15	-0.36	-0.83	-0.59	-0.29	0.29	21.120
G.I.	28.7	17.04	6.26	1.05	-1.06	-1.03	-0.79	-0.49	0.49	26.255
H.L.D.	28.5	23.14	10.36	3.05	0.24	-0.43	-0.49	-0.39	0.39	30.394
H.S.B.	29.8	20.44	8.76	2.55	-0.26	-0.83	-0.59	-0.49	0.49	30.274
H.H.	28.9	17.54	7.06	1.55	-0.46	-1.03	-1.09	-0.89	0.89	26.947
H.L.	24.7	18.04	9.06	2.55	-0.26	-0.83	-0.69	-0.39	0.39	21.726
HK C.G.	19.5	16.64	6.86	2.05	-0.06	-0.43	-0.39	-0.29	0.29	14.576
HK S.B.	21.5	13.34	5.46	0.85	-0.46	-0.93	-0.59	-0.39	0.39	15.044
HK A.F.	18.9	14.24	6.26	1.15	-1.26	-1.53	-1.09	-0.49	0.49	12.817*
HK R.T. 1	40.4	23.74	10.86	2.85	0.14	-0.43	-0.49	-0.39	0.39	52.323
HK R.T. 2	40.9	22.44	8.66	1.45	-0.76	-1.13	-0.89	-0.59	0.59	51.971
HK A.	38.0	26.04	11.16	3.45	0.64	-0.13	-0.39	-0.29	0.29	49.204
HK B.	37.3	19.64	7.46	0.75	-1.16	-1.33	-0.89	-0.69	0.69	42.669
HK C.	33.2	16.34	5.56	0.35	-1.56	-1.63	-0.99	-0.39	0.39	33.111
HK E.	21.4	14.04	5.86	0.95	-0.96	-1.03	-0.69	-0.29	0.29	15.276
HK L.C.	18.8	17.04	6.86	1.15	-1.06	-0.93	-0.69	-0.59	0.59	14.067
HK W.	36.9	17.64	3.16	-2.35	-2.56	-2.33	-1.39	-0.69	0.69	40.427
H.H.	20.8	13.44	4.96	0.95	-0.86	-1.13	-1.09	-0.39	0.39	14.269
H.C.H.	23.1	15.84	6.96	1.55	-0.16	-0.63	-0.49	-0.29	0.29	18.200
H.W.	17.4	14.54	6.56	1.65	-0.26	0.07	-1.19	-0.49	0.49	11.545*
H.D.	19.7	18.14	7.96	1.55	-0.06	-0.63	-0.89	-0.39	0.39	15.723
I.I.	45.3	22.24	7.06	-0.15	-2.16	-2.63	-2.19	-0.99	0.99	61.576
J.C.I.	48.3	22.94	7.26	0.55	-1.76	-2.03	-1.39	-1.09	1.09	69.336
J.S.E.	58.3	30.54	12.56	3.85	0.84	-0.03	-0.29	-0.29	0.29	104.391
H.W.B.	34.2	18.14	5.36	-1.05	-2.56	-2.43	-1.49	-0.89	0.89	35.858
M.H.	20.6	13.44	4.36	-0.15	-1.26	-1.63	-1.09	-0.59	0.59	14.004*
S.O.G.	31.7	18.44	7.16	1.15	-1.16	-1.13	-0.69	-0.39	0.39	31.857
Wharf	20.3	15.54	6.06	1.35	-0.46	-0.83	-0.69	-0.29	0.29	14.755
HSI	17.9	12.74	4.36	-0.45	-1.66	-1.33	-0.69	-0.19	0.19	11.016*
Average	29.27	18.396	7.097	1.24	-0.79	-1.10	-0.83	-0.50	0.50	

* : Normality is accepted at the 5 percent level.

Table 6

The Difference between the Empirical Frequency Distribution and Unit Normal

(percentage in each interval)

Stocks	0.5s	1s	1.5s	2s	2.5s	3s	4s	5s	> 5s	χ^2
A.I.	18.80	-5.46	-8.48	-4.71	-2.01	0.18	0.89	0.094	0.69	8186.2
A.P.	49.90	-21.26	-16.88	-7.91	-3.01	-0.87	-0.26	-0.006	0.29	1605.9
A.I.C.	41.10	-19.81	-14.18	-5.41	-2.51	-0.58	0.42	0.38	0.58	5875.1
B.E.A.	25.00	-5.76	-11.18	-6.41	-2.11	-0.87	0.54	0.29	0.49	4197.9
B.I.	24.80	-10.96	-9.18	-4.51	-1.31	-0.57	0.84	0.39	0.49	4196.4
C.L.	21.85	-1.61	-11.10	-6.71	-2.26	-0.77	-0.16	0.28	0.47	3865.8
C.M.	22.30	-6.36	-9.38	-5.41	-1.71	0.03	0.04	0.09	0.39	2689.2
C.I.	34.88	-15.16	-11.68	-6.31	-2.35	-0.30	0.14	0.19	0.58	5853.8
C.H.	21.76	-3.56	-11.68	-5.51	-2.11	-0.47	0.51	0.29	0.76	9906.5
E.E.	32.20	-17.12	-11.18	-5.28	-1.21	0.16	1.74	0.19	0.49	4224.4
F.E.C.	28.40	-8.79	-12.58	-5.55	-2.11	-0.57	0.32	0.39	0.48	4038.7
F.E.H.	30.10	-13.20	-11.00	-5.41	-1.81	0.33	0.51	0.28	0.19	707.8
G.E.	24.06	-5.26	-11.00	-5.65	-2.54	-0.49	0.31	0.28	0.28	1430.0
G.I.	28.70	-11.56	-10.78	-5.31	-2.11	-0.01	0.31	0.28	0.47	3876.4
H.L.D.	28.46	-5.36	-12.68	-7.41	-2.74	-0.68	-0.06	0.09	0.37	2445.8
H.S.B.	29.80	-9.36	-11.68	-6.23	-2.83	-0.49	0.22	0.09	0.47	3879.8
H.H.	28.90	-11.38	-10.52	-5.41	-2.11	-0.57	0.03	0.19	0.86	12650.5
H.L.	24.70	-6.68	-8.99	-6.51	-2.83	-0.49	0.13	0.28	0.38	2563.7
HK C.G.	19.50	-2.86	-9.78	-4.81	-2.21	-0.27	-0.04	0.09	0.29	1519.0
HK S.B.	21.50	-8.16	-7.88	-4.71	-1.31	-0.47	0.44	0.19	0.39	2687.6
HK Y.F.	18.90	-4.66	-7.98	-5.11	-2.44	-0.27	0.51	0.57	0.47	3858.9
HK R.T. 1	40.40	-16.66	-13.98	-7.01	-2.61	-0.57	-0.06	0.09	0.39	2736.4
HK R.T. 2	40.90	-18.46	-13.78	-7.21	-2.25	-0.39	0.32	0.29	0.57	5679.0
HK A.	38.00	-12.06	-14.88	-7.71	-2.71	-0.77	-0.16	-0.006	0.29	1563.7
HK B.	37.28	-17.56	-12.28	-6.71	-1.91	-0.20	0.51	0.19	0.67	7767.4
HK C.	33.16	-16.86	-10.68	-5.31	-1.91	-0.10	0.71	0.59	0.39	2717.0
HK E.	21.40	-7.36	-8.18	-5.01	-1.91	-0.07	0.44	0.39	0.29	1521.7
HK L.C.	18.79	-1.70	-10.28	-5.74	-2.21	0.11	0.34	0.09	0.59	6019.5
HK W.	36.90	-19.26	-14.58	-5.41	-0.21	0.23	0.84	0.79	0.69	8231.8
H.H.	20.80	-7.36	-8.51	-4.02	-1.81	-0.29	0.13	0.67	0.38	2555.0
H.C.H.	23.10	-7.26	-8.88	-5.41	-1.81	-0.37	0.14	0.19	0.29	1524.0
H.W.	17.40	-2.86	-7.98	-4.91	-2.01	-0.57	0.44	-0.006	0.49	4182.3
H.D.	19.70	-1.56	-10.18	-6.41	-1.71	-0.47	0.24	-0.006	0.39	2687.7
I.I.	45.30	-23.06	-15.18	-7.21	-2.11	-0.37	0.44	1.19	0.99	16759.0
J.C.I.	48.52	-25.56	-15.74	-6.67	-2.41	-0.17	0.64	0.29	1.09	202 69.7
J.S.E.	58.30	-27.76	-17.98	-8.71	-3.01	-0.87	-0.26	-0.006	0.29	1643.8
H.W.B.	34.00	-15.86	-12.68	-6.41	-1.61	0.13	0.84	0.69	0.89	13554.4
M.H.	20.60	-7.16	-9.09	-4.51	-1.11	-0.39	0.51	0.57	0.57	5627.1
S.O.G.	31.70	-13.29	-11.29	-5.93	-2.35	-0.01	0.51	0.28	0.37	2451.7
Wharf	20.30	-4.76	-9.48	-4.71	-1.91	-0.37	0.24	0.39	0.29	1520.0
HSI	17.90	-5.20	-8.38	-4.73	-1.25	0.33	0.74	0.39	0.19	684.8
Average	29.27	-10.96	-11.31	-5.854	-2.06	-0.32	0.36	0.30	0.50	

Table 7 Comparison of Empirical and Expected Number of Observations in Each Interval

Stock	0.5s		1s		1.5s		2s		2.5s		3s		4s		5s		< 5s	
	(A)	(E)	(A)	(E)	(A)	(E)	(A)	(E)	(A)	(E)	(A)	(E)	(A)	(E)	(A)	(E)	(A)	(E)
HSI	2762	1881	1216	1471	491	903	200	432	101	162	63	47	48	12	20	0.30	12	0.0029
A.I.	596	399	256	312	103	191	43	91	14	34	12	10	12	2	1	0.06	7	0.0006
A.P.	921	399	91	312	16	191	9	91	3	34	1	10	0	2	0	0.06	3	0.0006
A.I.C.	829	399	106	312	44	191	36	91	8	34	4	10	7	2	4	0.06	6	0.0006
B.E.A.	661	399	253	312	75	191	25	91	13	34	1	10	8	2	3	0.06	5	0.0006
B.I.	659	399	198	312	96	191	45	91	21	34	4	10	12	2	4	0.06	5	0.0006
C.L.	628	399	296	312	76	191	22	91	11	34	2	10	1	2	3	0.06	5	0.0006
C.M.	633	399	246	312	94	191	36	91	17	34	10	10	3	2	1	0.06	4	0.0006
C.I.	764	399	155	312	70	191	26	91	10	34	7	10	4	2	2	0.06	6	0.0006
C.H.	627	399	276	312	70	191	34	91	13	34	5	10	8	2	3	0.06	8	0.0006
E.E.	736	399	134	312	75	191	37	91	22	34	12	10	21	2	2	0.06	5	0.0006
F.E.C.	696	399	221	312	61	191	34	91	13	34	4	10	6	2	4	0.06	5	0.0006
F.E.H.	714	399	175	312	77	191	35	91	16	34	14	10	8	2	3	0.06	2	0.0006
G.E.	651	399	258	312	77	191	33	91	8	34	5	10	6	2	3	0.06	3	0.0006
G.I.	699	399	192	312	79	191	37	91	13	34	10	10	6	2	3	0.06	5	0.0006
H.L.D.	697	399	257	312	59	191	15	91	6	34	3	10	2	2	1	0.06	4	0.0006
H.S.B.	711	399	215	312	70	191	27	91	5	34	5	10	5	2	1	0.06	5	0.0006
H.H.	702	399	194	312	82	191	35	91	13	34	4	10	3	2	2	0.06	9	0.0006
H.L.	658	399	243	312	98	191	24	91	5	34	5	10	4	2	3	0.06	4	0.0006
C.G.	603	399	283	312	90	191	42	91	12	34	7	10	3	2	1	0.06	3	0.0006
H.K.B.	624	399	228	312	110	191	43	91	21	34	5	10	7	2	2	0.06	4	0.0006
H.K.F.	597	399	264	312	109	191	39	91	9	34	7	10	8	2	6	0.06	5	0.0006
R.T. 1	822	399	139	312	46	191	19	91	7	34	4	10	2	2	1	0.06	4	0.0006
R.T. 2	827	399	120	312	48	191	17	91	11	34	6	10	6	2	3	0.06	6	0.0006
HK A.	797	399	187	312	37	191	11	91	6	34	2	10	1	2	0	0.06	3	0.0006
HK B.	789	399	129	312	64	191	22	91	15	34	8	10	8	2	2	0.06	7	0.0006
HK C.	746	399	137	312	80	191	37	91	15	34	9	10	10	2	6	0.06	4	0.0006
HK E.	623	399	236	312	107	191	40	91	15	34	9	10	7	2	4	0.06	3	0.0006
HK L.	596	399	295	312	85	191	32	91	12	34	11	10	6	2	1	0.06	6	0.0006
H.H.W.	785	399	112	312	40	191	35	91	32	34	13	10	12	2	8	0.06	7	0.0006
H.H.D.	617	399	236	312	103	191	50	91	16	34	7	10	4	2	7	0.06	4	0.0006
H.C.H.	641	399	237	312	99	191	36	91	16	34	6	10	4	2	2	0.06	3	0.0006
H.W.	579	398	282	311	108	191	41	91	14	34	4	10	7	2	0	0.06	5	0.0006
H.D.	606	399	296	312	86	191	25	91	17	34	5	10	5	2	0	0.06	4	0.0006
I.I.	873	399	72	312	33	191	17	91	13	34	6	10	7	2	13	0.06	10	0.0006
J.C.I.	1377	607	70	475	42	291	34	139	15	52	12	15	14	4	4	0.09	18	0.0009
J.S.E.	999	396	23	309	4	190	1	91	3	34	1	10	0	2	0	0.06	3	0.0006
H.W.B.	755	399	147	312	59	191	25	91	18	34	12	10	12	2	7	0.06	9	0.0006
M.H.	615	399	238	312	97	191	45	91	23	34	6	10	8	2	6	0.06	6	0.0006
S.O.G.	731	399	174	312	74	191	30	91	10	34	10	10	8	2	3	0.06	4	0.0006
Wharf	612	399	263	312	93	191	43	91	15	34	6	10	5	2	4	0.06	3	0.0006

(A) is empirical number of observations, and (E) is expected number of observations.

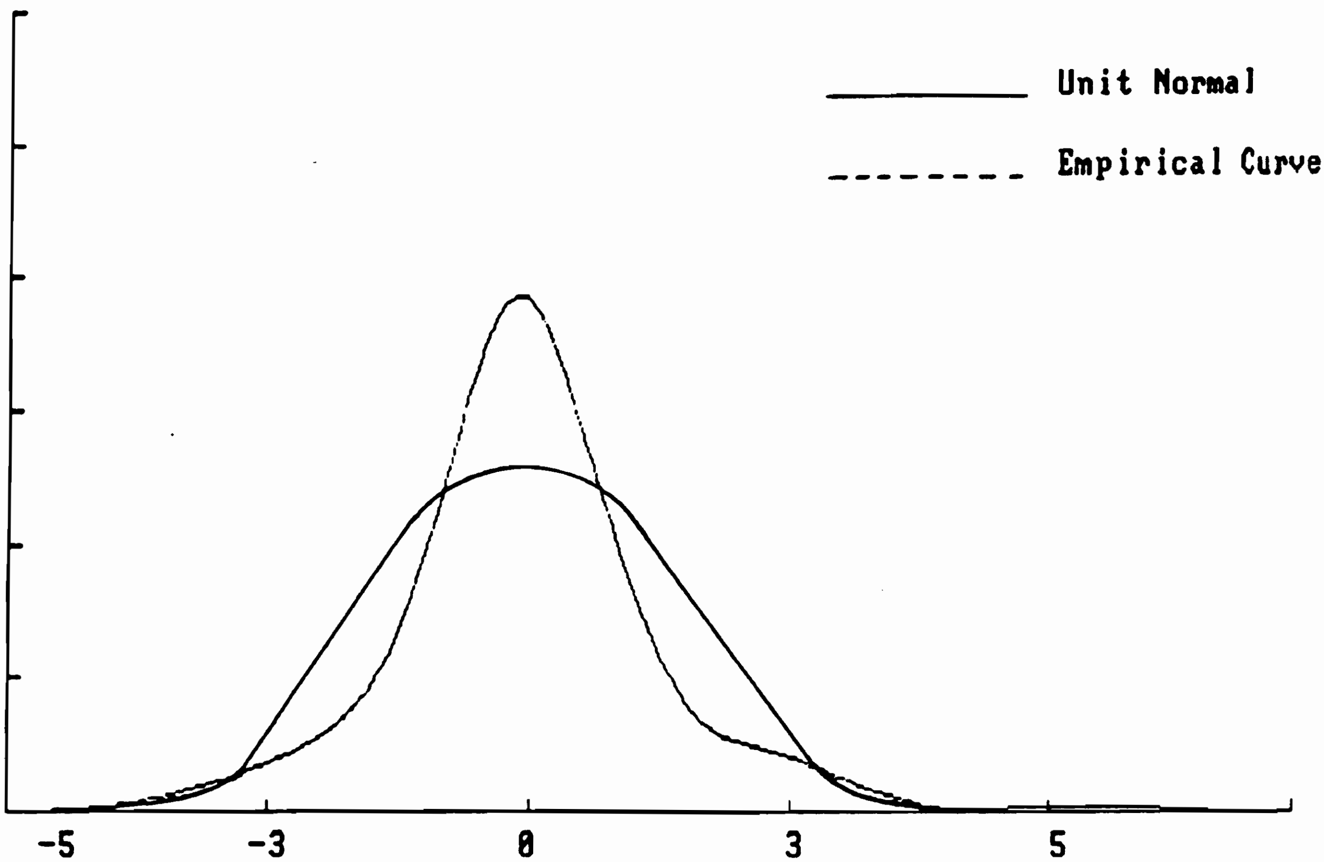
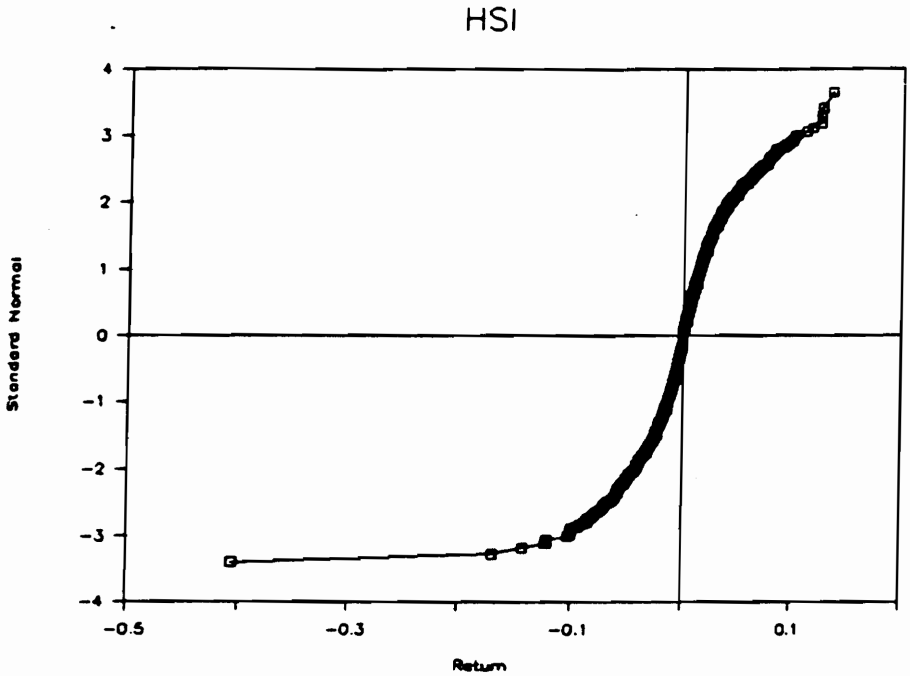


Figure 1. Frequency Plot



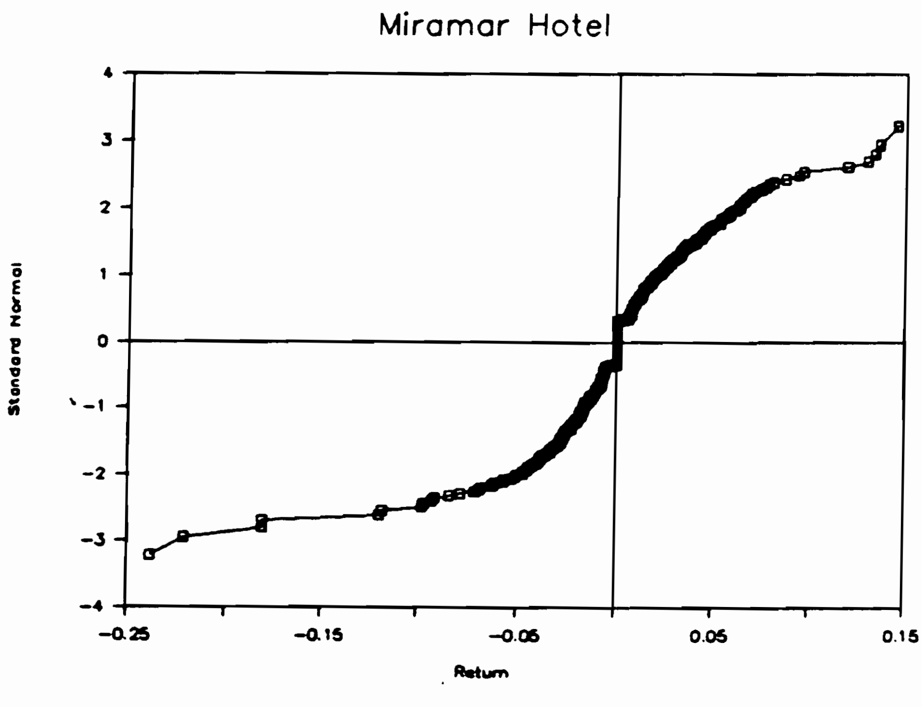


Figure 2. Normal Probability Graphs (1)

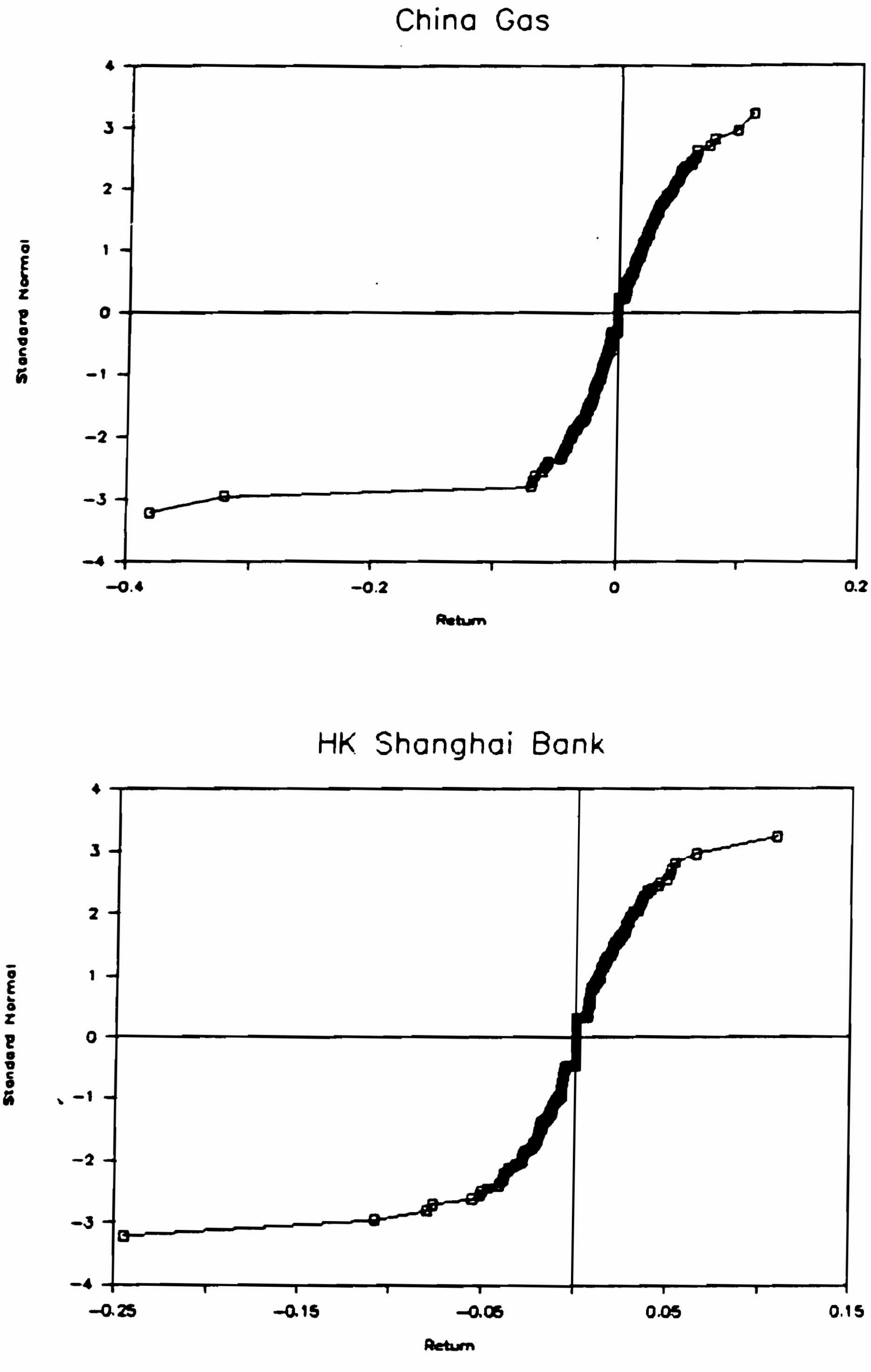
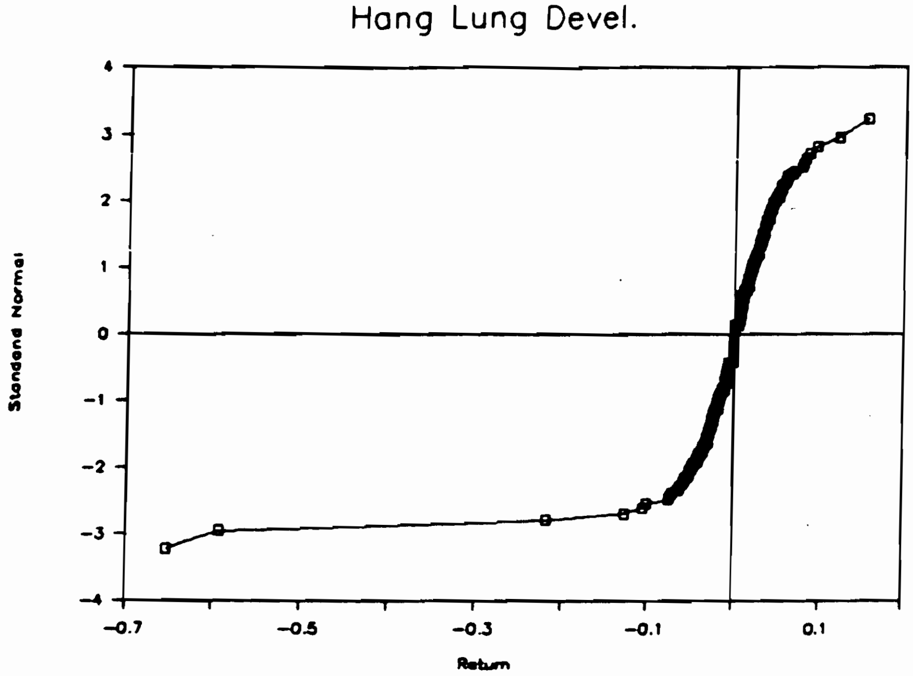


Figure 3. Normal Probability Graphs (2)



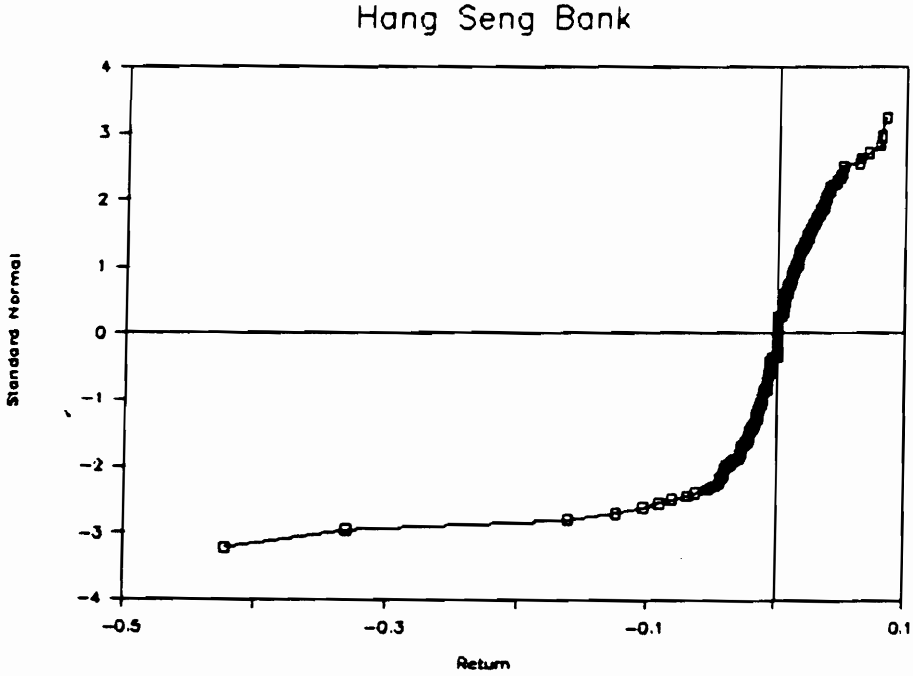
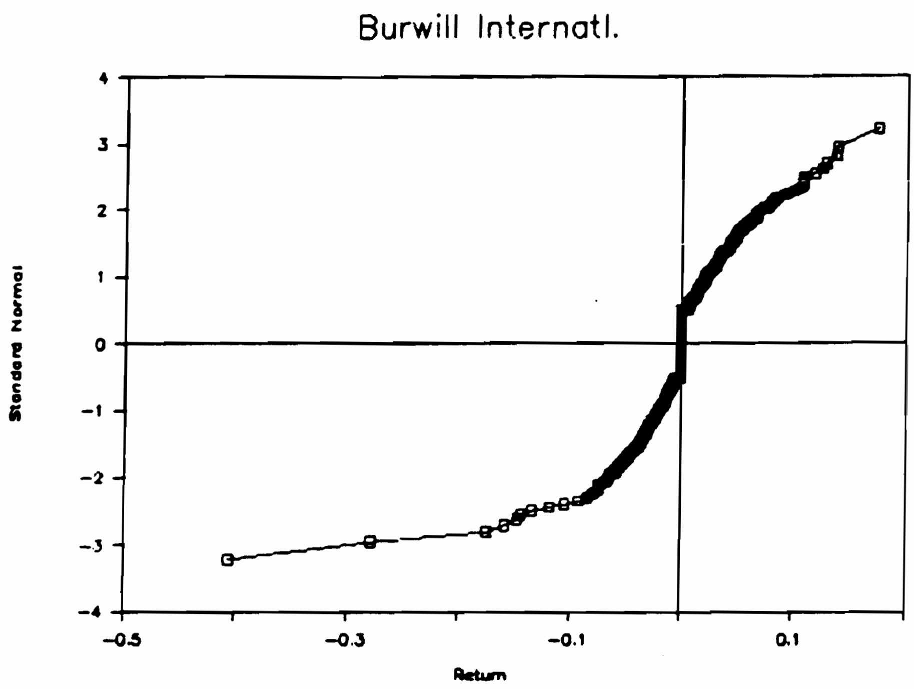


Figure 4. Normal Probability Graphs (3)



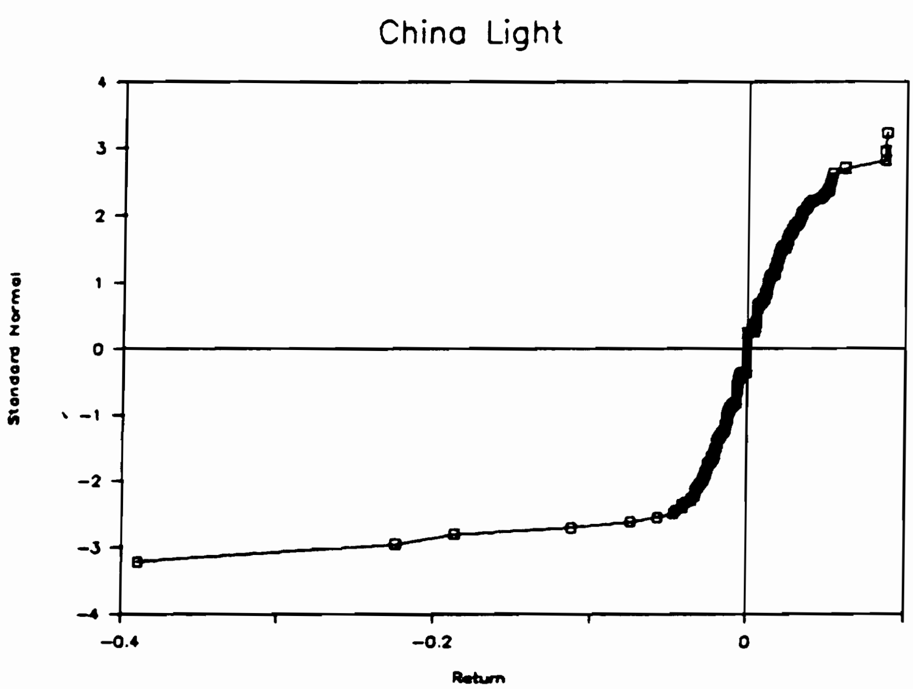
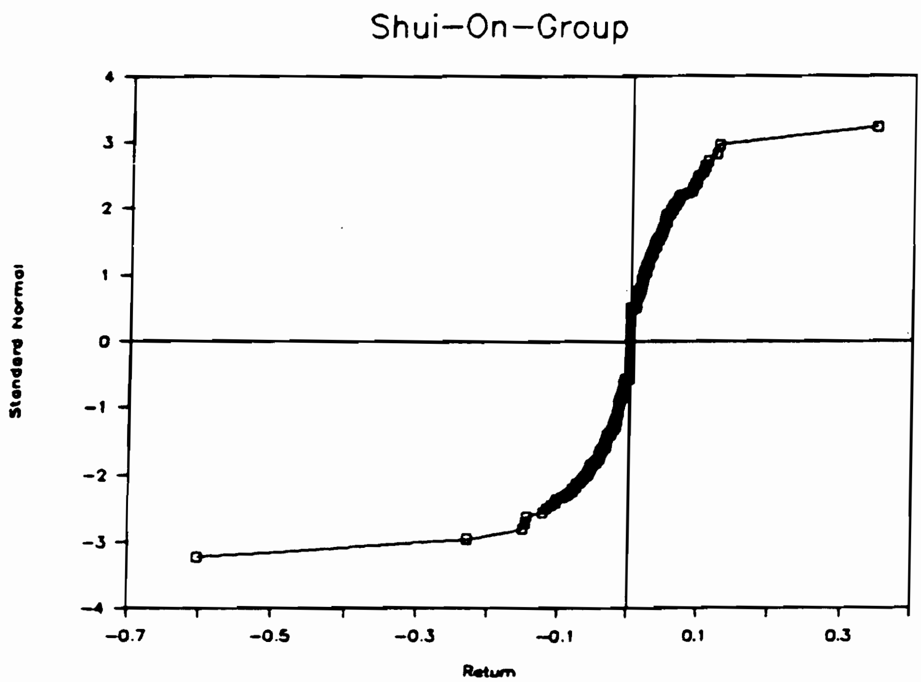


Figure 5. Normal Probability Graphs (4)



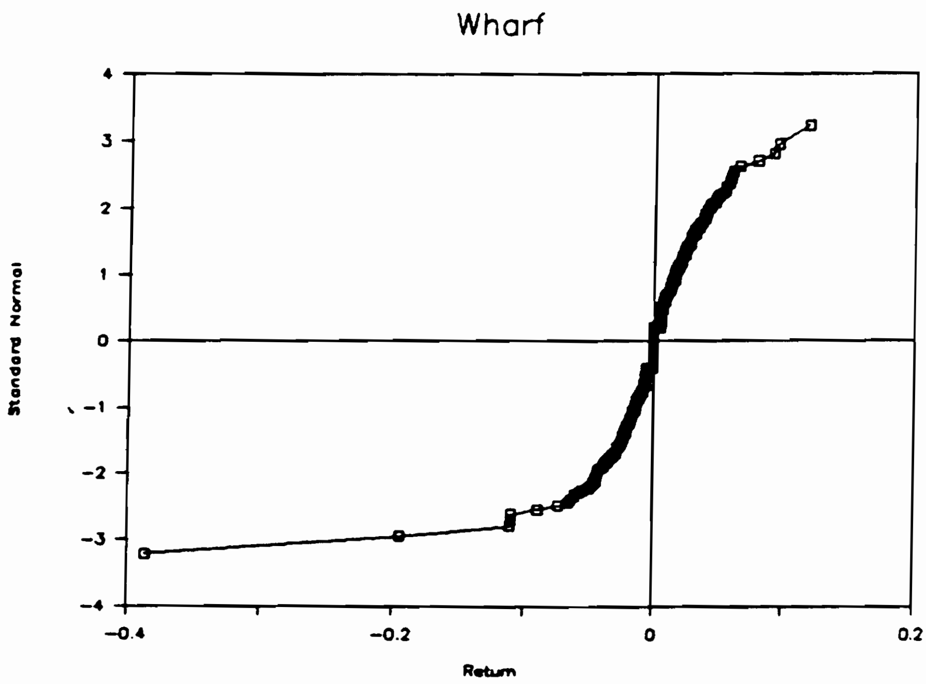
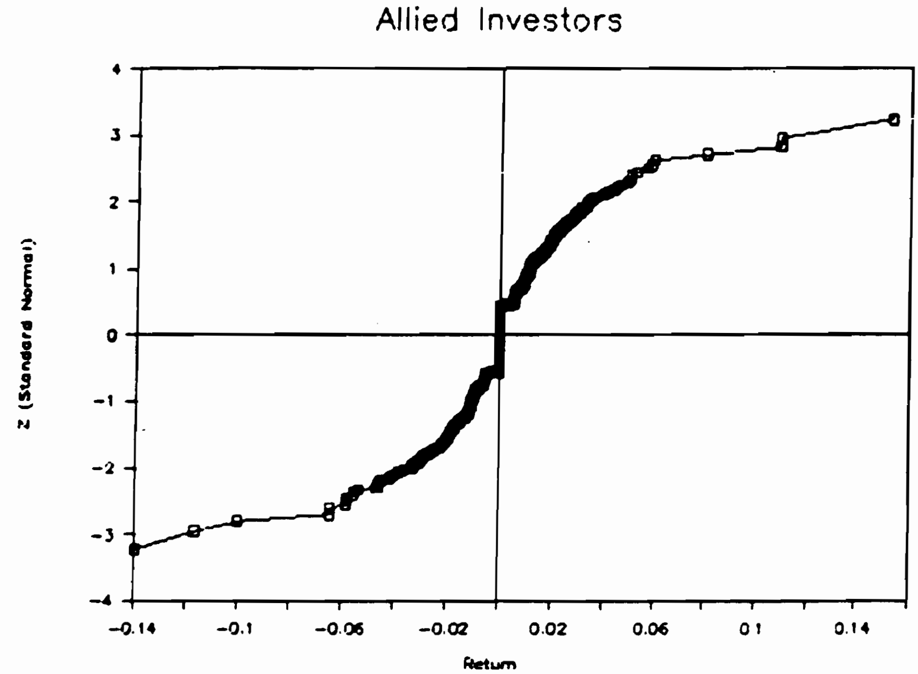


Figure 6. Normal Probability Graphs (5)



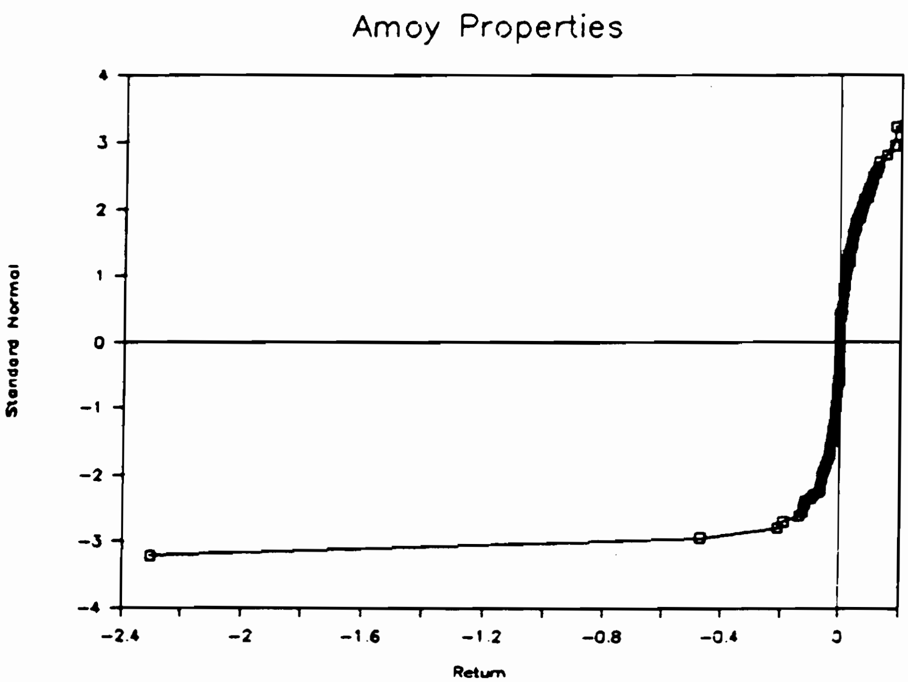
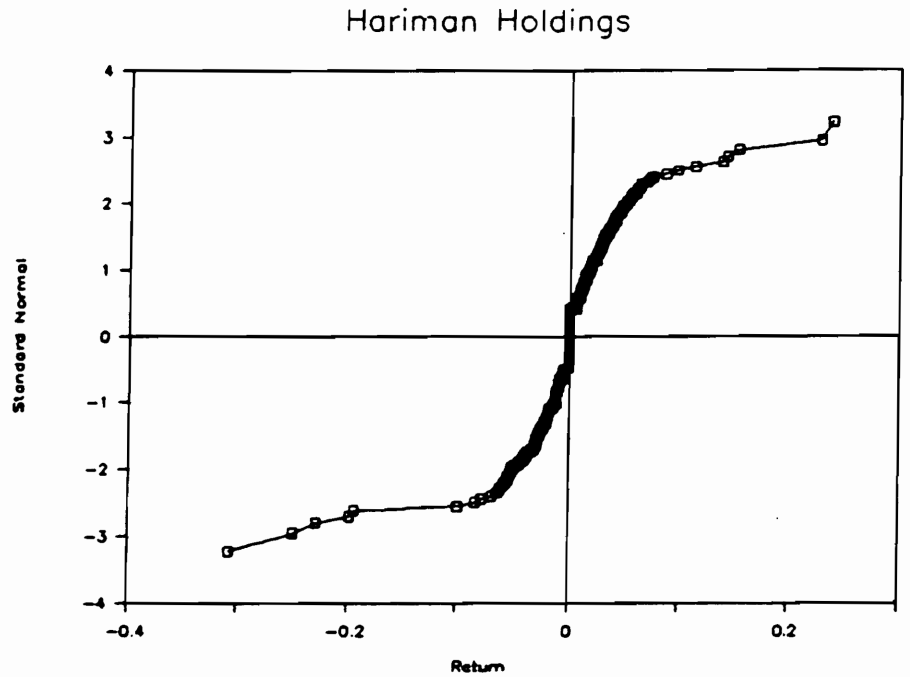


Figure 7. Normal Probability Graphs (6)



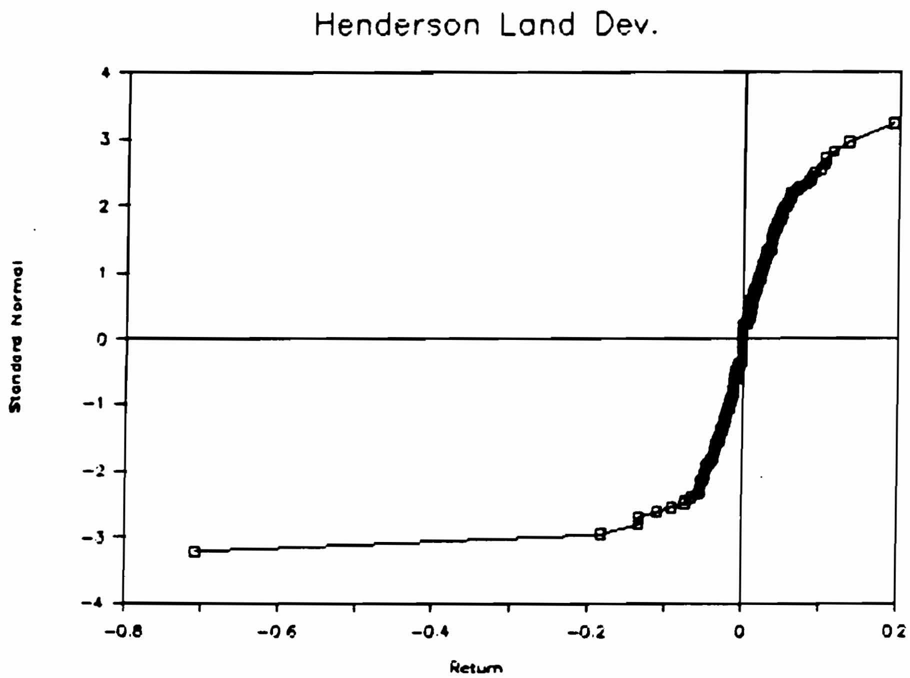


Figure 8. Normal Probability Graphs (7)

Table 8

Residaul Analysis for Independent Test

Stocks (1)	$\delta_{0,t}$ (2)	$\delta_{1,t}$ (3)	$\delta_{2,t}$ (4)
Allied Investors	0.000242	-0.000114	0.0259624 (0.831)
Amoy Properties	-0.00030	0.000130	-0.020037 (-0.644)
Asia Insurance Co.	-0.002189	0.0011076	-0.088304 (-2.838*)
Bank of East Asia	0.0028730	-0.000951	0.062425 (2.002*)
Burwill International	0.0000156	-0.000095	0.030956 (0.997)
China Light	-0.001574	0.0005466	-0.03412 (-1.093)
China Motor	0.0006292	-0.000238	0.043205 (1.390)
Conic Investment	0.0000163	-0.000104	0.015669 (0.502)
Cross Harbour	-0.003695	0.0015058	-0.18673 (-6.107*)
Essential Enterpress	0.0001224	-0.000767	0.195305 (6.406*)
Far East Consortm.	0.0007743	0.0017022	-0.10533 (-3.385*)
Far East Hotels	-0.000117	-0.000614	0.040004 (1.281)
Great Eagle	0.0000209	-0.000078	0.016238 (0.522)
Green Island	-0.000216	0.0000870	-0.00404 (-0.129)
Hang Lung Devel.	-0.000485	0.0002517	-0.03205 (-1.030)
Hang Seng Bank	-0.002361	0.0006826	-0.03478 (-1.111)
Garriman Holdings	0.0005294	-0.000363	0.004355 (0.139)
Henderson Land	-0.000672	0.0005550	-0.11817 (-3.828*)
HK China Gas	0.0009484	-0.000356	0.050214 (1.615)
HK Shanghai Bank	-0.000766	0.0004207	-0.05208 (-1.675)
HK Yaumati Ferry	0.0006968	-0.000485	0.083086 (2.678*)
HK Realty Trust 1	0.0005611	-0.000268	0.036537 (1.174)
HK Realty Trust 2	-0.000148	0.0003480	-0.03323 (-1.066)

(go to next page)

(continue)

Stocks (1)	$\delta_{0,i}$ (2)	$\delta_{1,i}$ (3)	$\delta_{2,i}$ (4)
HK Aircraft	0.0003345	-0.000117	0.019759 (0.634)
HK Building	-0.006558	0.0028944	-0.14269 (-4.601*)
HK Carpet	0.0028652	-0.001264	0.152724 (4.959*)
HK Electric	-0.001141	0.0006116	-0.11669 (-3.776*)
HK Land	-0.000495	0.0002641	-0.01839 (-0.588)
HK Worsted	-0.000116	0.0002204	-0.06723 (-2.168*)
Hopewell Holdings	0.0004390	-0.000505	0.053894 (1.732)
Hsin Chong Holdings	-0.000061	0.0000957	-0.02383 (-0.766)
Hutchison Whampoa	-0.000270	0.0001397	-0.03412 (-1.096)
Hysan Development	0.0002304	0.0009650	-0.10935 (-3.515*)
International Industries	0.0007792	-0.001436	0.119736 (3.864*)
Jack Chia International	-0.000183	-0.001290	0.097843 (3.883*)
Johnson Elec.	-0.032294	0.0217110	-0.46601 (-25.801*)
Ha Wah Bank	0.0006621	-0.000644	0.089042 (2.871*)
Miramar Hotel	0.0010477	-0.000690	0.105687 (3.412*)
Shui-On-Group	-0.000023	0.0003242	-0.03098 (-0.994)
Wharf	-0.001237	0.0006197	-0.02853 (-0.912)
HSI	-0.000824	0.000108	-0.023920 (-0.770)

1. $\varepsilon_{i,t} = \delta_{0,i} + \delta_{i,t-1} \ln P_{i,t-1} + \delta_{2,i}\, \varepsilon_{i,t-1}$

2. * stands for statistically significant at the 5% level.

Table 9

Return Correlation Analysis for Independent Test

Stocks (1)	$\beta_{0,t}$ (2)	$\beta_{1,t}$ (3)	$\beta_{2,t}$ (4)
Allied Investors	0.02466908	-0.0108887	0.0256752 (0.831)
Amoy Properties	0.00639118	-0.0028655	-0.019979 (-0.644)
Asia Insurance Co.	0.01779558	-0.0056803	-0.087753 (-2.838*)
Bank of East Asia	0.02433403	-0.0080090	0.0619553 (2.002*)
Burwill International	-0.0002568	-0.0017034	0.0309045 (0.997)
China Light	0.02543551	-0.0087503	-0.033810 (-0.1093)
China Motor	0.01313233	-0.0044967	0.0430131 (1.390)
Conic Investment	-0.0004610	-0.0079603	0.0155442 (0.502)
Cross Harbour	0.00458058	-0.0016840	-0.186229 (-6.107*)
Essential Enterpress	0.00096260	-0.0026983	0.1948361 (6.406*)
Far East Consortm	-0.0030394	-0.0081786	-0.104389 (-3.385*)
Far East Hotels	-0.0008683	-0.0075632	0.0397145 (1.281)
Great Eagle	0.00237908	-0.0026738	0.0161955 (0.522)
Green Island	0.00816903	-0.0030453	-0.004023 (-0.129)
Hang Lung Devel.	0.01135886	-0.0055703	-0.031869 (-1.030)
Hang Seng Bank	0.03164794	-0.0091801	-0.034454 (-1.111)
Harriman Holdings	0.01923323	-0.0131150	0.0042993 (0.139)
Henderson Land	0.00489604	-0.0028466	-0.117812 (3.828*)
HK China Gas	0.01678875	-0.0060116	0.0499155 (1.615)
HK Shanghai Bank	0.01076916	-0.0056989	-0.051775 (-1.675)
HK Yaumati Ferry	0.00857465	-0.0052565	0.0826539 (2.678*)
HK Realty Trust 1	0.00934612	-0.0043567	0.0363816 (1.174)
HK Realty Trust 2	0.00284375	-0.0059603	-0.033026 (-1.066)

(go to next page)

(continue)

Stocks (1)	$\beta_{0,i}$ (2)	$B_{1,i}$ (3)	$\beta_{2,i}$ (4)
HK Aircraft	0.01425828	-0.0047332	0.0196661 (0.634)
HK Building	0.03560237	-0.0153909	-0.140406 (4.601*)
HK Carpet	0.01400808	-0.0058517	0.1518970 (4.959*)
HK Electric	0.01018397	-0.0050888	-0.116094 (-3.776*)
HK Land	0.02531505	-0.0129634	-0.018153 (0.588)
HK Worsted	0.00466110	-0.0029270	-0.067027 (-2.168*)
Hopewell Holdings	0.00588846	-0.0058782	0.0535876 (1.732)
Hsin Chong Holdings	0.00457915	-0.0041089	-0.023727 (0.766)
Hutchison Whampoa	0.00944040	-0.0043361	-0.033972 (-1.096)
Hysan Development	-0.0000813	-0.0052007	-0.108744 (-3.515*)
International Industries	0.00320250	-0.0049286	0.1192612 (3.864*)
Jack Chia International	-0.0008875	-0.0070812	0.0972146 (3.883*)
Johnson Elec.	0.09364334	-0.0226778	-0.451906 (-25.801*)
Ha Wah Bank	0.00245408	-0.0030878	0.0888036 (2.871*)
Miramar Hotel	0.01001485	-0.0058846	0.1050726 (3.412*)
Shui-On-Group	0.00076184	-0.0053303	-0.030812 (0.994)
Wharf	0.02383635	-0.0117191	-0.028185 (0.912)
HSI	0.034209	-0.0043574	-0.023816 (-0.770)

1. $R_{i,t} = \beta_{0,i} + \beta_{1,i} \ln P_{i,t-1} + \beta_{2,i} R_{i,t-1}$

2. * stands for statistically significant at the 5% level.

Table 10

Estimates of the Characteristic Exponent by Range Analysis

Stocks (1)	α (n = 3) (2)	α (n = 5) (3)	α (n = 9) (4)	α (n = 15) (5)	Average (6)
Allied Investors	2.244	2.333	2.392	2.395	2.341
Amoy Properties	1.951	1.812	2.051	2.078	1.973
Burwill Internatl.	2.077	2.204	1.868	2.204	2.088
China Light	1.808	1.839	1.944	2.140	1.933
China Motor	2.108	2.064	2.249	2.409	2.207
Conic Investment	1.912	2.063	1.857	2.090	1.980
Far East Hotels	1.925	1.959	2.151	2.337	2.093
Great Eagle	1.840	1.934	1.957	2.162	1.974
Green Island	2.164	2.087	2.267	2.190	2.177
Hang Lung Devel.	1.927	1.828	2.053	2.188	1.999
Hang Seng Bank	1.869	1.917	1.917	1.967	1.917
Harriman Holdings	1.755	2.565	1.782	2.110	2.053
HK China Gas	2.067	2.182	2.179	2.277	2.177
HK Shanghai Bank	1.875	1.757	1.945	2.105	1.921
HK Realty Trust 1	2.085	2.148	2.092	2.187	2.128
HK Realty Trust 2	2.053	2.043	1.944	1.940	1.995
HK Aircraft	2.154	2.109	2.091	2.143	2.124
Hong Kong Land	1.953	1.979	1.910	1.781	1.906
Hopewell Holdings	2.000	2.091	2.011	2.067	2.042
Hsin Chong Holdings	1.910	1.808	2.066	2.273	2.014
Hutchison Whampoa	1.962	1.833	2.204	2.313	2.078
Shui-On-Group	1.827	2.109	2.470	2.205	2.153
Wharf	2.020	1.992	2.079	2.204	2.074
HSI	1.767	1.874	1.869	1.797	1.827
Average	1.969	2.023	2.056	2.149	2.049

$$* \ \alpha = \frac{\log n}{\log STD_n - \log STD_1}$$

Table 11

Means of the Stock Returns During Different Trading Periods

stocks	mean of the whole period	mean of 1985	mean of 1986	mean of 1987	mean of 1988	chi-square value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Allied Investors	0.00083	0.0015	0.00016	0.0004	0.00117	0.00145
Amoy Properties	0.00007	0.0052	0.00141	-0.0081	0.00080	1.43072
Asia Insurance Co.	0.00085	0.0004	0.00015	0.0014	0.00172	0.00203
Bank of East Asia	0.00021	0.0007	-0.00039	0.0006	-0.00016	0.00409
Burwill Internatl.	0.00097	-0.0026	0.00261	0.0019	0.00289	0.02068
China Light	0.00068	0.0010	0.00121	0.0005	-0.00013	0.00161
China Motor	0.00170	0.0025	0.00089	0.0017	0.00154	0.00076
Conic Investment	-0.00035	-0.0016	0.00021	0.0001	0.00019	-0.00653
Cross-Harbour	0.00052	0.000001	0.00019	0.0015	0.00047	0.00262
Essential Enterprs.	0.00100	-0.0004	0.00429	-0.0010	0.00139	0.01708
Far east Consortm.	0.00112	0.0014	0.00056	0.0021	0.00020	0.00205
Far East Hotels	0.00143	-0.00005	-0.00064	0.0056	0.00112	0.01680
Great Eagle	0.00263	0.0020	0.00215	0.0047	0.00157	0.00235
Green Island	0.00173	0.0007	0.00197	0.0009	0.00387	0.00374
Hang Lung Devel.	0.00137	0.0037	0.00202	-0.0016	0.00082	0.01077
Hang Seng Bank	0.00029	0.0008	-0.00039	-0.0003	0.00112	0.00601
Harriman Holdings	0.00132	0.0022	0.00028	0.0012	0.00154	0.00143
Henderson land Dev.	0.00198	0.0014	0.00290	0.0018	0.00189	0.00061
HK China Gas 19	0.00137	0.0025	0.00146	0.0006	0.00061	0.00178
HK Shanghai Bank	0.00066	0.0008	0.00140	0.0005	-0.00024	0.00217
HK Yaumati Ferry	0.00161	0.0021	0.00072	0.0023	0.00114	0.00108
HK Realty Trust 1	0.00064	0.0034	0.00099	-0.0027	0.00036	0.02947
HK Realty Trust 2	0.00089	0.0033	0.00115	-0.0017	0.00028	0.01436
Hong Kong Aircraft	0.00090	0.0031	0.00288	-0.0045	0.00178	0.04264
Hong Kong Building	0.00033	0.0006	0.00026	0.0002	0.00022	0.00038
Hong Kong Carpet	0.00086	0.0009	0.00157	-0.0014	0.00256	0.01015
Hong Kong Electric	0.00077	0.0012	0.00163	0.0004	-0.00028	0.00284
Hong Kong Land	0.00130	0.0024	-0.00005	0.0020	0.00055	0.00320
Hong Kong Worsted	0.00341	0.0045	0.00299	0.0026	0.00333	0.00063
Hopewell Holdings	0.00135	0.0018	0.00099	0.0017	0.00070	0.00066
Hsin Chong Holding	0.00223	0.0026	0.00202	0.0022	0.00203	0.00009
Hutchison Whampoa	0.00153	0.0022	0.00199	0.0008	0.00090	0.00097
Hysan Development	0.00137	0.0015	0.00187	0.0006	0.00155	0.00065
Intl. Industries	0.00120	-0.0007	0.00032	0.0022	0.00373	0.00985
Jack Chia Intl.	0.00013	0.0000001	-0.00085	0.0021	0.00005	0.03495
Johnson Elec.	0.00115	0.000001	0.00232	0.0021	0.00019	0.00393
Ka Wah Bank	-0.00057	-0.0003	-0.00056	-0.0011	-0.00035	-0.00073
Miramar Hotels	0.00160	0.0027	-0.00008	0.0025	0.00106	0.00320
Shui-On-Group	0.00080	0.00008	0.00157	0.0013	0.00032	0.00199
Wharf	0.00106	0.0019	0.00083	0.00006	0.00129	0.00177
HSI	0.00129	0.00176	0.00146	0.00117	0.00058	0.00059

Table 12

Standard Deviations of the Stock Returns During Different Trading Periods

stocks (1)	std of the whole period (2)	std of 1985 (3)	std of 1986 (4)	std of 1987 (5)	std of 1988 (6)	chi-square value (7)
Allied Investors	0.0162	0.0211	0.01184	0.0160	0.01310	0.003227
Amou Properties	0.0771	0.0349	0.01881	0.1490	0.01828	0.179067
Asia Insurance Co.	0.0239	0.0297	0.01235	0.0303	0.01522	0.011859
Bank of East Asia	0.0198	0.0166	0.01730	0.0268	0.01685	0.003709
Burwill Internatl.	0.0317	0.0251	0.03813	0.0378	0.02170	0.007013
China Light	0.0175	0.0200	0.01257	0.0220	0.01263	0.004246
China Motor	0.0219	0.0265	0.01725	0.0236	0.01764	0.002911
Conic Investment	0.0250	0.0277	0.01543	0.0347	0.01466	0.012004
Cross-Harbour	0.0126	0.0151	0.00660	0.0130	0.01357	0.003451
Essential Enterprs.	0.0297	0.0124	0.02266	0.0464	0.02907	0.021244
Far East Consortm.	0.0372	0.0323	0.03026	0.0543	0.02483	0.013894
Far East Hotels	0.0382	0.0366	0.02631	0.0544	0.02836	0.013179
Great Eagle	0.0319	0.0363	0.02035	0.0416	0.02265	0.010397
Green Island	0.0255	0.0211	0.02033	0.0355	0.02275	0.005981
Hang Lung Devel.	0.0305	0.0197	0.02038	0.0509	0.01904	0.025182
Hang Seng Bank	0.0216	0.0174	0.01627	0.0341	0.01175	0.013861
Harriman Holdings	0.0269	0.0306	0.01675	0.0367	0.01528	0.012965
Henderson Land	0.0249	0.0221	0.02855	0.0286	0.01890	0.002844
HK China Gas	0.0207	0.0185	0.01661	0.0295	0.01497	0.006339
HK Shanghai Bank	0.0142	0.0124	0.01515	0.0171	0.01151	0.001376
HK Yaumati Ferry	0.0237	0.0243	0.01611	0.0313	0.01988	0.005512
HK Realty Trust 1	0.0367	0.0281	0.01871	0.0630	0.01648	0.040824
HK Realty Trust 2	0.0442	0.0438	0.03427	0.0654	0.01571	0.030740
Hk Aircraft	0.0398	0.0229	0.01786	0.0719	0.01968	0.055292
HK Buildings	0.0195	0.0319	0.00997	0.0116	0.01109	0.019426
HK Carpet	0.0214	0.0195	0.01263	0.0288	0.02208	0.006377
HK Electric	0.0146	0.0142	0.01215	0.0195	0.01070	0.003096
HK Land	0.0231	0.0219	0.01881	0.0312	0.01759	0.005035
HK Worsted	0.0525	0.0736	0.04550	0.0475	0.02194	0.027663
Hopewell Holdings	0.0292	0.0270	0.02777	0.0379	0.02124	0.004983
Hsin Chong Holdings	0.0267	0.0268	0.02253	0.0338	0.02146	0.003551
Hutchison Whampoa	0.0197	0.0179	0.01643	0.0267	0.01602	0.003910
Hysan Development	0.0219	0.0189	0.01682	0.0302	0.01971	0.004993
Intl. Industries	0.0310	0.0194	0.01542	0.0451	0.03730	0.019820
Jack Chia Intl.	0.0294	0.0292	0.02964	0.0365	0.02176	0.003722
Johnson Elec.	0.1117	0.2054	0.01937	0.0331	0.01856	0.288046
Ka Wah Bank	0.0250	0.0248	0.02910	0.0290	0.01183	0.008259
Miramar Hotels	0.0266	0.0316	0.02006	0.0292	0.02257	0.003405
Shui-On-Group	0.0286	0.0263	0.02673	0.0373	0.02187	0.004530
Wharf	0.0206	0.0214	0.01870	0.0245	0.01667	0.001681
HSI	0.0134	0.0130	0.0110	0.0171	0.0116	0.00175

Chapter 5

Dividend and Bonus Issue Announcement on the Hong Kong Stock Market

The efficiency of capital market implies that security prices fully, immediately and without bias reflect all available information. Information, therefore, becomes a valuable commodity in a world of uncertainty, because investors can eliminate uncertainty by acquiring relevant information. A large number of empirical investigations have been conducted to measure the market's reaction to major information generating events, and most evidence supports the weak-form and semi-strong-form efficient market hypothesis. The announcement of a dividend increase or a stock split, for example, is widely accepted as a positive signal to the market. This signal can not be mimicked by unsuccessful firms because the cost mechanism related to the dividend announcement eliminates the possible imitations.

The results in Chapter III indicate that the hypothesis of weak-form efficient market is supported on the Hong Kong stock market. This chapter studies the semi-strong form efficiency of the Hong Kong stock market by examining the announcement effect of the dividend changes and bonus issues.[2] The study examines the speed and the accuracy of market reactions to these announcements for the securities price listed on the Hong Kong Stock Exchange, and provides some evidence concerning the validity of the efficient market hypothesis in a small but active Asian equity market.

5.1. Data and Methodology

The data used in our study is the daily rate of returns for 40 firms listed on the Hong Kong Stock Exchange over the period from Nov. 1, 1984 to Nov. 1, 1988.[3] To examine the announcement effect of dividend and bonus issue on the Hong Kong market, the following data have been collected: (1) the dividend payment (bonus issue); (2) the dates of dividend (bonus issue) announcement;[4] (3) the daily stock prices around the announcement dates. The market index for the Hong Kong stock market used in our study is the the Hang Seng Index (HSI).

To test the market reaction to dividend and bonus issue announcements, two subsamples are formed. For the sample of dividend announcements, 188 announcements involving 40 firms over the testing period from Nov. 1, 1984 to Nov. 1, 1988 are included, while 41 events are collected for the sample of bonus issues. In the test of dividend announcements, the measure of unexpected change in dividends is calculated with a naive expectation model which forecasts no change in dividends from the previous to the current period. That is, ex-ante, the dividend expected in the present period is equal to the dividend paid in the previous corresponding period. Any difference in these two dividends is defined as unexpected. This justification for the naive model comes from the fact that managers are reluctant to change dividends payments unless they have reasons to expect a

---

[2] A bonus issue is also called a stock dividend, script issue, or capitalization issue. A bonus issue is made by a company transferring some of its reserves to its share capital account, and thus the total value of the holdings by each shareholder remains constant after a bonus issue. The price of each individual share falls by an equivalent amount although the number of shares held by each shareholder increases.

[3] The data is supplied by the Reuters News.

[4] The amounts and the dates of dividend and bonus issue are collected from Company Handbook published by the Hong Kong Stock Exchange, and from the companies included in the test sample through a questionnaire investigation.

significant change in the future prospects of the firm. Thus, an increase in dividends signals a favorable change in manager's expectations, whereas a decrease in dividends indicates a pessimistic view of the firm's prospects. The dividend announcements in our sample, therefore, are classified as three groups: decrease, no change, and increase. The announcements included in each group are independent dividend announcements, i.e., no bonus issue announcement have been made within the seven-day period surrounding the dividend announcement.

A bonus issue often comes along with a cash dividend announcement. Thirty-one out of forty-one bonus issue announcements in our sample are associated with a cash dividend announcement. Therefore, the 41 announcements of bonus issues are also divided into 2 groups: one includes "pure" bonus issues with 10 announcements, and the other 31 cases are classified as "joint" announcements, that is, announcements associated with both dividend and bonus issue.

In the present study, the efficient market tests of dividend and bonus issue information on the Hong Kong market are performed by the mean adjusted model and the market model. The announcement period in our study is defined as a seven-day period, i.e., $t = -2, ..., 0, ..., 4$. where $t = 0$ is the announcement day. Because it is expected that some price adjustment occurs during the announcement period, the parameters of both the mean adjusted model and the market model are estimated over a control period. The control period is defined as the whole testing period, i.e., from Nov. 1 1984 to Nov. 1, 1988, except for the announcement period of both dividend and bonus issues. The two models can be expressed as follows:

For the mean adjusted model,

$$E\,[R_{iT}] = K_i \qquad (5.1.1)$$

R_{iT}: daily return of security i during the control period T.

The excess return accrued from the dividend announcement or bonus issue announcement for security i at announcement period t is

$$u_{ij,t} = R_{it} - K_i \qquad t = -2, ..., 0, ..., 4 \tag{5.1.2}$$

The average excess return of group g at announcement period t is

$$u_{g,t} = \frac{\sum_{i=1}^{I}\sum_{j=1}^{J} u_{ij,t}}{n} \qquad t = -2, ..., 0, ..., 4 \tag{5.1.3}$$

R_{it}: daily return of security i at the announcement period t, and i = 1, 2, ..., 40.

$u_{ij,t}$: residual return on security i, adjusted by the mean-adjusted model for jth dividend announcement or jth bonus issue announcement at time t,

$u_{g,t}$: residual return on group g at time t, and g = the group of dividend decrease, dividend increase, no change in dividends, "pure" bonus issues, and "joint" bonus issues.

For the market model

$$R_{iT} = \alpha_i + \beta_i R_{mT} \tag{5.2.1}$$

$$\varepsilon_{iT} = R_{iT} - \alpha_i - \beta_i R_{mT} \tag{5.2.2}$$

R_{mT}: daily return of the market index HSI at time T, and T refers to the days in the control period.

The excess return accrued from the announcement of dividend and bonus issue for security i at announcement period t is

$$v_{ij,t} = R_{it} - \alpha_i - \beta_i R_{mt} \qquad t = -2, ..., 0, ..., 4 \qquad (5.2.3)$$

The average excess return for group g at time t is

$$v_{g,t} = \frac{\sum_{i=1}^{I}\sum_{j=1}^{J} v_{ij,t}}{n} \qquad t = -2, ..., 0, ..., 4 \qquad (5.2.4)$$

$v_{ij,t}$: residual return on security i, adjusted by the market model for the jth dividend announcement at time t,

$v_{g,t}$: residual return on group g at time t.

To eliminate the possible heteroskedasticity, the residuals derived from the both models are further standardized by the standard deviation of the residuals estimated in the control period. The standardized residuals during the announcement period will be defined as:

$$su_{ij,t} = u_{ij,t}/S^{m}_{i,T} \qquad t = -2, ..., 0, ..., 4 \qquad (5.3.1)$$

for the residuals from the mean-adjusted model, and

$S^{m}_{i,T}$: standard deviation of residuals estimated in the control period T from the mean-adjusted model for firm i.

The average standardized excess return of group g at announcement period t for the mean-adusted model is

$$su_{g,t} = \frac{\sum_{i=1}^{I}\sum_{j=1}^{J} su_{ij,t}}{n} \qquad t = -2, \ldots, 0, \ldots, 4 \tag{5.3.2}$$

$$sv_{ij,t} = v_{ij,t}/S_{i,T}^{k} \qquad t = -2, \ldots, 0, \ldots, 4 \tag{5.3.3}$$

for the residuals from the market model, and

$S_{i,T}^{k}$: standard deviation of residuals estimated in the control period T from the market model for firm i.

The average standardized excess return of group g at announcement period t is

$$sv_{g,t} = \frac{\sum_{i=1}^{I}\sum_{j=1}^{J} sv_{ij,t}}{n} \qquad t = -2, \ldots, 0, \ldots, 4 \tag{5.3.4}$$

Brown and Warner [1980] demonstrate that the mean adjusted method is efficient if there is no severe clustering problem. The market model, on the other hand, reflects a linear relation between the returns of individual security and the returns on some broad based market index. The market model has been commonly used to examine the performance of securities and portfolios, however, it will cause some bias if the parameters of the model are not stable over the testing period. Using the two model at the same time can eliminate some possible noises in the measurement of security performance.

5.2. Dividend Announcement Effect on the Hong Kong Stock Market

Past studies of the U. S. equity market suggests that the announcement of dividend changes conveys a considerable amount of information about firms' future cash flows, and the market reaction upon the change in dividends is nontrivial. The hypotheses of the test of dividend announcement effect on the Hong Kong market are following:

$H_0^{5.1}$: The adjusted standardized abnormal returns for the Hong Kong stocks will be positive if a dividend increase is announced, with the adjustment captured during the trading period immediately following the announcement.

$H_0^{5.2}$: The adjusted standardized abnormal returns for the Hong Kong stocks will be negative if a dividend decrease is announced, with the adjustment captured during the trading period immediately following the announcement.

Table 13 presents the results of the mean adjusted model, where the residuals of each security are adjusted by the mean of stock returns excluding the announcement period, i.e., $t = -2, -1, 0, ..., 4$, and standardized by the standard deviation of residuals in the control period. As expected, we can see that there is no significant announcement effect associated with the no change group immediately following the announcement, and there is significantly negative effect on the group of dividend decreases. At $t = 1$, the dividend decrease group has a significantly negative excess return, with an average of -0.76 percent. However, the market does not respond significantly to the announcement of dividend increases, with no significantly positive excess return appearing during the announcement period. Furthermore, the standard deviations from the mean for both the decrease group and the increase group are larger than that of the no change group surrounding the announcement day, which indicates that the stock prices are affected by the information of dividend changes.

Table 14 presents the results using the market model method. The coefficients of the market model, α and β, are estimated for each security in the control period which excludes the announcement period, i.e., $t = -2, -1, 0, ..., 4$, with the control period covering four years from Nov. 1, 1984 to

Nov. 1, 1988. The standardized residuals listed in the table are the mean excess returns of each group in the announcement period adjusted by the market model. As we can see, the results in Table 14 are quite close to those reported in Table 13. Again, no systematic effect appears for both the no change group and the increase group. There is a significant announcement effect for the dividend decrease group, with the negative abnormal return captured at t = 1, the day following the announcement day. The results from the Table 13 and Table 14 show that there is a significant negative reaction to the announcement of dividend decreases.

It is difficult to determine the exact day of the announcement since a number of announcements may have been made after the market closed on that day. The results from Table 13 and Table 14 show that in all cases the main effect of the announcement is compounded into security prices on the day following the announcement. The results of our study support the hypotheses that the adjusted standardized abnormal returns for the Hong Kong stock are negative (positive) when a dividend decrease (increase) is announced, with the adjustment captured during the trading period immediately following the announcement. However, only the market reaction to a dividend decrease is significantly negative during the announcement period.

5.3. The Announcement Effect of Bonus Issues on the Hong Kong Stock Market

Bonus issues are popular in the Asian and European stock markets. They are made by a company transferring some of its retained earnings to its capital account. Thus, a bonus issue is also called a stock dividend and is equivalent to a small stock split on the U. S. market. Because a stock dividend announcement on the U. S. market conveys a favorable signal about the firm's future cash flows, we would expect that changes of the stock prices on the Hong Kong market to a bonus issue will be similar to the changes of stock price in the U. S. market to a stock dividend announcement. Therefore, the hypothesis for the test is:

$H_0^{5.3}$: The stock prices on the Hong Kong market reacts positively and quickly to the announcement of bonus issues if the efficient capital market hypothesis holds, with the adjustment being captured during that trading period immediately following the announcement.

Because a bonus issue is often announced at the same time cash dividends are announced, the test of the bonus issue effect, in fact, is a joint test of bonus issue and dividend announcement effect. To examine the announcement effect of bonus issues on the Hong Kong market, we first measure the abnormal return at the announcement using both the mean adjusted model and the market model. The joint dividend and bonus issue effect is then measured by a regression model, which identifies the incremental effect of a changes in dividends. The hypothesis for this test will be:

$H_0^{5.4}$: The stock prices on the Hong Kong market will capture the incremental effect of the announcement of joint bonus and dividend issue if the efficient capital market hypothesis holds, with the adjustment being captured during that trading period immediately following the announcement.

The model can be expressed as follows:

For the residuals from the mean-adjusted model,

$$su_{DB,t} = \delta_0 + \delta_1 D_{plus} + \delta_2 D_{minus} \qquad (5.4.1)$$

For the residuals from the market model,

$$sv_{DB,t} = \delta_0 + \delta_1 D_{plus} + \delta_2 D_{minus} \qquad (5.4.2)$$

where

$su_{DB,t}$: standardized mean excess returns derived from the mean-adjusted model for the group of events associated with both bonus issue and dividend announcement at announcement period t.

$sv_{DB,t}$: standardized mean excess returns derived from the market model for the group of events associated with both bonus issue and dividend announcement at announcement period t.

D_{plus}: the dummy variable for the events associated with both bonus issues and dividend increase.

D_{minus}: the dummy variable for the events associated with both bonus issues and dividend decrease.

The intercept term, δ_0, therefore, will reflect the effect of no change in dividend and bonus issues; the coefficient of the first dummy variable, δ_1, reflects the incremental effect of the announcement with both bonus issues and dividend increases, while the coefficient of the second dummy variable, δ_2, reflects the incremental effect of the announcement with both bonus issue and dividend decrease. We expect that the coefficients indicate the incremental effect of dividend changes associated with the bonus issue.

Table 15 lists the effect of bonus issue derived from the mean adjusted model, while Table 16 provides the results from the market model. The BB group includes the cases only bonus issue announcements, while the DB group includes the cases with both dividend and bonus issue announcements. In group DB, seven out of thirty-one cases are associated with no change dividend announcements, four cases are the first dividend announcement after a period of non-dividend issuing, fourteen cases involve a dividend increase and six cases are associated with a dividend decrease comparing to the previous corresponding period. The results from Table 15 and Table 16 show that the market reaction to bonus issues is significantly positive at $t=1$ for both groups and both the mean adjusted model and the market model. For the "pure" bonus issue announcements, i.e., group BB, the abnormal return at $t=1$ is 0.82 for the mean-adjusted model, and 0.78 for the market model. For the joint bonus issue and dividend announcements, i.e., group DB, the abnormal returns at $t=1$ are 0.75 and 0.84 respectively. Except for the results of group BB from the market model, which is significantly positive at the 10 percent level, all of them are significantly positive at the 5 percent level.

Table 17 lists the results from the regression model, which identifies the associated effect of different changes in dividend. Panel A lists the coefficients of the regression model from the mean-adjusted model while Panel B lists the coefficients of the regression model from the market model. Clearly, only those announcement with both bonus issue and dividend increases, i.e., δ_1 in the model, have a significant incremental effect comparing to other joint announcements, and this incremental effect is captured quickly on the announcement day, and completely compounded into the security price during that trading day.

The results from Table 15, Table 16, and Table 17 reveal that a bonus issue conveys important information, and the market's reaction is significantly positive on the announcement. In particular, for both bonus issue and dividend increase, the incremental effect of dividend increase associated with the "joint" announcement is large and captured quickly. However, the positive effect of bonus issues is compounded into the security price over a two-day announcement period, with a negative adjustment of the stock price occurring after day $t = 1$. In Table 15 and Table 16, we can see that there is a positive residual on day $t = 1$ for both group BB and DB, which turns negative after $t = 1$. It is significantly negative on day $t = 3$ for the group with only bonus issues (the significantly negative effect lasts two trading days in Table 16). No clear reason could be found to explain this pattern of reversals.

To investigate the remaining question, we pool the dividend announcement sample and the bonus issue announcement sample together, i.e., 188 dividend announcements and 41 bonus issue announcements. A regression model is constructed to simultaneously account for the content of the information, and identify the market reaction over the announcement period. The hypothesis of this test will be:

$H_0^{5.5}$: The change of stock returns on the Hong Kong market will correctly reflect the content of information if the efficient market hypothesis holds. That is, the adjusted standardized abnormal returns for the Hong Kong stock are negative when a dividend decrease is announced, and the abnormal standardized abnormal returns are positive when a dividend increase and/or a bonus issue is announced, with the adjustment being captured during that trading period immediately following the announcement.

The regression model is as follows:

$$su_{i,t} = \alpha_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 \tag{5.5.1}$$

$$sv_{i,t} = \alpha_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 \tag{5.5.2}$$

where

$su_{i,t}$: the standardized residuals of security i at time t estimated by the mean-adjusted model;

$sv_{i,t}$: the standardized residuals of security i at time t estimated by the market model;

D_1: the dummy variable for the events with only bonus issue, that is, $D_1 = 1$ for $su_{i,t}$ or $sv_{i,t}$ of group BB and $D_1 = 0$ otherwise;

D_2: the dummy variable for the events associated with decreased dividend announcement, that is, $D_2 = 1$ for $su_{i,t}$ or $sv_{i,t}$ of the group of dividend decrease and the cases in the "joint" announcement associated with a dividend decrease, and $D_2 = 0$ otherwise;

D_3: the dummy variable for the events associated with increased dividend announcement, that is, $D_3 = 1$ for $su_{i,t}$ or $sv_{i,t}$ of the group of dividend increase, and $D_3 = 0$ otherwise;

D_4: the dummy variable for the events associated with both bonus issues and dividend announcements, that is, $D_4 = 1$ for $su_{i,t}$ or $sv_{i,t}$ of the cases in group DB associated with a dividend increase, and $D_4 = 0$ otherwise.

Intercept term α_0, therefore, reflects the mean of abnormal returns for the group of events with no change in dividend while other coefficients, β_1, β_2, β_3 and β_4, reflect incremental effects of different groups with dividend and bonus issue announcements. If the efficient market hypothesis is supported, then we should expect that $\alpha_0 \simeq 0$, $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$, and $\beta_4 > 0$ on the announcement day.

Table 18 presents the results of equation (5.5.1) and (5.5.2), where Panel A shows the results of residuals from the mean-adjusted model, and Panel B shows the results of residuals from the market model. Again, the results in the two tables are close. As expected, the coefficients of all dummy variables are consistent with previous findings. For example, the intercept, reflecting the announcement effect of dividends with no change, is indifferent from zero at the 5 percent level over the announcement period. The coefficients for the bonus issues, β_2, for the "pure" bonus issue, is marginally significantly positive at t = 1, and β_4, for the "joint" bonus issue and dividend increase, is significantly positive at t = 0 for the market model and at t = 1 for the mean-adjusted model. For the dividend change groups, the market reaction upon the dividend decrease is very strong, with a significantly negative effect lasting for 2 days, i.e., t = 1 and t = 2, while the market reaction upon the dividend increase is positive but not significant at the announcement day. The relative weak market reaction to dividend increase and "pure" bonus issues implies, again, that there is some expectation of a dividend increase when a firm announces a dividend. The results from Table 17 and Table 18 indicate that the movement of security prices on the Hong Kong market accurately reflects the publicly available information, though the speed of the adjustment is slower than that on the U. S. market.

5.4. Summary

This study examines the announcement effect of dividend changes and bonus issues on the Hong Kong equity market. It shows that the announcements convey substantial information, and the market makes use of the announcements in assessing the value of a security. The study reveals several interesting facts:

1. The market reaction to the joint announcement of dividend and bonus issue is significantly positive, and it is most positive for the joint announcement of a bonus issue and dividend increase. The incremental dividend increase associated with a bonus issue is captured immediately after the announcement. The market reaction to the announcement of dividend increase, on the other side, is not significant during the announcement period. The fact indicates that the market expects some dividend increase when a firm announces a dividend, and the market interprets a large dividend increase, i.e., a joint announcement of both bonus issue and dividend increase in our test, as a favorable signal implying managerial confidence concerning the firm's future prospects.

2. The market reaction associated with dividend decreases is unambiguously negative. Our study shows that the market reaction to a dividend decrease is significantly negative on the Hong Kong market, with the negative effect covering for two days. The fact that the magnitude of the abnormal returns for dividend decreases is much larger than that for dividend increases, i.e., -0.76 vs. 0.17 for the mean adjusted model at $t = 1$, and -0.89 vs. 0.11 for the market model at $t = 1$, indicating that dividend decreases convey a signal of the firm's pessimistic prospects.

3. It is interesting to note that the evidence found on the Hong Kong equity market concerning the market's reaction to the announcement of cash or stock dividends is similar to what has been found in the U. S. market. Security prices on the Hong Kong market reflect the announcement of dividend changes without bias, although the speed of the adjustment is slower and lasts longer than that in the U. S. market. The results from this study further support the widely accepted position of dividend nontriviality.

Table 13

Residuals of the Stock Returns during the Dividend Announcement Period

(Mean Adjusted Model)

Announcement Date	No Change (59 events)		Decrease (37 events)		Increase (92 events)	
	Mean	t	Mean	t	Mean	t
-2	0.01113 (0.65178)	0.1312 (0.90)	0.39710 (1.17614)	2.0537 (0.05)*	0.05208 (1.10524)	0.4520 (0.65)
-1	0.15904 (0.71303)	1.7133 (0.09)	0.00035 (0.72434)	0.0029 (0.99)	0.03801 (0.82015)	0.4446 (0.66)
0	-0.09441 (0.65476)	-1.1075 (0.27)	0.02819 (1.03784)	0.1652 (0.87)	-0.16634 (2.55946)	-0.6234 (0.53)
1	-0.06026 (0.69088)	-0.6700 (0.51)	-0.76162 (1.46287)	-3.1669 (0.003)*	0.16773 (1.31171)	1.2265 (0.22)
2	0.14936 (0.63239)	1.8142 (0.07)	-0.44866 (2.07188)	-1.3172 (0.20)	0.09041 (0.91270)	0.9501 (0.34)
3	-0.09466 (0.62044)	-1.1719 (0.25)	-0.08685 (0.80609)	-0.6554 (0.52)	-0.21669 (2.60001)	-0.7950 (0.43)
4	-0.00011 (0.47294)	-0.0018 (0.99)	-0.04728 (1.09735)	-0.2621 (0.79)	0.13392 (0.86650)	1.4744 (0.14)

* The numbers in the brackets under the mean are the standard deviations from the mean;
* The numbers in the brackets under the t-value are the probability of a greater absolute value of student's t.

Table 14

Residuals of the Stock Returns during the Dividend Announcement Period

(Market Model)

Announcement Date	No Change (59 events)		Decrease (37 events)		Increase (92 events)	
	Mean	t	Mean	t	Mean	t
-2	-0.05718 (0.73086)	-0.6010 (0.55)	0.36543 (1.32676)	1.6754 (0.10)	0.13801 (1.18802)	1.1142 (0.27)
-1	0.23698 (0.74468)	2.4444 (0.02)*	0.05198 (0.72912)	0.4337 (0.67)	0.12591 (0.90215)	1.3387 (0.18)
0	-0.15617 (0.75034)	-1.5987 (0.12)	0.05495 (1.02312)	0.3267 (0.75)	-0.04771 (1.57891)	-0.2899 (0.77)
1	-0.05948 (0.72797)	-0.6276 (0.53)	-0.88583 (1.50501)	-3.5802 (0.001)*	0.11386 (1.38848)	0.7865 (0.43)
2	0.21047 (0.63294)	2.5542 (0.01)*	-0.42899 (2.05460)	-1.2700 (0.21)	0.05041 (0.90794)	0.5325 (0.60)
3	-0.10803 (0.65449)	-1.2679 (0.21)	-0.09427 (0.78449)	-0.7310 (0.47)	-0.10656 (1.64465)	-0.6181 (0.54)
4	0.02826 (0.44736)	0.4852 (0.63)	-0.03390 (1.03891)	-0.1985 (0.84)	0.07672 (1.03960)	0.7039 (0.48)

* The numbers in the brackets under the mean are the standard deviations from the mean;
* The numbers in the brackets under the t-value are the probability of a greater absolute value of student's t.

Table 15

Residuals of the Stock Returns during the Bonus Issue Annoncement

(Mean Adjusted Model)

Announcement Date	Only Bonus Issue (BB)		Dividend and Bonus Issue (DB)	
	Mean	t	Mean	t
-2	-0.05832	-0.2807	0.08222	0.6002
	(0.65699)	(0.79)	(0.76267)	(0.55)
-1	-0.17302	-1.0263	0.06479	0.3684
	(0.53314)	(0.33)	(0.97915)	(0.72)
0	-0.15370	-0.8266	0.22114	1.2699
	(0.58797)	(0.43)	(0.96958)	(0.21)
1	0.81561	2.3514	0.75727	3.2270
	(1.09687)	(0.04)*	(1.30658)	(0.003)*
2	-0.11945	-0.5348	-0.22535	-1.2221
	(0.70636)	(0.61)	(1.02669)	(0.23)
3	-0.57830	-2.2939	-0.25587	-1.9393
	(0.79722)	(0.05)*	(0.73463)	(0.06)
4	-0.22533	-1.6028	-0.14159	-0.9063
	(0.44456)	(0.14)	(0.86985)	(0.37)

* The numbers in the brackets under the mean are the standard deviations from the mean;
* The numbers in the brackets under the t-value are the probability of a greater absolute value of student's t.

Table 16

Residuals of the Stock Returns during the Bonus Issue Annoncement

(Market Model)

Announcement Date	Only Bonus Issue (BB)		Dividend and Bonus Issue (DB)	
	Mean	t	Mean	t
-2	-0.25498 (1.12179)	-0.7188 (0.49)	0.14129 (0.94942)	0.8286 (0.41)
-1	-0.25097 (0.90387)	-0.8780 (0.40)	0.07397 (1.04393)	0.3945 (0.70)
0	0.15578 (0.75686)	0.6509 (0.53)	0.19749 (1.06785)	1.0297 (0.31)
1	0.78484 (1.28061)	1.9380 (0.08)	0.84183 (1.37060)	3.4197 (0.002)*
2	-0.04036 (0.83811)	-0.1523 (0.88)	-0.14702 (1.31826)	-0.6210 (0.54)
3	-0.38417 (0.52785)	-2.3015 (0.05)*	-0.20262 (0.71714)	-1.5731 (0.13)
4	-0.56921 (0.42571)	-4.2283 (0.002)*	-0.08770 (0.94085)	-0.5190 (0.61)

* The numbers in the brackets under the mean are the standard deviations from the mean;
* The numbers in the brackets under the t-value are the probability of a greater absolute value of student's t.

Table 17

Coefficients of Dividend Changes in "Joint" Announcments

A. Residuals from the Mean Adjusted Model

Day	δ_0	δ_1	δ_2
-2	0.06375 (0.217)	0.10877 (0.314)	-0.23089 (-0.534)
-1	-0.07634 (-0.201)	0.26123 (0.585)	-0.05449 (-0.098)
0	-0.44512 (-1.342)	1.05192 (2.692)*	0.28661 (0.587)
1	0.68796 (1.378)	-0.09002 (-0.153)	0.62812 (0.855)
2	-0.08903 (-0.222)	-0.18239 (-0.386)	-0.15715 (-0.267)
3	-0.36334 (-1.288)	0.05686 (0.171)	0.38469 (0.926)
4	-0.59366 (-1.910)	0.42074 (1.149)	1.07346 (2.346)*

B. Residuals from the Market Model

Day	δ_0	δ_1	δ_2
-2	0.00747 (0.021)	0.34301 (0.818)	-0.33761 (-0.645)
-1	-0.13304 (-0.332)	0.37951 (0.805)	-0.06896 (-0.117)
0	-0.54412 (-1.465)	1.13269 (2.588)*	0.43353 (0.793)
1	0.80704 (1.583)	-0.22845 (-0.380)	0.86511 (1.153)
2	-0.01206 (-0.023)	-0.22755 (-0.376)	-0.01466 (-0.019)
3	-0.60385 (-2.287)*	0.45242 (1.454)	0.71576 (1.842)
4	-0.56818 (-1.672)	0.46112 (1.151)	1.09912 (2.197)*

* : Statistically significant at the 5 percent level;
δ_0 : Intercept refering to both bonus issue and dividend no change;
δ_1 : Coefficent of the dummy 1 refering to both bonus issue and dividend increase;
δ_2 : Coefficent of the dummy 2 refering to both bonus issue and dividend decrease.

Table 18

Coefficients of the Test for Information Content

A. Residuals from the Mean Adjusted Model

Day	α_0	β_1	β_2	β_3	β_4
-2	0.01671 (0.141)	-0.07503 (-0.229)	0.30166 (1.597)	0.03537 (0.227)	0.15581 (0.608)
-1	0.13408 (1.374)	-0.30710 (-1.142)	-0.15203 (-0.979)	-0.09607 (-0.751)	0.05081 (0.214)
0	-0.13161 (-0.611)	-0.02209 (-0.037)	0.13375 (0.390)	-0.03473 (-0.123)	0.73840 (1.588)
1	0.01910 (0.125)	0.79652 (1.887)*	-0.49081 (-2.013)**	0.14863 (0.741)	0.57885 (1.750)*
2	0.12408 (0.886)	-0.24353 (-0.631)	-0.54449 (-2.442)**	-0.03367 (-0.183)	-0.39550 (-1.307)
3	-0.12316 (-0.575)	-0.45514 (-0.770)	0.05141 (0.151)	-0.09353 (-0.332)	-0.18332 (-0.396)
4	-0.06306 (-0.628)	-0.16227 (-0.586)	0.08933 (0.559)	0.19698 (1.494)	-0.10985 (-0.507)

B. Residuals from the Market Model

Day	α_0	β_1	β_2	β_3	β_4
-2	-0.05033 (-0.378)	-0.20465 (-0.558)	0.31870 (1.505)	0.18834 (1.081)	0.40081 (1.395)
-1	0.19774 (1.870)*	-0.44870 (-1.539)	-0.18120 (-1.076)	-0.07183 (-0.518)	0.04873 (0.213)
0	-0.19731 (-1.320)	0.35309 (0.857)	0.22917 (0.963)	0.14960 (0.764)	0.78589 (2.433)**
1	0.03243 (0.199)	0.75241 (1.676)*	-0.56133 (-2.165)**	0.08143 (0.382)	0.54616 (1.553)
2	0.18687 (1.292)	-0.22723 (-0.570)	-0.55973 (-2.430)**	-0.13646 (-0.720)	-0.42648 (-1.365)
3	-0.16062 (-1.110)	-0.22355 (-0.560)	0.09512 (0.413)	0.05407 (0.284)	0.00919 (-0.029)
4	-0.03500 (-0.320)	-0.53421 (-1.773)*	0.07992 (0.459)	0.11172 (0.778)	-0.07206 (-0.305)

* (* *): Statistically significant at the 10 (5) percent level;
α_0 : Intercept referring to dividend no change;
β_1 : Coefficent of the dummy 1 referring to a 'pure' bonus issue;
β_2 : Coefficent of the dummy 2 referring to a dividend decrease;
β_3 : Coefficent of the dummy 3 referring to a dividend increase;
β_4 : Coefficent of the dummy 4 referring to a joint announcement of bonus issue and dividend increase.

Chapter 6

The Transmission of Stock Market Movements among the Hong Kong, the U.S., the Japanese, and the U.K. Market

In recent years, international stock price movements have shown that there exists a substantial degree of interdependence. However, little research has been performed on the direction, strength, and interdependence of these relationships. The purpose of this chapter is to provide an analysis of stock price movement in a small but active market, i.e., the Hong Kong stock market, and examine its relationship with other larger stock markets in the world. Specifically, the study addresses the following issues:

1. Are there any common features of stock returns in terms of the seasonal or daily patterns between the Hong Kong market and other national markets?

2. How much of the movements on the Hong Kong stock market can be explained by innovations in other markets? And how rapidly are the innovations transmitted from one market to the others?

The study is composed of two parts. One is a description of stock returns in terms of the seasonal or daily patterns, and the other is the examination of information transmission among different national stock markets.

6.1. Sample Description

In our study, three different national stock markets are chosen to be compared with the Hong Kong market. They are the U. S. market, the Japanese market, and the U. K. market. As the largest financial markets in the world, the stock return patterns in the U. S. market and the Japanese market should provide a valuable reference for the stock price behavior on the Hong Kong market. Because of the historical relation between Hong Kong and the U. K., the degree of correlation between these two markets will provide a further understanding of stock price movements on the Hong Kong market.

The data to be used in the study, therefore, are market indices of the stock exchanges in Hong Kong, the U. S., Japan, and the U. K.. More specifically, these are the Hang Seng Index (HSI), the value-weighted CRSP market index (including dividends), the Nikkei Stock Average (225 shares) (NSA), and the Financial Time Industrial Ordinary Share Index (100 shares) (FTIO).[5] Except for the Nikkei Stock Average, the data for the three indices is on a daily basis, covering a 19-year period from January 1, 1970 to November 1, 1988. The data for the Nikkei Stock Average also covers the same period, however, the index is on a weekly basis before 1981, while it is on a daily basis after January 26, 1981.

[5] The HSI is provided by the HSI Services Ltd. The NSA and the FTIO are collected by hand through the Japanese Economic Journal and the Financial Time.

6.2. A Description of Stock Returns in Terms of the Seasonal or Daily Patterns for the Four Markets

The efficient market theory suggests that stock prices follow a random walk, and stock returns are independently and identically distributed. Recently this theory has been severely challenged by the evidence of a growing number of 'anomalies' in the U. S. stock market. One of the 'anomalies' deals with the seasonal or daily pattern in stock returns. This systematic pattern in stock returns flies in the face of the efficient market theory in that it allows speculators or short-term stock holders to make profits due to a predictable price pattern. This issue has drawn a great deal of attention in recent years but as of yet there is no convincing explanation for it. However, it is possible that those anomalies are mere illusions, caused by statistical errors or biases in empirical procedures. Our study in this section involves a description of stock returns in terms of the seasonal or daily patterns for the four markets, i.e., Hong Kong, the U. S., Japan, and the U. K.. The purpose of the description is to shed some light on the stock price movements among the four markets, and pave the way for the further analysis in the section III.

The initial test will be conducted using the changes in the stock index expressed as a natural logarithm. As such, the returns of stock index are defined as follows:

$$R_{i,\,t+1} = \ln\,(\text{Index}_{i,\,t+1}) - \ln\,(\text{Index}_{i,\,t}) \qquad i = \text{HSI, CRSP, NSA, FTIO.} \qquad (6.1)$$

To better compare the returns of the four indices, the daily returns are standardized by the standard deviation of the corresponding annual mean. Thus, the standardized returns are expressed as:

$$SR^{i}_{y,\,t} = \frac{R_{i,\,t}}{s^{i}_{y}} \qquad (6.2)$$

where

$SR^i_{y,t}$: the standardized return of index i at time t, i = HSI, CRSP, NSA, FTO, and y = 1, ..., 18, which stands for the 19-year testing period from 1970 to 1988;

s^i_y : the standard deviation from the annual mean for index i at year y.

Table 19 and Fig. 9 to Fig 11 illustrate the seasonal or daily patterns of returns for the four market indices. Panel A of Table 19 lists the standardized monthly returns, the standard deviation from the mean, the t value, and the probability of a greater absolute value of student's t. Fig. 9 compares the monthly returns between the HSI and every other index. We can see that although the return patterns are different from market to market, there are some common features. It is noted that January returns are relatively high for all four indices, and in fact have the highest return during the year on NSA, HSI, and the FTIO. The CRSP index has the largest standard deviation from the mean in January. The index returns for the four markets begin to fall in February, suffering a large drop in April. All four indices' returns then start to raise after May, and drop together after August. The returns of indices raise again after October, (after November for HSI), remaining relatively high until the end of the year (except for the CRSP). Although the magnitudes of monthly returns are quite different, these common features suggest that there exists some interdependence of stock price movements among different national stock markets.

Panel B of Table 19 provides the weekly return patterns for the four indices, while Fig. 10 shows the corresponding return curves. The beginning week in each month includes the first seven days in the month, while the ending week is made up of the last seven days in each month. The remaining days in each month, then, are evenly divided as mid1-week, and mid2-week. The results given on Panel B and Fig. 2 also show some common features in the weekly returns of the four indices. The mean returns and the standard deviations from the mean are relatively high in the beginning week of month for all four indices, though the magnitude is quite different. Except for the HSI, the three indices manifest similar weekly return patterns that are characterized by being higher in the beginning and ending weeks, and lower in the mid weeks, with a concave curve of returns.

This pattern is most strongly reflected in the return pattern of the NSA, with returns of 0.23 and 0.24 at the beginning and the end of the month, and 0.004 and 0.008 in the mid1-week and mid2-week. The finding of extremely high returns on the Japanese market at the turn of the month is similar to Agrawal and Tandon [1990] and Ziemba [1989]. Agrawal and Tandon find that the average returns of the last three days of the month on the Japanese market are 0.282, 0.244, and 0.243, respectively, and Ziemba finds that the average return on the last day of the month is 0.2255 while the average returns on the first and the second day of the month are 0.098 and 0.1006 respectively. Nevertheless, the return pattern of the HSI is somewhat different, with its lowest point at the mid1-week, with the return curve being relatively flat from week to week.

Panel C of Table 19 shows the weekday return patterns of the four market indices. It should be noted that the Japanese stock market operates on alternative Saturdays, and thus its return pattern includes six weekdays. The results provided here are consistent with the past empirical studies such as French [1980] and Jaffe & Westerfield [1985]. There is a return pattern apparent on all four market indices, with a relatively high return over the weekend and a relatively low return at the beginning of the week. Furthermore, every index appears to have a return peak during the middle of the week, on Wednesday. Fig 11 gives us a comparison of the weekday return patterns among those markets. It can be seen that the weekend return patterns are similar for all of the four indices, except for a large drop for the NSA on Tuesday. Therefore, the weekday return patterns, among different national markets, seem more similar than other periodic return patterns, providing a useful evidence that interdependence of stock price movements may exist among different national markets.

Since we find that the weekday return patterns for the HSI is more similar to the patterns of the other three indices than those of monthly and weekly patterns, we further investigate the daily returns of the different indices and examine if this seasonal pattern that occurs on the Hong Kong market is independent of the seasonal patterns found in the other markets. Given that national stock markets generally operate in different time zones with different opening and closing times, stock returns on the different markets on a given calendar day are realized over different real time periods. Hong Kong and Japan are twelve and fourteen hours ahead of New York, and eight and ten hours ahead of London, respectively, and thus it appears a one day lag of stock returns between the Far Eastern market and the Western market. As such, we explicitly consider the different time zones in our study. We use a linear regression model, which is similar to that of Jaffe and Westerfield [1985], to simultaneously account for the market correlations between the HSI and other market indices. The model can be expressed as follows:

$$SR_{H,t} = \alpha_0 + \beta_{i,t-1} SR_{i,t-1} + \beta_{i,t} SR_{i,t} + \beta_{i,t+1} SR_{i,t+1} + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4 \tag{6.3}$$

where

$SR_{H,t}$: standardized daily return of the HSI at time t over the testing period from January 26, 1981 to November 1, 1988,

$SR_{i,t}$: standardized daily return of the index i at time t over the test period, and i = CRSP, NSA, and FTIO,

D_1 : the dummy variable for Monday,

D_2 : the dummy variable for Tuesday,

D_3 : the dummy variable for Wednesday,

D_4 : the dummy variable for Friday.

Since the previous results show that Thursday is relatively more "quiet" than the other weekdays, the constant term, α_0, captures effect associated with Thursday. We should expect that the weekday return pattern on the Hong Kong market will disappear after allowing for the common effects of the other three stock markets, i.e., $\beta_{i,t-1}$, $\beta_{i,t}$, and $\beta_{i,t+1}$, if the weekday return pattern in Hong Kong is consistent with the other markets.

Table 20 lists the results of the regression. The regression has been adjusted for the different time zones. Since the results for the NSA with Saturday returns and without Saturday returns are numerally the same, the results listed in the table is that without Saturday returns. From the table we can see that the coefficients for common effects on time t, i.e., the effect appearing on the same trading day after considering different time zones are significantly positive for all pairs of indices, i.e., $\beta_{i,t}$ for the HSI and the CRSP, the HSI and the NSA, the HSI and the FTIO. After allowing for the common effects of the other three stock markets, the weekday return pattern disappears for the pair between the HSI and the NSA, but still remains significantly negative on Tuesday for the pairs between the HSI and the CRSP, and between the HSI and the FTIO. The results suggest that the weekday return pattern of the Hong Kong market index is quite consistent with that of the Japanese market index; moreover, there does exist a large difference between the pattern found for the Far Eastern market and the Western market on Tuesday which is characterized by a negative relationship.

Based upon the discussion above, we can see that there are some common features between the seasonal or daily patterns of stock returns among the four markets. The results indicate that there exists some degree of interdependence of stock price movements among the different national stock markets.

6.3. Transmission of Stock Return Movements among the Four Markets

The description of stock price movements for the four market in section II reveals that there are some common features appeared to the stock price movements among the different national markets. The study in this section examines the transmission mechanism of stock return movements among the four markets by estimating a four-market vector autoregression (VAR) system, and thereby providing an in-depth analysis of the interdependence structure of national stock markets. The study tries to reveal how innovations are transmitted from one market to the other, and shed light on how the domestic market is explained by stock price movement in the foreign markets by tracing out the international innovation transmission. Therefore, the hypotheses of this study is as follows:

$H_0^{6.1}$: There exists a substantial degree of interdependence of stock price movement among the Hong Kong, the U.S., the Japanese, and the U.K. market.

$H_0^{6.2}$: A substantial part of stock price movement on the Hong Kong market can be explained by innovations in the U.S., the U.K., and the Japanese market because of interdependence among those national markets.

$H_0^{6.3}$: The international innovation transmissions among different national markets are rapid and without delay if the efficient market hypothesis is supported.

6.3.1. The VAR Methodology

The data to be used in our VAR system are the daily rates of returns on four market indices, i.e., the CRSP-Index, NSA, HSI, and FTIO, covering a period from January 26, 1981 to November 1, 1988. Since VAR system requires a consistent data base among the examined variables, we omit the Saturdays in computing returns on the NSA, and on holidays when some markets are closed. Thus, the final data includes 1763 observations for each index over the eight year testing period.

The VAR system is a method of examining the relationship between a set of variables (a vector) and their past values (autoregression). It begins with the concept of a covariance stationary time series, and such a time series can be decomposed into two components: one is a linear combination of its own past value; and the other is a moving average of white noise error. Thus, estimating a four variable VAR system, in our example, involves estimating four equations, with each equation including past values of all four variables on the right hand side. Our VAR model can be expressed as follows:

$$R(t) = Z + A\,\varepsilon(t) \tag{6.4}$$

and

$$E(\varepsilon(t)) = 0$$

$$E(\varepsilon(t), \varepsilon(t-k)) = \begin{cases} \sigma & k = 0 \\ 0 & k \neq 0 \end{cases}$$

where

R (t) : a 4×1 column vector of daily rates of return on the four market indices;

Z : a $4 \times n$ matrix of one-step ahead predicted value of R's, which includes all historical information referring R (t), and n is the length of the lag in the model;

A : a polynomial in the n-lag operator;

$\varepsilon(t)$: the 9×1 column vector of forecast errors of the best linear predictor of R (t) using all the past R (t).

When A is invertible, an autoregressive representation of equation (6.4) exists and can be written as

$$A^{-1}R(t) = A^{-1}Z + \varepsilon(t) \tag{6.5}$$

By moving the lagged returns to the right hand side equation and combining with Z, which is a linear function of lagged R's, we can rewrite (6.5) as follows:

$$R(t) = \sum_{p=1}^{n} B(p)\,R(t-p) + \varepsilon(t) \tag{6.6}$$

The lag length in the model, n, will be infinitive by definition, but in practice it is generally truncated to some number that is both small enough to be computationally feasible and large enough to ensure that the equation residuals are approximately white noise.

Equation (6.6) presents the basic framework of our VAR model. Each regressor $r_i(t)$, an element of the vector R (t), is a linear function of its own lagged values, the lagged values on the other three regressors in the system, and a white noise error term. Thus, each equation in the VAR system treats every variable as being endogenous, and each has two components — its best linear predictor given the information available one period previously, including both domestic and foreign markets, and its linearly unpredictable "innovation".

The innovations, the residuals across equations, are contemporaneously correlated. As shown in (6.6), the basic VAR framework omits contemporary right-hand variables at the estimation stage, and thus any contemporaneous correlation shows up as a correlation among the current innovations in the model. In order to be able to see the distinct patterns of movement that the system may display, it is useful to transform the residuals to orthogonal form, triangulating the system with a certain order of the variables. Therefore, the assumption about this causal ordering of triangulating the VAR system is a decision about admitting current variables into the estimating equations. To distinguish the contemporaneous correlation among the residuals, the variables should be ordered in such a way that a given error affects only errors that are lower in the list, that is, $\varepsilon_j(t)$ affects $\varepsilon_i(t)$ only if $j < i$ in the triangularization of the system. In other words, those variables that respond most to current events should be placed at the bottom of the equation list so that their values reflect contemporaneous realizations of variables of a higher order. Conversely, those variables that are less sensitive to the current innovations of other variables would be placed at the top.

In terms of ordering variables in our model, Fig. 12, a two-day cycle of opening and closing time of the four markets in Hong Kong time, provides some insight. For a given calendar day, stock trading begins on the Japanese market and ends on the U. S. market, and there is a time gap between two sets of markets with overlapping trading time: Japan & Hong Kong and the U.K. & the U.S.. If we set the order according to the calendar time zone, it would be an order of Japan, Hong Kong, the U. K., and the U. S.. However, because the western markets has more influence on the eastern markets in terms of stock price movement, such an order may not appropriately identify the contemporaneous correlation among the markets. We should use an order which reflects both the time zone differences and the mutual influences among the markets. One way to deal with the matter is to explicitly consider a one-day lag between the U. K. and U. S. markets and the Japanese and Hong Kong markets, and set the order such as the U. K., the U. S., Japan, and Hong Kong. Thus, we adjust the return of the FTIO and CRSP-Index at t-1 contemporaneously with the return on the NSA and HSI at t. Therefore, the new system, revised from the basic VAR framework (6.6), can be expressed as follows:

$$R(t) = \sum_{p=1}^{n} B(p)\, R(t-p) + CR(t) + \varepsilon(t) \tag{6.7}$$

where

$$R(t) = \begin{bmatrix} r_{FTIO}(t) \\ r_{CRSP}(t) \\ r_{NSA}(t) \\ r_{HSI}(t) \end{bmatrix}$$

$$B(p) = \begin{bmatrix} b_{FF}(p) & b_{FC}(p) & b_{FN}(p) & b_{FH}(p) \\ b_{CF}(p) & b_{CC}(p) & b_{CN}(p) & b_{CH}(p) \\ b_{NF}(p) & b_{NC}(p) & b_{NN}(p) & b_{NH}(p) \\ b_{HF}(p) & b_{HC}(p) & b_{HN}(p) & b_{HH}(p) \end{bmatrix}$$

and $b_{i,j}$ (i,j = F (FTIO), C (CRSP), N (NSA), H (HSI)) is the coefficient of $r_i(p)$ against $r_j(p)$.

$$R(t-p) = \begin{bmatrix} r_{FTIO}(t-p) \\ r_{CRSP}(t-p) \\ r_{NSA}(t-p) \\ r_{HSI}(t-p) \end{bmatrix}$$

$$C = \begin{bmatrix} 0 & 0 & 0 & 0 \\ c_{CF} & 0 & 0 & 0 \\ c_{NF} & c_{NC} & 0 & 0 \\ c_{HF} & c_{HC} & c_{HN} & 0 \end{bmatrix}$$

and c_{ij} (i,j = F, C, N, H) are the coefficients of $r_i(t)$ upon $r_j(t)$.

In our final model, the first regressor, $r_{FTIO}(t)$, is left unaltered from the basic VAR framework, that is, no contemporaneous value of the variables is added into the equation, while the following three regressors include the contemporaneous value of the previous regressor (regressors) on the right. An equivalent way to think of what is being done is that, through an adjusted time cycle of opening and closing time of the four markets, we assume innovation occurred on the U. K. market to disturb all other three markets instantly, while the U. K. market is only affected by the one-day lagged shocks of the other three markets. Similarly, a shock from the U. S. market would affect the Japanese and the Hong Kong market instantly, while it is disturbed by an instant shock from the U. K. market, and one-day lagged shocks from the Japanese and the Hong Kong market. Finally, the Hong Kong market responses to all instant shocks from other three markets but affects the other markets with a one-day lag.

The element of B (p) or C in the model represents the response of ith market in p periods or the contemporaneous period upon a random shock in the jth market. Because the model treats all variables as being endogenous, the variation of the response of ith market upon a unit random shock in the jth market is a component of the innovation explaining that random shock, i. e., the variance of the forecast error. This decomposition of the innovation provides a measure of the overall relative importance of the compared markets in the model in exerting influence on the stock price movement of their own and other markets. As Eun and Shim [1989] note in their study that "if one stock market is causally prior to other markets in the sense that the price movements of the market affect subsequent price movements in other markets, but are not affected by price movements of other markets in early periods, then the forecast errors of future returns of this influential market should be mostly accounted by its own innovations, and should not be explained substantially by the innovations of the other market."

The following empirical results will present the degree of interdependence among the four markets and innovation transmission from one market to the other. It will answer the question that how much of the stock movements on the Hong Kong market can be explained by innovations of foreign markets.

6.3.2. Empirical Results

As Eun and Shim [1989] have shown, there is little feedback to the current stock market returns from returns lagged more than 15 days. Thus, the lag length of VAR in our model is chosen to be 15 trading days, which is equivalent to three weeks.

Table 21 and Table 22 present the contemporaneous correlation of residual returns among the four markets. The residual returns are estimated by equation (6.6). Since our first estimating model, equation (6.6), does not include contemporaneous values of the variables, the residuals or innovations represent the abnormal returns to those different stock markets which are not predicted on the basis of available information reflected in the past returns. Furthermore, because our model considers all variables as being endogenous, the contemporaneous correlations of the residual returns manifest the degree to which new information producing an abnormal return in one market is shared by the other markets instantly.

Table 21 reports the correlation based on the whole test period, covering from January 26, 1981 to November 1, 1988, while Table 22 reports the correlation on a yearly base. As expected, we can see from the tables, the contemporaneous correlation is higher for markets located relatively close, for example, Japan & Hong Kong and the U. K. & the U. S.. Thus, this higher correlation between each pair of markets might be explained by their geographic location, similar economic system or environment, and their overlapping trading hours. However, the magnitudes of the contemporaneous correlations between the markets are quite unstable from year to year. For example, the correlation of the residual returns between the U. K. and the U. S. are 2.96 % in 1985 and 59.88% in 1987, while the correlation between the U. K. and Hong Kong are -1.3 % in 1985 and 45.33% in 1987. It seems that all four markets have the lowest contemporaneous correlation between each other in 1985 and the highest correlation in 1987. This high level of contemporaneous correlation among the various markets in 1987 may be the result of the stock market crash that year; however, the low level of correlation in 1985 is hard to explain. Comparing the two tables, we can find that the correlation of residual returns derived from the whole testing period, reported in Table 21, provides a general level of interdependences among the markets, while correlation on an annual basis as presented in Table 22 records the movements of the interdependences among the markets, and thus more accurately reflects the relationship of the different stock markets.

Because of the unstable correlation among the different markets, and the fact that the VAR methodology is based upon the concept of a covariance stationary time series, we will develop our VAR model on a yearly basis. Table 23 reports, on a yearly basis, the decomposition of 2-day, 5-day, 10-day, 15-day, and 20-day ahead forecasts of stock market returns into fractions that are accounted for by innovations in different markets. The results provide information as to how innovations are transmitted from one market to the other. As Table 23 shows, no one market can fully explain its variance by its own innovation, instead, a substantial fraction of the error variance is contributed by the innovations in foreign markets. As expected, the amount of innovation transmission is not stable over time, and it is related to the degree of the contemporaneous correlation of the residual returns. For example, the amount of innovations explained by foreign markets for each domestic market in a 20-day horizon was relatively small in 1985, with a range from 16.46 % for the U. S. market to 29.21% for the Japanese market. However, the amount of innovations explained by foreign markets in 1987 was extremely large, with a range from 54.49% for the U.S. to 81.98% for Hong Kong. These results, which are consistent with the movement of the correlation of residual returns presented in Table 4, imply that the contemporaneous correlation among the markets is a barometer for the transmission of innovation among the markets. Furthermore, this interdependence among national markets is sensitive to worldwide events. The stock market crash in 1987 inspired foreign market innovations accounting for the error variance of the domestic market up to 82% for Hong Kong, and two thirds for Japan and the U.K..

The results in the Table 23 confirm the fact that the U.S. market is consistently the most influential among the four markets during the testing period. Column 4 of the table lists the innovations of the U.S. market which explain the error variance of the three other markets, and they are absolutely larger than that of any other markets. Furthermore, the average innovation over the test period that the U.S. market accounts for the foreign market innovations (listed at the last column of Table 23) is 46.63 percent for the U.K. market, 47.25 percent for the Japanese market, and 37.25 percent for the Hong Kong market in a 20-day horizon, with all of them far above one third. This fact shows up in both the large explanation provided by the U.S. market and the efficient reaction of the U.S. market to other innovations. The U.S. market, in general, accounts for the largest fraction of the error variance in a 2-day horizon, with an average of 17.28% comparing to an average of 6.5% for the U.K., 2.33% for Japan, 2.25% for Hong Kong. On the other hand, the U.S. innovations contribute the largest amount of its own variance and no other market can match it in such a substantial degree.

In terms of the degree of the exogenous nature of the other three markets, there is significant instability over the periods and markets, with the U.K. market playing a larger role in explaining the error variance of other markets.

The explanation of the stock price movement on the Hong Kong market given by the foreign markets is not constant across the testing period. It is about 20% to 30% before 1987. It soars to 82% in 1987 and returns back to one third in 1988. The results indicate that the Hong Kong market is highly vulnerable to external factors. Further examination of the innovations of foreign markets reveals that the U.S. market exerts the largest influence on the Hong Kong market, while the influence from the U.K. and the Japanese market is similar, with a percentage of 37.25% given by the U.S. market, 33.25% by the U.K. market, and 29.5% by the Japanese market in a 20-day horizon. The Hong Kong market appears to be more of a follower among the four markets, and its performance is closer to that of the Japanese market than to the others.

To obtain additional insight into the mechanism of international transmission of stock market movements, we examine the pattern of dynamic responses of each of the four market to innovations in the U.S. and the Hong Kong market using the simulated responses of the estimated VAR system. Table 24 reports the results, and Fig. 13 & Fig 14 provide the standardized impulse responses of the other three markets to a typical shock, i.e., positive residuals of one standard deviation unit, in the U.S. and the Hong Kong market respectively. Since the Japanese, the Hong Kong and the U.K. market are closed or almost closed when the U.S. market opens, those three markets react to a shock from the U.S. market with a one-day lag. On the other hand, a one-day lag is not associated with a shock from the Hong Kong market because the Hong Kong market opens before the Japanese market closes, and it closes before the U.K. and the U.S. market open. Therefore, excluding the effect of different time zones, the transmission of the innovation among the markets is without delay. Fig. 13 and Fig 14 also indicate that impulse responses of the shock are absorbed within two or three days for the shock from the U.S. and one or two days for the shock from the Hong Kong market. Another interesting fact is that the magnitudes of the impulse response to different markets, the U.S. and Hong Kong, are very different. The standardized impulse responses to a typical shock from the U.S. market are 0.35% for Japan and 0.32% for the U.K., however, the similar responses to the shock from the Hong Kong market are 0.11% for Japan and 0.07% for the U.K., which are two thirds or three fourths less than the response to the U.S. shocks. This fact provides further evidence that the U.S. holds a leading position among the four markets.

6.4. Summary

In sum, our results support the hypotheses, indicating that a substantial degree of interdependence exists among the four national markets, and the transmission of innovation among the markets are efficient and significant. The description of the seasonal or daily pattern of stock returns reveals some common features among the four markets. The analysis of VAR indicates that there exists contemporaneous correlations between the forecast errors of future returns among the four national stock markets, and that the U.S. market is the most influential market in terms of its capability to account for the error variances of other markets. Foreign markets explain the stock price movement on the Hong Kong market up to a range of one-third, and 1987 results indicate that it is highly vulnerable to major international stock price movements. Among the foreign markets examined, the U.S. market is a most influential market relative to the Hong Kong market.

Table 19

Return Patterns of CRSP-Index, NSA, HSI, and FTIO

A. Monthly Return Patterns

Month	CRSP-Index		NSA		HSI		FTIO	
	Mean	t	Mean	t	Mean	t	Mean	t
Jan	0.136567	1.6968	0.327604	4.3030	0.166902	3.2171	0.150567	2.8455
	(0.350819)	(0.1069)	(0.324039)	(0.0004)	(0.226135)	(0.0047)	(0.230649)	(0.0107)
Feb	0.065286	1.3185	0.162746	1.7163	0.067128	1.2964	0.057806	1.0653
	(0.215828)	(0.2038)	(0.373322)	(0.1042)	(0.225696)	(0.2111)	(0.236533)	(0.3008)
Mar	0.071977	1.4828	0.190694	2.3694	-0.038436	-0.9929	0.045610	0.8035
	(0.211580)	(0.1554)	(0.350314)	(0.0299)	(0.168728)	(0.3338)	(0.247417)	(0.4321)
Apr	0.047226	0.8715	0.173242	1.6909	0.086296	1.4772	0.137066	3.247
	(0.236205)	(0.3949)	(0.433859)	(0.1091)	(0.254634)	(0.1568)	(0.184000)	(0.0044)
May	0.009812	0.2020	-0.052423	-0.5572	0.033661	0.7554	-0.089060	-1.8693
	(0.211684)	(0.8421)	(0.435570)	(0.5846)	(0.194233)	(0.4597)	(0.207668)	(0.0779)
Jun	0.089966	2.1557	0.155066	2.0663	0.084592	1.7429	-0.039962	-0.7304
	(0.181909)	(0.0448)	(0.330030)	(0.0534)	(0.211566)	(0.0984)	(0.232130)	(0.4750)
Jul	-0.020048	-0.4075	0.043007	0.4941	0.060505	1.2692	-0.018016	-0.4527
	(0.214459)	(0.6884)	(0.400358)	(0.6271)	(0.207801)	(0.2205)	(0.168827)	(0.6564)
Aug	0.112357	1.8209	0.012002	0.0688	-0.000080	-0.0015	0.060889	1.3519
	(0.268966)	(0.0853)	(0.455433)	(0.9458)	(0.238089)	(0.9988)	(0.196323)	(0.1931)
Sep	-0.040201	-0.7975	0.014234	0.1141	-0.054628	-0.8477	-0.055909	-0.9918
	(0.219710)	(0.4355)	(0.417893)	(0.9103)	(0.280892)	(0.4077)	(0.245724)	(0.3344)
Oct	-0.010765	-0.1388	0.002158	0.0569	0.076176	0.9872	-0.036205	-0.605
	(0.338054)	(0.8911)	(0.539513)	(0.9552)	(0.336367)	(0.3366)	(0.260863)	(0.5527)
Nov	0.154344	2.3369	0.072460	0.76455	-0.062175	-0.8826	0.009290	0.1303
	(0.287895)	(0.0312)	(0.444204)	(0.4544)	(0.307068)	(0.3890)	(0.302505)	(0.8978)
Dec	0.110574	2.2697	0.236925	2.5448	0.147740	2.7926	0.062133	1.4382
	(0.206687)	(0.0365)	(0.387380)	(0.0203)	(0.224453)	(0.0124)	(0.183287)	(0.1685)

*The value in the bracket under the mean is the standard deviation from the mean, and the value in the bracket under the t value is the probability of a greater absolute value of student's t.

* The t value is under the null hypothesis that the mean is equal to zero.

Table 19

(continue)

B. Weekly Return Patterns

Week	CRSP-Index		NSA		HSI		FTIO	
	Mean	t	Mean	t	Mean	t	Mean	t
1	0.135486 (0.543440)	3.7563 (0.0002)	0.230717 (0.941411)	3.6102 (0.0003)	0.079519 (0.457279)	2.6199 (0.0093)	0.081539 (0.454501)	2.6851 (0.0077)
2	0.038443 (0.502570)	1.1499 (0.2514)	0.004362 (0.725753)	0.089 (0.9291)	0.033466 (0.424549)	1.1850 (0.2372)	0.005513 (0.442791)	0.1859 (0.8526)
3	0.016692 (0.472609)	0.5310 (0.5960)	0.00766 (0.849791)	0.13168 (0.8953)	0.036876 (0.393884)	1.4074 (0.1606)	-0.018552 (0.457072)	-0.6075 (0.5441)
4	0.070063 (0.490081)	2.1492 (0.0327)	0.241022 (0.828441)	4.34743 (0.0001)	0.041337 (0.507034)	1.2256 (0.2216)	0.036164 (0.435924)	1.2416 (0.2156)

C. Weekday Return Patterns

Week Day	CRSP-Index		NSA		HSI		FTIO	
	Mean	t	Mean	t	Mean	t	Mean	t
Mon	-0.11526 (0.62885)	-1.6997 (0.0929)	0.07794 (0.66938)	1.1048 (0.2724)	-0.12588 (0.62632)	-1.8639 (0.0657)	-0.0693 (0.52516)	-1.2097 (0.2298)
Tue	0.08854 (0.44371)	1.8613 (0.0661)	-0.12573 (0.43502)	-2.3891 (0.0191)	-0.05582 (0.40152)	-1.2967 (0.1981)	0.0149 (0.46772)	0.2931 (0.7701)
Wed	0.12969 (0.45293)	2.6553 (0.0095)	0.27414 (0.44191)	5.1909 (0.0001)	0.10711 (0.37988)	2.6148 (0.0105)	0.1281 (0.47822)	2.4549 (0.0161)
Thu	0.07319 (0.45023)	1.5076 (0.1354)	0.00385 (0.46732)	0.0704 (0.9440)	0.04434 (0.46770)	0.8792 (0.3817)	0.04117 (0.48094)	0.7845 (0.4349)
Fri	0.13330 (0.42722)	2.8936 (0.0048)	0.05790 (0.37095)	1.3107 (0.1935)	0.11606 (0.46617)	2.3088 (0.0233)	0.1133 (0.48207)	2.1547 (0.0340)
Sat			0.21950 (0.47964)	4.1944 (0.0001)				

*The value in the bracket under the mean is the standard deviation from the mean, and the value in the bracket under the t value is the probability of a greater absolute value of student's t.

* The t value is under the null hypothesis that the mean is equal to zero.

* The test period of weekday return for NSA is from Jan. 26, 1981 to Nov. 1, 1988.

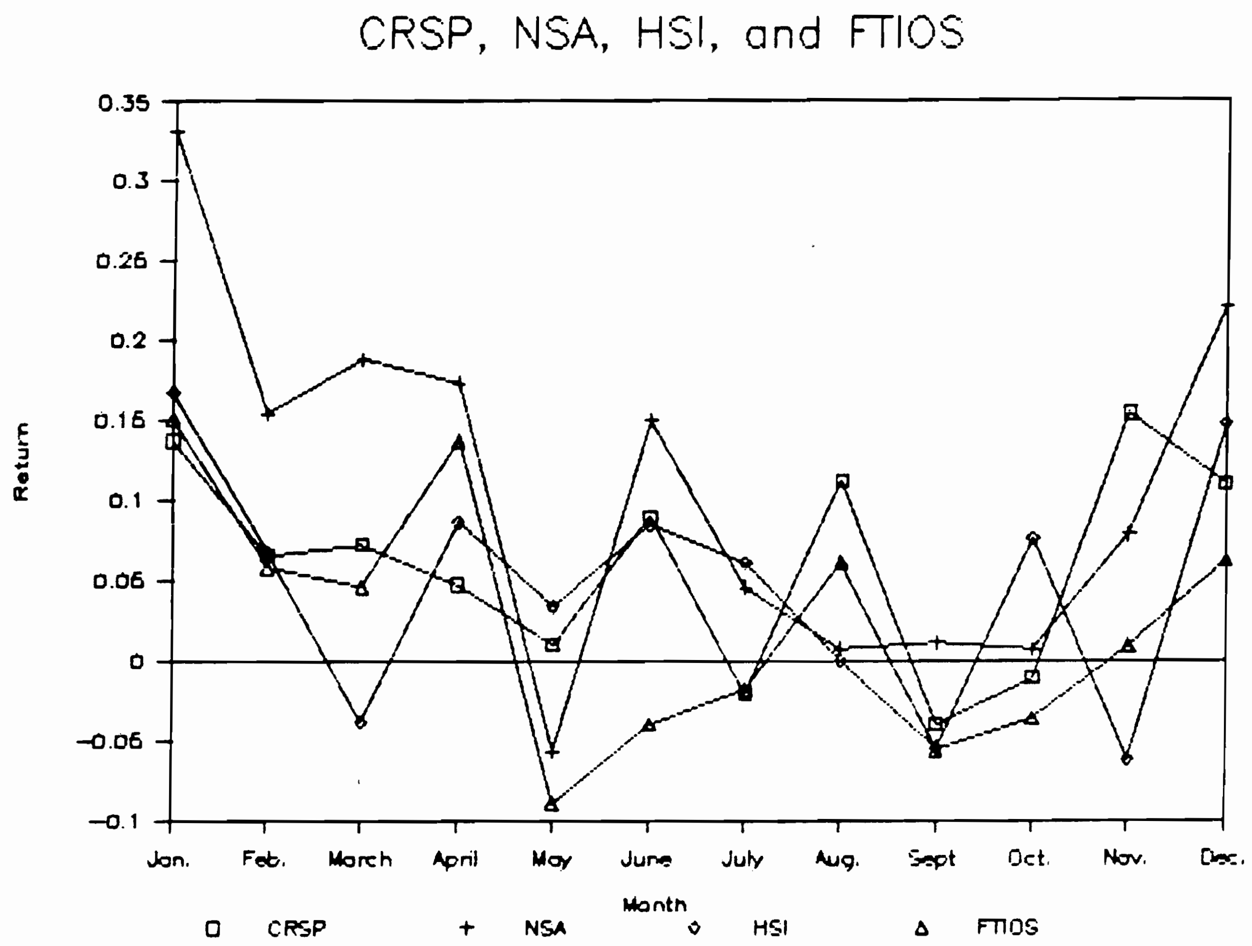


Figure 9. **Monthly Return Patterns among the Stock Markets of Hong Kong, Japan, the U.K., and the U.S.**

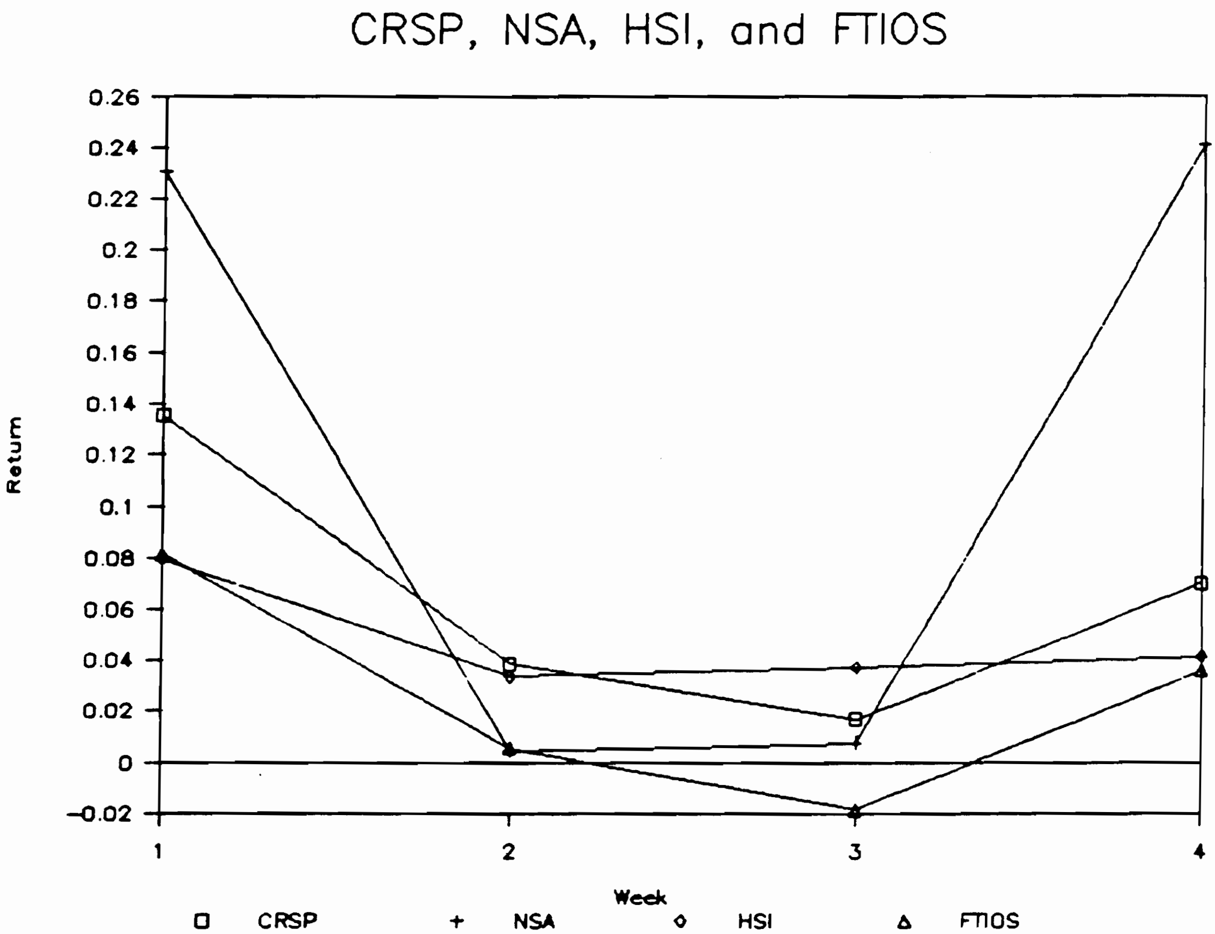


Figure 10. **Weekly Return Patterns among the Stock Markets of Hong Kong, Japan, the U.K., and the U.S.**

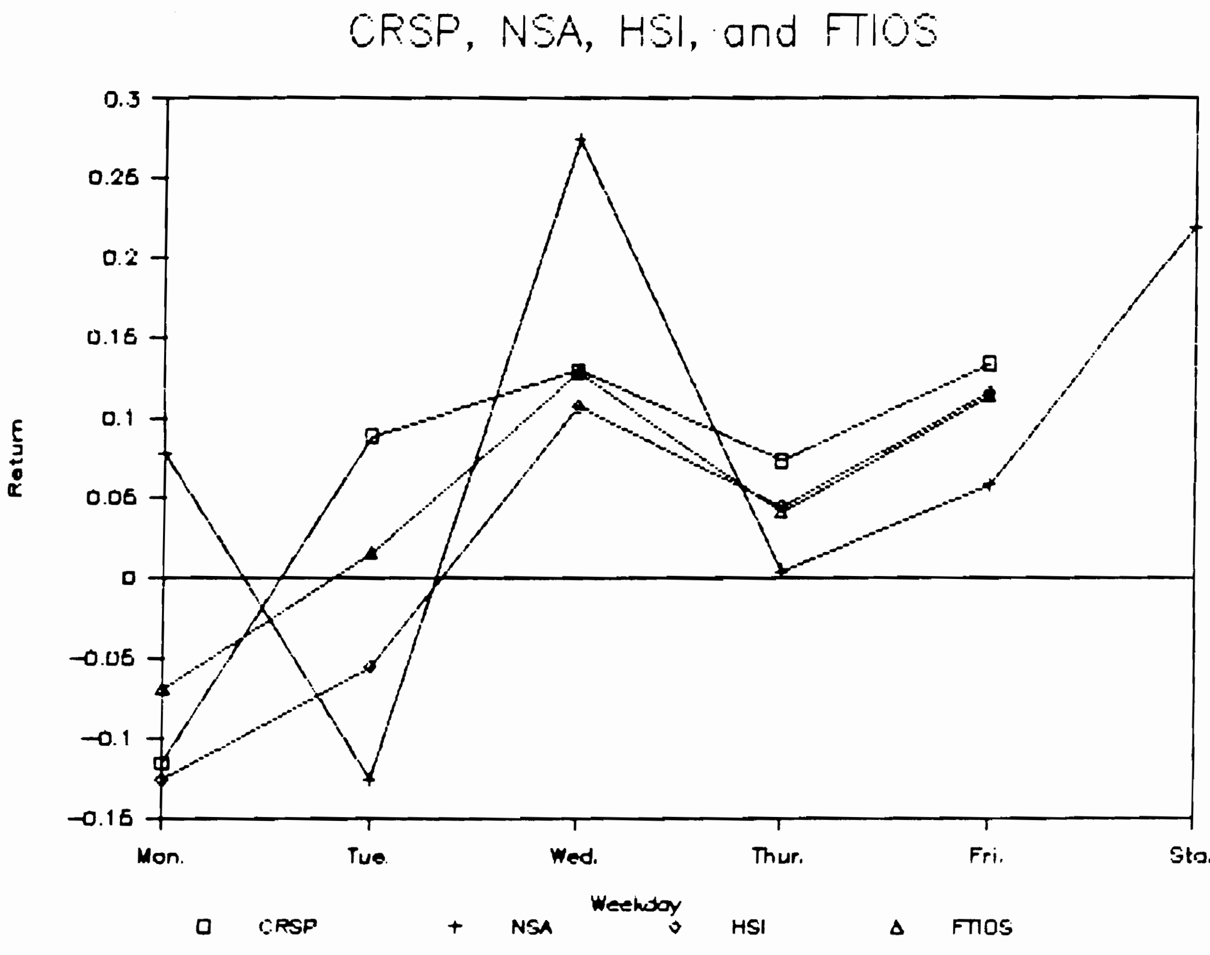


Figure 11. Weekday Return Patterns among the Stock Markets of Hong Kong, Japan, the U.K., and the U.S.

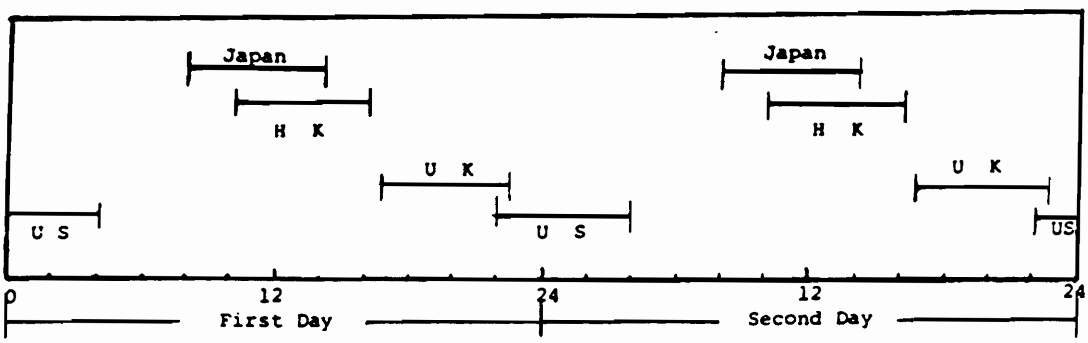


Figure 12. A Two-day Cycle of Opening and Closing Time of the Four Markets in Hong Kong Time

Table 20

Test for Equality of Mean Stock Return between Hong Kong and Other Three Market across Weekdays after Allowing for the Common Factors

Coefficient	HK&US	HK&Japan	HK&UK
α_0	0.03163 (0.648)	0.06442 (1.257)	0.03748 (0.756)
$\beta_{i,t-1}$	0.05555 (2.243)*	0.03190 (1.189)	0.06148 (2.483)*
$\beta_{i,t}$	0.22844 (8.801)*	0.15760 (5.512)*	0.14374 (5.728)*
$\beta_{i,t+1}$	0.04190 (1.600)	0.02207 (0.769)	0.07860 (3.039)*
δ_1	-0.11364 (-1.110)	0.03313 (0.310)	-0.10580 (-1.016)
δ_2	-0.22226 (-2.179)*	-0.10153 (-0.952)	-0.20694 (-1.992)*
δ_3	0.04465 (0.641)	-0.08342 (-1.120)	0.05630 (0.795)
δ_4	0.02885 (0.416)	-0.03093 (-0.421)	0.02575 (0.365)

* $SR_{H,t} = \alpha_0 + \beta_{i,t-1} SR_{i,t-1} + \beta_{i,t} SR_{i,t} + \beta_{i,t+1} SR_{i,t+1} + \delta_1 D_1 + \delta_2 D_2 + \delta_3 D_3 + \delta_4 D_4$, where $SR_{H,t}$ is standardized returns of HSI at time t, and $SR_{i,t}$ is standardized returns of CRSP-Index, NSA, and FTIO at time t. The dummy variables stand for Monday, Tuesday, Wednesday, and Friday respectively.

* The * stands for statistically significant at 5% level.

Table 21

The Correlation Matrix of Residual Returns after Considering Time Difference

(Jan. 26, 1981 - Nov. 1, 1988)

	US	Japan	HK	UK
US	1.00000	0.13630	0.14665	0.37288
Japan		1.00000	0.19402	0.24843
HK			1.00000	0.18624
UK				1.00000

Table 22

Annually Correlation Matrix of Residual Returns after Considering Time Difference

(Jan. 26, 1981 - Nov. 1, 1988)

		US	Japan	HK	UK
US	81	1.00000	-0.00337	0.13871	0.23592
	82		0.13012	0.17790	0.32823
	83		0.02845	0.02066	0.19515
	84		0.14293	-0.01894	0.28967
	85		0.04300	-0.01859	0.02961
	86		0.13079	0.06838	0.37917
	87		0.19378	0.31625	0.59878
	88		0.13598	0.15643	0.49924
Japan	81		1.00000	0.21817	0.29777
	82			0.24798	0.16386
	83			0.10049	0.24726
	84			0.20018	0.21947
	85			-0.06100	0.08795
	86			0.08898	0.18769
	87			0.29092	0.37885
	88			0.36718	0.21699
HK	81			1.00000	0.14383
	82				0.19991
	83				0.10902
	84				0.09821
	85				-0.01336
	86				-0.01869
	87				0.45334
	88				0.22865
UK					1.00000

Table 23

Accounting National Stock Market Innovations

Market Explained	Horizon (in days)	By Innovation UK	US	Japan	HK	Sum of Foreign Markets
			(1981)			
UK	2	78.47	17.91	3.59	0.03	21.53
	5	75.95	18.60	4.93	0.52	24.05
	10	72.25	17.50	8.53	1.72	27.75
	15	67.98	19.07	9.62	3.33	22.02
	20	66.77	19.43	10.07	3.73	33.23
US	2	3.64	95.08	0.94	0.34	4.92
	5	4.16	90.72	1.83	3.29	9.28
	10	7.85	85.56	2.98	3.61	14.44
	15	10.35	78.78	5.11	5.76	21.22
	20	10.93	77.65	5.32	6.10	23.35
Japan	2	2.11	9.13	86.43	2.33	13.57
	5	5.02	10.18	79.77	5.03	20.23
	10	6.08	13.81	72.96	7.15	27.04
	15	8.42	14.75	68.32	8.51	31.68
	20	9.31	15.12	67.09	8.48	32.91
HK	2	1.95	6.08	2.35	89.62	10.38
	5	3.27	10.56	3.12	83.05	16.95
	10	6.85	10.15	6.86	76.14	23.86
	15	8.66	10.79	7.50	73.05	26.95
	20	9.01	11.49	8.69	70.81	29.19
			(1982)			
UK	2	89.40	9.01	1.01	0.58	10.60
	5	80.26	14.86	4.00	0.88	19.74
	10	73.96	13.75	6.87	5.42	26.04
	15	69.80	13.62	10.32	6.26	30.20
	20	66.62	13.33	10.39	9.66	33.38
US	2	7.17	90.54	1.25	1.04	9.46
	5	7.54	84.05	5.42	2.99	15.95
	10	7.96	74.00	6.32	11.72	26.00
	15	8.71	69.19	8.05	14.04	30.81
	20	8.89	67.42	8.79	14.90	32.58
Japan	2	4.80	15.27	79.91	0.02	30.09
	5	5.71	14.81	75.28	4.20	24.72
	10	7.33	14.37	72.78	5.52	27.22
	15	8.95	14.96	70.10	5.99	29.90
	20	9.47	15.04	69.41	6.08	30.59
HK	2	3.05	5.30	1.09	90.56	9.44
	5	3.53	5.95	3.23	87.29	12.71
	10	4.74	7.20	5.28	82.78	17.22
	15	6.18	8.99	6.27	78.56	21.44
	20	6.18	9.02	7.18	77.62	22.38

(Continue)

Market Explained	Horizon (in days)	UK	US	By Innovation Japan	HK	Sum of Foreign Markets
			(1983)			
UK	2	91.77	3.77	0.67	3.79	8.23
	5	85.84	6.07	4.24	3.85	14.16
	10	78.94	8.72	5.94	6.40	21.06
	15	73.83	10.87	6.59	8.71	26.17
	20	71.93	11.08	6.85	10.14	28.07
US	2	4.71	94.52	0.71	0.06	5.48
	5	5.52	89.99	0.94	3.55	10.01
	10	8.32	82.25	2.41	7.02	17.75
	15	8.79	79.70	4.33	7.18	20.30
	20	9.39	77.73	4.94	7.94	22.27
Japan	2	1.11	1.22	96.10	1.57	3.90
	5	1.12	3.68	91.00	4.20	9.00
	10	1.75	5.27	84.50	8.48	15.10
	15	2.26	10.01	79.79	7.94	20.21
	20	2.92	10.63	77.00	9.45	23.00
HK	2	0.33	0.13	1.94	97.60	2.40
	5	1.42	1.72	2.71	94.15	5.85
	10	4.18	4.25	5.76	85.81	14.19
	15	5.65	7.43	7.04	79.88	20.12
	20	6.28	8.54	7.59	77.59	22.41
			(1984)			
UK	2	85.22	13.62	1.01	0.15	14.78
	5	79.39	15.43	2.00	3.18	20.61
	10	71.85	14.30	5.33	8.52	28.15
	15	66.78	15.63	5.89	11.70	33.22
	20	65.43	16.34	6.25	11.98	34.57
US	2	7.18	92.53	0.18	0.11	7.47
	5	8.03	88.30	1.79	1.88	11.70
	10	8.25	84.99	2.83	3.93	15.01
	15	8.48	80.70	5.61	5.21	19.30
	20	9.43	77.80	6.86	5.91	22.20
Japan	2	7.14	12.99	79.35	0.52	20.65
	5	7.24	13.37	78.15	1.24	21.85
	10	7.22	14.05	70.39	8.32	29.61
	15	7.63	14.05	67.91	10.41	32.09
	20	8.14	14.47	66.38	11.02	33.62
HK	2	6.64	5.25	0.81	87.30	12.70
	5	7.03	7.29	1.12	84.56	15.44
	10	9.40	9.90	4.29	76.41	23.59
	15	9.55	12.61	5.49	72.35	17.65
	20	9.43	14.66	5.81	70.10	29.10

(Continue)

Market Explained	Horizon (in days)	UK	US	By Innovation Japan	HK	Sum of Foreign Markets
			(1985)			
UK	2	94.10	5.80	0.08	0.02	5.90
	5	87.65	7.66	2.21	2.48	12.35
	10	82.76	8.78	5.10	3.36	17.24
	15	80.08	9.88	5.14	4.90	19.92
	20	79.30	10.02	5.45	5.23	20.70
US	2	0.09	99.60	0.00	0.31	0.40
	5	0.52	93.54	2.64	3.30	6.46
	10	2.30	87.18	4.30	6.22	12.82
	15	4.17	84.03	5.28	6.52	15.97
	20	4.23	83.54	5.73	6.50	16.46
Japan	2	2.15	9.56	88.27	0.02	11.73
	5	2.67	11.75	84.28	1.30	15.72
	10	5.18	14.36	78.63	1.83	21.37
	15	9.20	14.38	71.93	4.48	28.07
	20	9.87	14.22	70.79	5.12	29.21
HK	2	0.54	5.72	1.70	92.04	7.96
	5	2.33	6.52	3.01	88.14	11.86
	10	3.50	6.53	6.27	83.70	16.30
	15	5.66	7.25	7.75	79.34	20.66
	20	6.66	7.26	8.44	77.66	22.34
			(1986)			
UK	2	90.78	7.78	0.28	1.16	9.22
	5	86.82	9.38	2.10	1.70	13.18
	10	82.07	10.79	5.02	2.12	17.93
	15	77.89	11.68	4.81	5.62	22.11
	20	77.17	11.88	5.19	5.76	22.87
US	2	10.17	89.27	0.00	0.56	10.73
	5	11.46	85.88	1.91	0.75	14.12
	10	12.74	79.98	4.65	2.63	20.02
	15	13.08	78.77	4.62	3.53	21.23
	20	13.47	77.56	5.20	3.77	22.44
Japan	2	0.13	9.73	90.13	0.01	9.87
	5	0.67	13.89	84.94	0.50	15.06
	10	2.07	14.03	79.83	4.07	20.17
	15	4.51	15.70	75.46	4.33	24.54
	20	5.06	15.77	74.46	4.71	25.54
HK	2	0.64	0.01	0.01	99.34	0.66
	5	2.30	0.74	2.44	94.52	5.48
	10	5.56	2.06	4.31	88.07	11.93
	15	6.80	3.75	7.61	81.85	18.15
	20	8.12	4.58	7.72	79.58	20.42

(Continue)

Market Explained	Horizon (in days)	By Innovation UK	US	Japan	HK	Sum of Foreign Markets
			(1987)			
UK	2	48.59	39.23	11.96	0.22	51.41
	5	48.96	32.31	15.31	3.42	51.04
	10	38.98	34.87	19.48	6.67	61.02
	15	36.87	34.85	19.40	8.88	63.13
	20	34.88	36.76	18.94	9.41	65.12
US	2	36.67	63.03	0.13	0.17	36.97
	5	35.36	53.70	8.09	2.85	46.30
	10	33.75	49.50	11.84	4.91	50.50
	15	31.44	44.46	16.45	7.66	55.54
	20	30.04	45.51	16.62	7.83	54.49
Japan	2	26.71	34.56	37.71	1.02	65.44
	5	25.30	36.61	35.54	2.55	63.40
	10	22.10	34.82	34.61	8.47	65.39
	15	21.37	32.62	35.54	10.47	64.46
	20	20.37	36.02	33.52	10.10	66.48
HK	2	8.38	29.79	14.32	47.51	52.49
	5	32.51	39.13	14.94	13.42	86.58
	10	32.24	34.39	16.98	16.40	83.60
	15	30.54	33.81	17.45	18.21	81.79
	20	29.87	33.48	18.63	18.02	81.98
			(1988)			
UK	2	87.39	3.89	4.41	4.31	12.61
	5	82.13	5.04	6.46	6.37	17.87
	10	74.49	8.63	6.77	10.11	25.51
	15	67.53	10.96	7.62	13.89	32.47
	20	65.75	11.16	9.40	13.69	34.25
US	2	9.12	84.80	4.13	1.95	15.20
	5	12.02	80.61	4.90	2.47	19.39
	10	11.82	75.53	6.29	6.36	24.47
	15	13.17	71.19	7.27	8.37	28.81
	20	13.44	69.58	8.10	8.88	30.42
Japan	2	3.90	5.69	82.38	8.03	17.62
	5	4.52	6.65	79.70	9.13	20.30
	10	7.27	7.35	75.23	10.15	24.77
	15	8.47	7.66	72.63	11.24	27.37
	20	8.66	8.55	70.51	12.28	29.49
HK	2	7.67	5.89	3.37	83.07	16.92
	5	9.70	8.43	3.53	78.34	21.66
	10	11.70	9.19	4.33	74.78	25.21
	15	12.59	10.15	7.67	69.59	30.41
	20	13.19	11.16	7.63	68.02	31.98

Table 24

Impulse Responses to the Unit Shock in the U. S. and Hong Kong Market

A. Impulse Responses to the Unit Shock in the U. S. Market

ith Day After Shock	Impulse Responses in US	Japan	HK	UK
1	1	0.026204	0.056082	0.22371
2	0.12019	0.35056	0.219453	0.31797
3	0.02038	0.117555	0.08362	-0.16953
4	0.00895	-0.04093	0.024994	0.06061
5	0.00969	0.037132	0.059942	-0.0108
6	-0.00397	-0.00212	0.036907	-0.00536
7	0.03498	0.057836	0.021374	0.00644
8	-0.04863	0.035726	-0.02886	0.03606
9	-0.01569	-0.02452	0.000967	-0.03056
10	-0.04182	-0.03963	-0.03481	0.03001
11	-0.00919	-0.0104	-0.03582	-0.00104
12	-0.00367	-0.01532	-0.00265	-0.00593
13	0.03676	-0.03409	-0.00713	0.00255
14	-0.00104	0.033956	-0.06585	0.02168
15	-0.01042	0.03175	-0.01921	-0.01591
16	0.0519	0.024463	0.08083	-0.00344

B. Impulse Responses to the Unit Shock in the Hong Kong Market

ith Day After Shock	Impulse Responses in HK	US	Japan	UK
1	1	0.056082	0.115804	0.074231
2	0.00962	-0.02742	-0.05089	0.015023
3	0.02168	0.032761	-0.00318	0.05328
4	0.08394	-0.06343	0.057932	0.015195
5	0.0244	-0.03850	-0.08319	-0.02655
6	0.05248	-0.01751	-0.05383	0.016547
7	0.01584	-0.03053	0.001794	0.040934
8	0.07743	-0.09182	-0.02328	0.003752
9	0.05773	0.002487	0.01133	0.039988
10	0.01652	0.004785	0.060589	0.018889
11	0.05357	-0.07423	0.037627	-0.01194
12	0.00284	-0.00636	-0.03272	0.030155
13	0.01366	-0.02693	0.026883	-0.01049
14	0.04606	-0.02072	0.033305	-0.00751
15	0.00415	-0.01043	0.057359	-0.00329
16	0.01461	0.015551	0.058227	0.051174

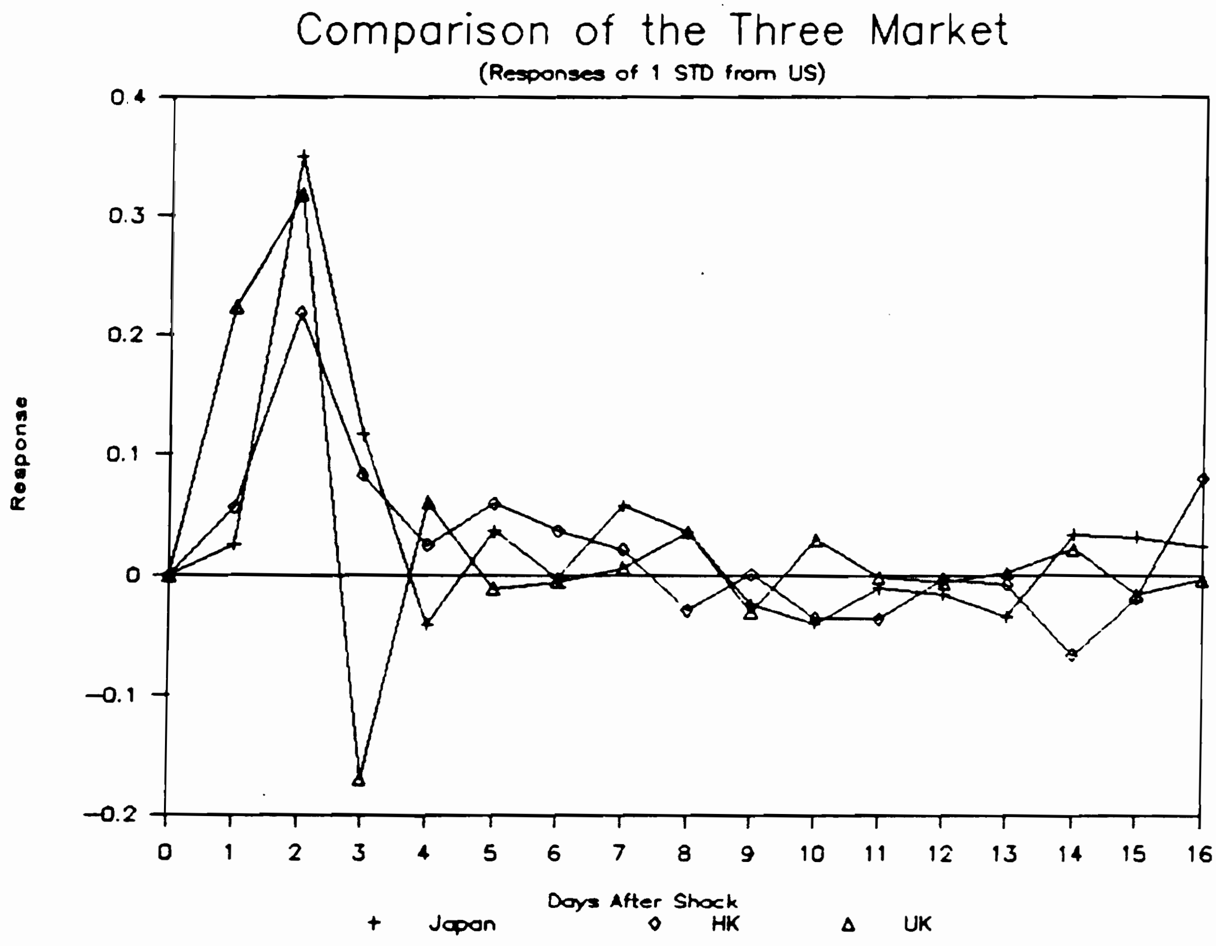


Figure 13. Impulse Responses to the Unit Shock in the U.S. Market in Hong Kong Time

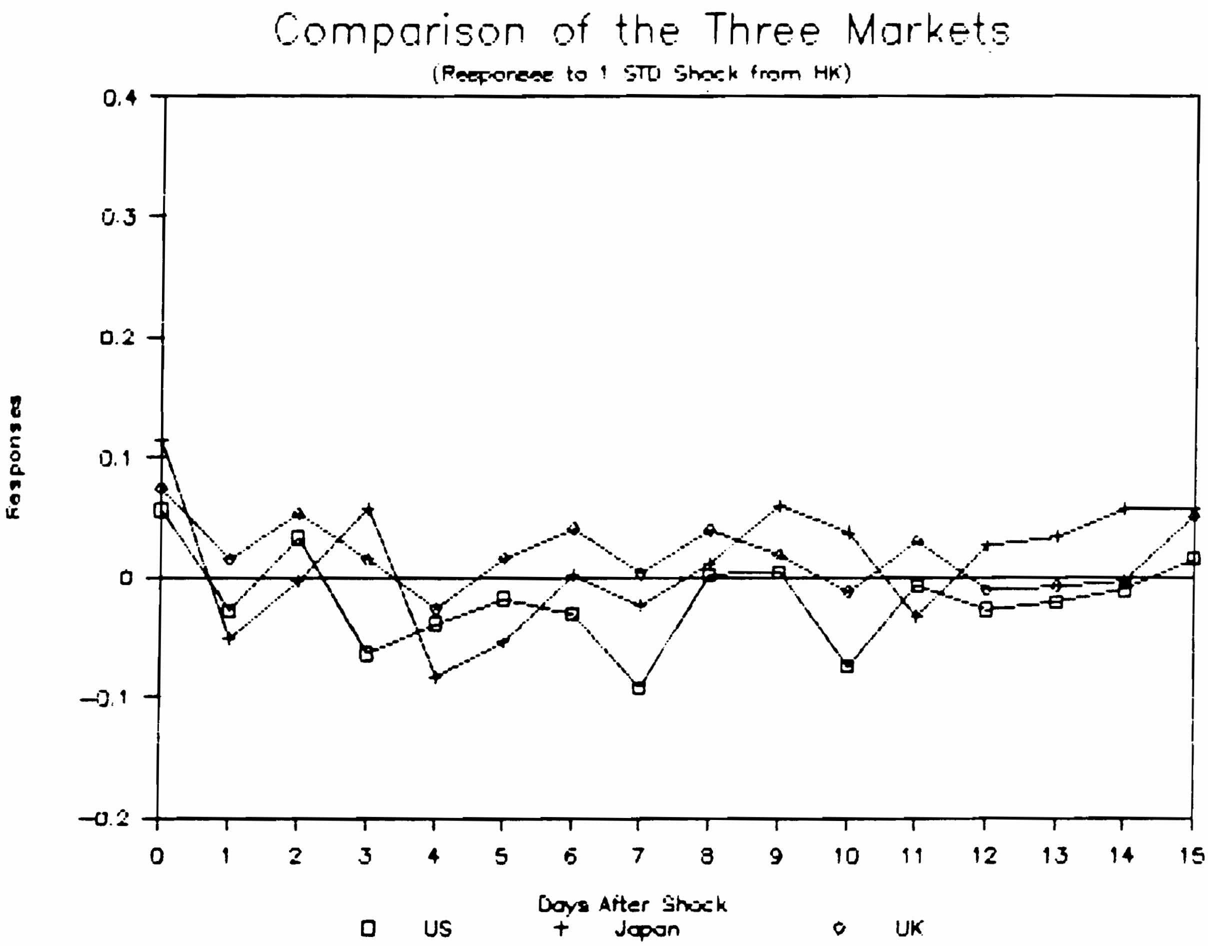


Figure 14. Impulse Responses to the Unit Shock in the Hong Kong Market in Hong Kong Time

Chapter 7

International Diversification of Asian Stock Markets

The previous chapters have examined the stock price movements on the Hong Kong market, and the interdependence between the Hong Kong market and other different national markets. The study in this chapter will explore the benefits from international diversification. Inclusion of international securities in a portfolio can result in reduced risk because different national markets, owing to unique characteristics, can create investment opportunities with lower covariance between foreign and domestic securities. Thus, an internationally diversified portfolio, given a certain level of return, will be preferable to a domestically diversified portfolio.

The study in this chapter examines the possibilities and potential gains from international diversification in the Asian and the Hong Kong stock markets. It will analyze the daily return correlations among the Asian national stock markets, and between the Asian national stock markets and the U.S. market or the U.K. market. The study will consider three main questions regarding international diversification in those equity markets:

(1) What is the effect of exchange rate risk exposures on international diversification?

(2) What is the relationship between the U.S. equity market and the Asian equity market given trading time lags?

(3) What is the benefit of international diversification as compared to intranational diversification in the Hong Kong and the Asian markets?

The organization of the chapter is as follows: Section I discusses the data and basic data transformation. Section II presents the hypotheses and empirical results, followed by a summary in the final section.

7.1. Data and Basic Data Transformations

There are two sample data sets used in our study. One is the daily rates of returns on individual stocks, including 40 Hong Kong stocks and 80 U. S. stocks which are randomly selected from the stocks of different industries listed on the Hong Kong Stock Exchange and CRSP respectively, covering a four-year period from November 1984 to November 1988. The second is the daily market indices of 12 countries in 1988, including Australia, Hong Kong, South Korea, Japan, Malaysia, New Zealand, Philippines, Singapore, Thailand, Taiwan, the U.K., and the U.S.[6] The exchange rates of different currencies are taken from International Financial Statistics, a monthly data base, which is published by International Monetary Fund.

The daily market indices of 10 countries, except for the U.S. and Hong Kong, are first transformed into U.S. dollars, and then converted into returns. The basic transformations are as follows:

$$P_{i,t} = \frac{I_{i,t}}{E_{i,t}} \tag{7.1}$$

---

[6] Daily prices of 40 Hong Kong stocks are provided by Reuters News, and daily indices of 10 Asian countries are provided by James Capel (Far East) Limited in Hong Kong.

where

$I_{i,t}$: index i at time t, and i = Australia, Korea, Malaysia, Japan, New Zealand, Philippines, Singapore, Thailand, Taiwan, and the U.K.;

$E_{i,t}$: exchange rate of currency i at time t defined as the price of one U.S. dollar.

$$R_{i,t} = \ln(P_{i,t}) - \ln(P_{i,t-1}) \tag{7.2}$$

where

$R_{i,t}$: continuously compounded daily rate of return, after adjusted by the exchange rate, on index i at time t.

The daily rates of return on 40 Hong Kong stocks are not adjusted by the exchange rate, because the Hong Kong dollar is pegged to the U.S. dollar and at a fixed exchange rate at $US 1 = $HK 7.8. The currency risk exposures in terms of the U.S. dollar on the Hong Kong dollar, therefore, is nonexistent.

7.2. Empirical Results

7.2.1. Effect of Currency Risk

Past empirical studies have indicated that the currency risk exposures should be considered in international diversification. However, because the currency risk may not be highly correlated with the stock market risk, the magnitude of the reduction of the power of international diversification is not clear. Therefore, the hypothesis for the test of currency risk effect is as follows:

$H_0^{7.1}$: The exposure to foreign exchange rate fluctuations in international stock markets will reduce the power of international diversification.

Table 25 provides the mean returns and the standard deviations of the 12 indices during the testing period before and after the adjustment for exchange rates. The last column of Panel A and Panel B lists the changes of the parameters in percentage with and without the adjustment for exchange rates. We can see that the changes of the mean return with respect to the adjustment of exchange rate are not consistent, with a range from -114% for the index of Australia to +20% for the index of New Zealand, and most of the others being less than a change of 15 percent. On the other hand, the changes for the standard deviation of the indices returns with respect to the adjustment of exchange rate are consistently positive, with a half of the indices changing less than 10 percent, and a half changing more than 10 percent. The consistent increase in the variation of stock return after the adjustment clearly indicates the exposure to currency risk in international stock markets, however, the direction of changes in the mean return is hard to be explained because it combines both effects of the appreciation of domestic currency and the performance of equity market.

Table 26 shows the correlation of daily rates for the return for the 12 stock markets. The top half contains the correlation among the returns adjusted by the exchange rate, while the bottom half contains the correlation among unadjusted returns. The results contain several interesting points: (1) Major equity markets in Asia are highly correlated each other. For example, the correlations among Australia, Hong Kong, Japan, Singapore are well above thirty percent, except for the correlation between Australia and Japan which is 29.24%. (2) Geographic location seems to highly affect the correlation of national equity markets. Australia and New Zealand or Singapore and Malaysia, for examples, are more closely correlated with each other than others, with a correlation of 55.41% and 76.41% respectively. These surprisingly high correlations among major Asian equity markets and geographically related national markets might provide further evidences of integrated national equity markets in the present age. (3) In an integrated world market, we expect that introducing exposure to currency risk into equity markets may transform dissimilar stock price movements among different national markets into similar movements. This is because the changes of exchange rates act as a barometer reflecting the level and direction of capital flows from one market to the other. However, our results show that the correlations of daily rates of return on the 12 indices are reduced significantly after the exchange rate adjustment. For example, the correlation between Australia and Japan before adjustment is 29.24%, which is significantly positive at the 5 percent level; however, it is reduced to 9% after the adjustment, being insignificantly different from zero at the same level. The correlation between Japan and the U.K. actually changes direction after the adjustment, being 26.22% before the adjustment and -16.07% after the adjustment, both being significant at the 5 percent level. For most pairs of indices, the correlations of returns are reduced after the adjustment. Although the correlations for a few pairs show some increase after the adjustment, except for the pair of Philippines and Malaysia, none of them are significant. There are two reasons which may account for this reduction in the correlations. First, the fluctuations of exchange rates may not be closely related to the price movements of the stock market because the real valuation factors underlying the two markets may not be the same, with the change in exchange rates not only affected by the financial markets, but also affected by the international and domestic commodity markets. Secondly, the daily index prices in our sample are adjusted using a monthly-based exchange rate, which may underestimate the actual fluctuations of exchange rates, introducing some estimation noise in our results. Thus, the reduction of the correlations of the daily rates of return on different indices, after adjusting for exchange rates, suggests that the exposure to currency risk by equity markets does not necessarily reduce the value of international diversification. However, some further study is needed to explain the internal relationships between the stock market and the foreign currency market under the assumption of an integrated world market.

Fig. 15 provides some insight to the argument. The figure presents the efficient frontiers for the 12 indices with and without the exchange rate adjustment.[7] The solid curve reflects the efficient frontier of the 12 indices with an adjustment for exchange rates, and the dashed curve is the efficient frontier of the 12 indices without the adjustment. The difference between the two curves is not significant and the unadjusted curve is slightly above. This result is not surprising. The adjusted curve results

[7] The derivation of the efficient frontier will be discussed later.

from increased return variation. The insignificant difference between the two curves, which may caused by offseting effects of a decrease in the correlation of returns among alternative national equity markets and an increase in the return variation after introducing the exposure to currency risk, shows that exchange rate fluctuations may have only a minor effect on international diversification.

Thus, the results from Table 25 and Fig. 15 support the hypothesis, indicating that exposure to foreign exchange rate fluctuations in international stock markets reduces the power of international diversification. However, since the offset effects discussed above, this reduction of the value of international diversification is not significant in our test. While our results provide some insights, it is still early to come to a conclusion, because the effects of the two opposite influences, i.e., the increase of the variations versus the decrease of the return correlations among different assets after introducing the exposure of foreign exchange risk, are not stable over time. Unfortunately, our data only covers the period of 1988, so the results are quite limited.

7.2.2. The Relationship between the U.S. Equity Market and the Asian Equity Markets

The hypothesis for the relationship between the U.S. equity market and the Asian equity markets is:

$H_0^{7.2}$: Stock price movement in the U.S. market would have a significant influence on the Asian equity markets, but not vice versa.

To test the hypothesis, we analyze the correlations between the U.S. market and other Asian national markets with respect to the effect of time zone differences. All Asian countries are twelve to fifteen hours ahead of New York. For instance, Hong Kong and Singapore are 12 hours ahead of New York, Tokyo and Seoul are 14 hours ahead, while Sydney is 15 hours ahead of New York. Thus, national stock markets generally operate in different time zones with different opening and closing times, as such stock returns on the different markets on a given calendar day are realized over different real time periods. Asian stock markets, on a given calendar day, are all closed before the New York stock market opens. If the U.S. market exerts an influence on the Asian equity markets, then the effect should appear on a one day lag.

Table 27 shows the correlation of daily returns between the U.S. and other 10 Asian equity markets with and without the adjustment for time zone differences. The second column lists the correlations of the returns on the same calendar day, that is, the correlation without the time zone adjustment. Finally, the third column lists the return correlations with the time zone adjustment, reflecting the effect of one day lagged returns between the U.S. and the Asian national markets. The difference after the adjustment for time zone differences is dramatic. Before the adjustment, most Asian equity markets are not significantly positive correlated with the U.S. equity market. However, all Asian markets have a large increase in their correlations with the U.S. market after the adjustment, and most of them remain significantly positive at the 5 percent level. The return correlations provided in Table 27 have been adjusted by exchange rates.

The results of our tests strongly support the hypothesis that the stock price movement in the U.S. market exerts a large influence on the Asian Equity markets. As shown, the Asian stock markets are highly correlated with the U.S. stock market after the adjustment for time zone difference. This high degree of positive correlation suggests that the benefit of diversification might not be very great if investors diversify their portfolios only within one Asian national market and the U.S. market.

7.2.3. Benefit of International Diversification

After examining the effect of exposure to foreign currency risk and the relations among different national equity markets, we come to the last qestion: What is the benefit of international diversification as compared to intranational diversification? Thus, the hypothesis for this test is:

$H_0^{7.3}$: An internationally diversified portfolio, given a certain level of return, will be preferable to a domestically diversified portfolio.

In order to examine the potential gain accruing from international diversification, we simulate a set of efficient portfolios. An efficient portfolio is defined as a combination of investments in various assets which either maximizes the rate of return for a given level of variance, or minimizes the variance given the rate of return. The locus of all such points composes the efficient frontier in return-variance space.

The locus of the efficient set, therefore, is found by deriving the investment proportions X_i which minimize the variance of the portfolio, for given expected rates of return. The derivation can be expressed as follows:

$$L = X'VX - \lambda_1 (X'R - r_p) - \lambda_2 (X'I - 1) \tag{7.3}$$

subject to

$$X'I = 1 \tag{7.4}$$

and

$$r_p = X'R \tag{7.5}$$

where

X : vector of the investment proportions;

V : Variance-covariance matrix of the assets in the portfolio;

R : vector of the mean returns of the assets in the portfolio;

λ_1, λ_2: Undetermined multipliers.

The efficient point in return-variance space will be determined by

$$r_p = X' R \tag{7.6}$$

$$\sigma_p^2 = X'VX \tag{7.7}$$

Two groups of portfolios are examined in our analysis. One includes 5 common stock portfolios which are (1) 40 Hong Kong stocks (HK40), (2) 40 U.S. stocks (US40), (3) 20 Hong Kong stocks and 20 U.S. stocks (HK&US40), (4) 80 U.S. stocks (US80), and (5) 40 Hong Kong stocks and 40 U.S. stocks (HK&US80). The other group of portfolios is made up of indices. The first index portfolio includes ten Asian countries, while the second includes the Asian countries and plus the U.K. and the U.S..

The efficient frontiers of the 5 common stock portfolios are given in Fig. 16. The curves reflect portfolios of two different sizes. Curve A , B, and C are the portfolios with 40 common stocks, while Curve E and Curve D are the portfolios with 80 common stocks. The gains from the diversification are clearly illustrated by these curves. For the same size portfolios, the efficient frontiers of internationally diversified portfolios dominate the efficient frontiers of domestically diversified portfolios. That is, Curve C is above Curve A and Curve B, and Curve E is above Curve D. Furthermore, the size of the portfolio is also an important factor in diversification. The frontier of the 80 U.S. stock portfolio, Curve D, is higher than that of the 40 U.S. stock portfolio, Curve B, and size improvement for internationally diversified portfolio is even more striking. Similarly, Curve E, the 80 U.S. and Hong Kong stock portfolio, is preferable to Curve C, the 40 U.S. and Hong Kong stock portfolio.

It is interesting to note that the difference between Curve A and Curve C is negligible. This is not surprising because the return correlation between the U.S. equity market and the Hong Kong equity market is quite high, and also the Hong Kong market tends to follow to the U.S. market. Thus, it does not pay much for Hong Kong investors to diversify in the U.S. market with a relatively small portfolio. However, a U.S. investor might gain more than a Hong Kong investor when he/she invests in the Hong Kong market because the efficient frontier of mixed portfolio, HK&US40, is preferable to that of the domestic portfolio, US40.

Fig. 17 illustrates the efficient frontiers of alternative international portfolios, i.e., the portfolio with 10 Asian market indices, and the portfolio with 10 Asian countries, the U.K. and the U. S. market indices. The efficient frontier of the 12-index portfolio dominates the efficient frontier of the Asian portfolio, although the improvement is quite limited from the Asian portfolio to the 12-index portfolio. The explanation for this is quite simple. Table 26 and Table 27 showed the high return correlation between the U.S. market and the Asian markets, and the U.K. market and some Asian national markets. The small improvement between the efficient frontier is simply a result of an increase in the opportunity set. However, it is clear that an investor would suffer some loss if he restricts his portfolio to either the U.S. market or the Hong Kong market. The plots A and H represent the average return of the market index in the U.S. and Hong Kong, and both of them are well below the frontiers of the either efficient internationally diversified portfolios.

Table 28 present the optimal investment proportions for the 12-index portfolio at 2, 3, 4, 5, and 6 percent interest rates, respectively. The relative weights are quite consistent across different interest rates. Although 12 countries are considered in our study, only 7 countries are actively involved. Comparing with Table 1 and Table 2, we can see that the large short position taken in Australia index caused by its negative mean return. In addition, a large positive weight is given to indices of Philippines, Japan, Malaysia, the U.S., Korea, and Taiwan due to their low return correlations with other national markets, such as Philippines, Korea, Malaysia, Taiwan, or the relatively favorable mean returns and variances, such as Japan and the U. S.. Furthermore, Korea and Taiwan both have a high mean return, but the standard deviation of this return is very large.

The potential benefit from international diversification can be seen most clearly in Table 29, which quantifies the gains of international diversification. By constructing market opportunity lines at different interest rates, the table lists the variance of the various optimal portfolios at a given level of expected return. First, Panel A compares the portfolios with 40 common stocks, i.e., HK&US40, HK40, and US40. At a given level of expected return, it is clear that the internationally diversified portfolio, the 40 U.S. and Hong Kong stock portfolio, dominates the domestically diversified portfolio, the 40 Hong Kong stock or the 40 U.S. stock portfolio, because the variations of the portfolio returns for the international portfolio are lower than those of the domestic portfolios in all cases. Panel B provides results similar to those of Panel A. It compares the variations of the portfolios with HK&US80 and US80 at the given expected returns. Again, the variances of the internationally diversified portfolio are preferable to those of the domestically diversified portfolio. Finally, Panel C presents the results comparing the 10 Asian country portfolio with the 12 country portfolio. As expected, the 12 country portfolio performs better than the 10 country portfolio. Therefore, the results clearly indicate that the hypothesis is supported that an internationally diversified portfolio, given a certain level of return is preferable to a domestically diversified portfolio.

7.3. Summary

Our study discusses the possibilities and the potential gains of international diversification in Asian equity markets. The results indicate that American investors should not restrict their investments solely to the U.S. market, as the inclusion of Asian assets in the opportunity set materially improves the risk-return positions of American investors. It is also interesting to note that, for Hong Kong investors, little is gained from only diversifying in the U.S. market. The reason for this is the high level correlation of the stock returns between the two markets, combined with the fact that the Hong Kong market tends to follow the U.S. market, limits the possibility of risk reduction through diversification.

This study also demonstrates the effect of exchange rate risk in international diversification. However, this additional risk exposure does not necessarily reduce the value of international diversification. In fact, when exchange rate risk is accounted for, the correlation among the various national equity markets dropped while the variation of the portfolio returns increased. Moreover, it was found that the effects of exchange rate risk varies considerably over time. Thus, the effect of the exchange rate risk exposure on international diversification can not be simply defined. Our results are somewhat limited in this point because of the short testing period.

Table 25

Daily Rates of Return and Standard Deviation of Market Indices before and after the Adjustment for Exchange Rate Changes

(In Percentage)

A. Daily Rates of Return

Country	Mean Return With Adjustment for Exchange Rate Changes (1)	Mean Return Without Adjustment for Exchange Rate Changes (2)	Changes in Percentage [(1)-(2)]/(2)x100
Australia	-0.0076	0.0530	-114
Hong Kong	0.0590	0.0540	9.25
Korea	0.2932	0.2626	11.65
Malaysia	0.0980	0.1165	-15.88
Japan	0.1458	0.1368	6.58
New Zealand	0.0120	0.0100	20.00
Philippines	0.0950	0.1087	-12.60
Singapore	0.0990	0.0860	15.12
Thailand	0.0850	0.0820	3.66
Taiwan	0.3086	0.2838	8.74
U. K.	0.0190	0.0200	-5.00

B. Standard Deviation

Country	Mean Return With Adjustment for Exchange Rate Changes (1)	Mean Return Without Adjustment for Exchange Rate Changes (2)	Changes in Percentage [(1)-(2)]/(2)x100
Australia	1.0518	0.9464	11.14
Hong Kong	1.0959	1.0964	4.56
Korea	2.0752	2.0465	1.40
Malaysia	0.9939	0.9127	8.9
Japan	0.9220	0.7321	25.94
New Zealand	1.2592	1.1753	7.14
Philippines	1.0485	0.8509	23.22
Singapore	1.4444	1.4074	4.72
Thailand	3.3604	3.3446	2.63
Taiwan	3.1669	2.3551	34.47
U. K.	1.0341	0.8037	28.67

Table 26

Correlation of Daily Rates of Return of 12 International Equity Market
(1988)

	Australia	HK	Korea	Malaysia	Japan	New Zealand	Philip.	Sigapore	Thailand	Taiwan	U. K.	U. S.
						with Adjustment for Exchange Rate Changes						
Australia		.4004	-.0359	.4590	.0090	.5616	.0807	.2642	.1336	.1892	.1873	.007
Hong Kong	.4566		-.0261	.4557	.3183	.2847	.0663	.4326	.0857	.1339	.2358	.143
Korea	.0079	-.0211		-.0251	.0318	-.0625	-.0661	.1169	.0064	-.0292	-.0683	-.065
Malaysia	.4728	.4635	-.0217		.4059	.3041	.3168	.7454	.1045	-.1648	.2201	.091
Japan	.2924	.4089	.0256	.4256		-.0147	.2574	.3174	.1008	-.1407	-.1607	.113
New Zealand	.5541	.2931	-.0610	.3194	.2225		.1130	.2817	.0473	.0974	.0925	-.100
Philippines	.1104	.0661	-.0531	.0915	.0824	.1758		.1787	-.0130	-.4104	-.0158	-.185
Singapore	.3512	.4474	.0757	.7641	.3561	.3296	.0938		.1019	-.0413	.1829	.081
Tailand	.1468	.0898	.0061	.1606	.1667	.0590	.0546	.1319		.1072	-.0843	-.060
Taiwan	.1655	.1219	-.0490	.1183	.1719	.0490	-.0161	.1223	.0570		.1476	.039
U. K.	.1872	.3182	-.1183	.2525	.2622	.0620	.0207	.2064	-.1053	.0991		.381
U. S.	.0407	.1408	-.0711	.1002	.1517	-.0711	-.2040	.0921	-.0616	.0327	.452	
						without Adjustment of Exchange Rate Changes						

Table 27

Correlation of Daily Rates of Return between the U. S. and Other 11 Indices with and without the Adjustment of Time Zone Difference Effect

(1988)

Country	U. S. without Adjustment	U. S. with Adjustment
Australia	0.0072	0.4027*
Hong Kong	0.1429*	0.4884*
Korea	-0.0653	0.0165
Malaysia	0.0911	0.4811*
Japan	0.1131	0.2758*
New Zealand	-0.1000	0.3383*
Philippines	-0.1852*	0.0790
Singapore	0.0814	0.5215*
Thailand	-0.0602	0.2243*
Taiwan	0.0390	0.1661*
U. K.	0.3806*	0.3801*

* Statistically significant at the 5 percent level.

Table 28

Optimal Weights of 12 Indices at Different Levels of Interest Rate

(In Percentage)

Country	2%	3%	4%	5%	6%
Australia	-17.72	-18.87	-20.02	-21.50	-22.76
Hong Kong	-2.42	-2.56	-2.70	-2.87	-3.02
Korea	16.12	16.56	16.99	17.56	18.03
Malaysia	20.58	21.51	22.45	23.65	24.67
Japan	24.45	24.69	24.94	25.25	25.52
New Zealand	6.44	6.31	6.18	6.01	5.88
Philippines	29.17	29.48	29.78	30.17	30.50
Singapore	-7.61	-7.73	-7.84	-7.99	-8.11
Tailand	0.12	0.07	0.02	-0.04	-0.10
Thaiwan	13.09	13.49	13.90	14.41	14.85
U. K.	-2.15	-2.81	-3.48	-4.33	-5.05
U. S.	19.93	19.86	19.78	19.68	19.59
	100.00	100.00	100.00	100.00	100.00

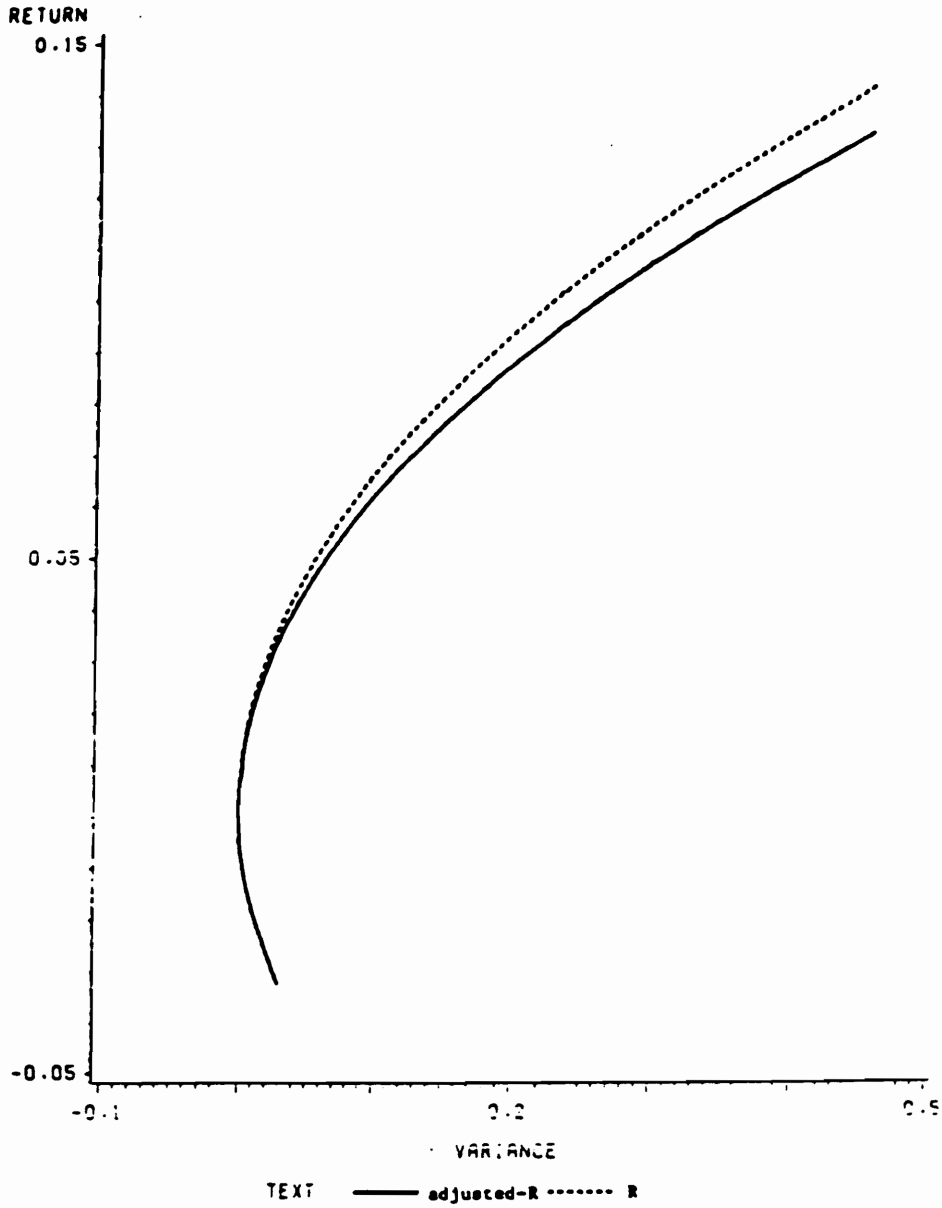


Figure 15. Efficient Frontier of 12 Indices

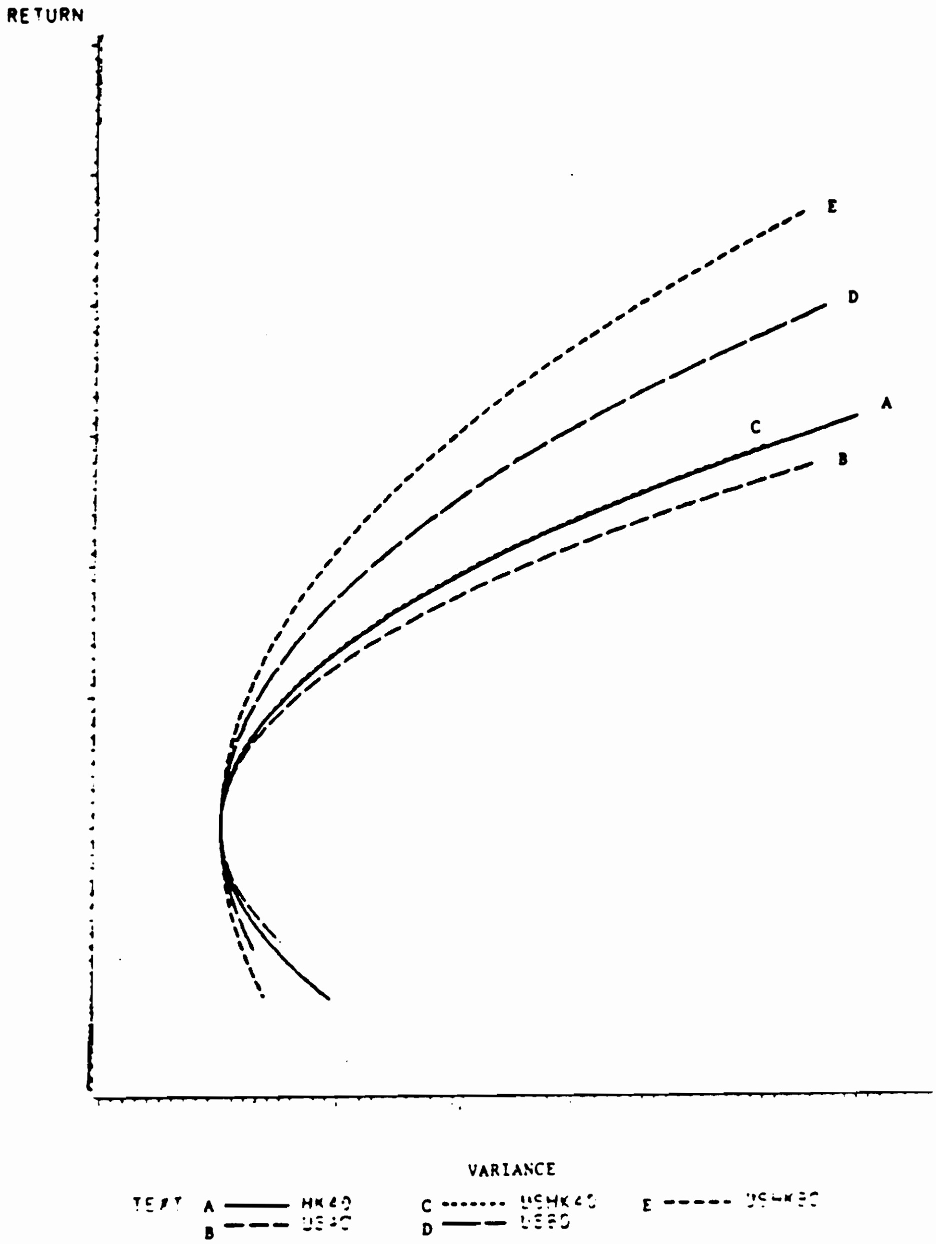


Figure 16. Efficient Frontier of HK, US and US&HK Portfolios

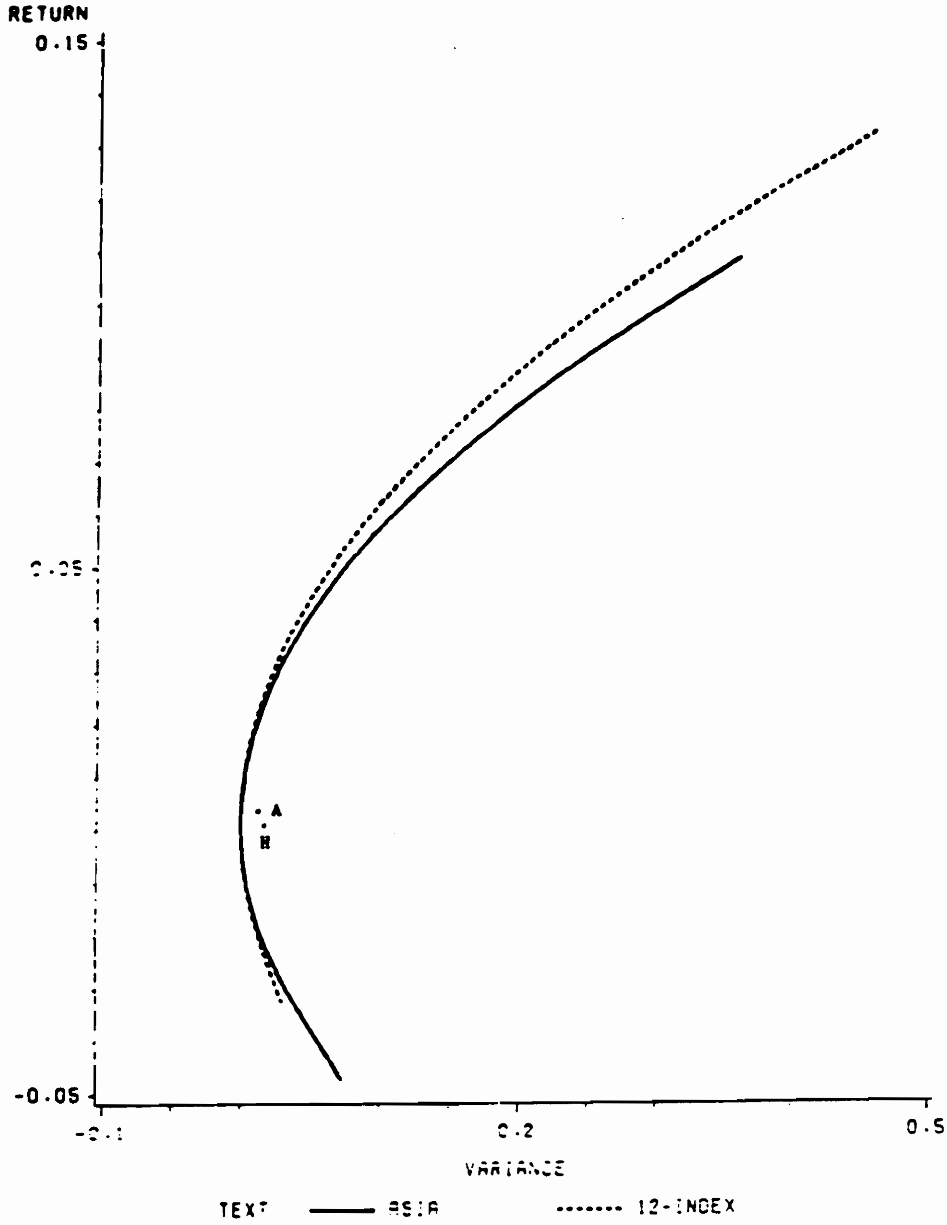


Figure 17. Efficient Frontier of Alternative International Portfolios

Table 29

Comparison of Variations of Various Diversified Portfolios at Certain Level of Expected Returns

A. Portfolios with 40 Common Stocks

Expected Return	Variance		
	HK&US40	HK40	US40
0.0196643	0.0020747	0.00223741	0.00234747
0.0235523	0.0029812	0.00324384	0.00348323
0.0299835	0.0048438	0.00496839	0.00545250
0.0413346	0.0092360	0.00960265	0.01081200
0.0192534	0.0192534	0.01981690	0.02276060

B. Portfolios with 80 Common Stocks

Expected Return	Variance	
	HK&US80	US80
0.0084691	0.0001709	0.00021583
0.0091888	0.0001992	0.00025455
0.0099819	0.0002331	0.00030112
0.0111087	0.0002861	0.00037432
0.0121747	0.0003415	0.00045116

C. Portfolios of Market Indices

Expected Return	Variance	
	10 Indices (Asia)	12 Indices (Asia, UK, US)
0.0020273	0.0000518	0.0000486
0.0020593	0.0000535	0.0000504
0.0020910	0.0000553	0.0000523
0.0021309	0.0000446	0.0000436
0.0021640	0.0000597	0.0000568

Chapter 8

Summary and Conclusions

This study examined the stock price behavior on the Hong Kong market, and the comovement of stock returns among the U.S., Japanese, U.K., and Hong Kong markets under the assumption of an integrated world market. The results discussed in previous chapters can be summarized as follows:

1. Stock returns on the Hong Kong market are stable, and the returns of most stocks in our sample are independently distributed. Therefore, the hypothesis of a weak-form efficient market is supported on the Hong Kong market.

2. The announcement effects of dividend and bonus issues on the Hong Kong market indicate that the market reaction associated with a dividend decrease is unambiguously negative, and the market reaction to a joint announcement of dividends and bonus issues is significantly positive. The results from the study show that semi-strong form efficiency applies to an equity market outside the U.S..

3. The analysis of the comovement of stock returns in Chapter VI reveals some common features among the different national markets, indicating a substantial degree of interdependence existed among the U.S., U.K., Japanese and Hong Kong markets.

4. The results of the analysis using a VAR system show that the transmission of innovation among the markets is efficient and significant. The U.S. market is the most influential market in terms of its capacity to account for the error variances of other markets. Moreover, the Hong Kong market appears to be vulnerable to external shocks, with foreign markets explaining up to one third of the stock price movement on the Hong Kong market.

5. International diversification, under the assumption of an integrated world market, is favorable to domestic diversification. The results from Chapter VII suggest that the return-risk position can be materially improved for both Hong Kong and U.S. investors through the inclusion of foreign assets in their stock portfolios.

Therefore, our results suggest that the stock market in Hong Kong is efficient, and its price behavior is similar to what has been found on the U.S. market. There is a substantial degree of correlation between the Hong Kong and the other national markets, i.e., the U.S., the U.K., and Japan, providing added support to the hypothesis of an integrated international financial market. As a small and active market, Hong Kong is strongly affected by stock price movements on the international markets.

References

1. Adler, Michael and Simon, David, Winter 1986, "Exchange Risk Surprises in International Portfolios", *Journal of Portfolio Management*, pp. 44-53,

2. Agmon, Tamir, 1972 "The Relations among Equity Markets: A Study of Share Price Co-movements in the United States, United Kingdom Germany and Japan", *The Journal of Finance*, Vol. 27, No. 4, pp. 839-855.

3. Agrawal, Anup and Tandon, Kishore, May 1990, "Anomalies or Illusions? Evidence from Stock Markets in Nineteen Countries", *Working Paper*

4. Aharony, Joseph and Swary, Itzhak, 1980, "Quarterly Dividend and Earnings Announcements and Stockholders' Returns: An Empirical Analysis",*The Journal of Finance* , 35 (March), pp. 1-11.

5. Ariel, Robert A., 1987, "A Monthly Effect in Stock Returns", *Journal of Financial Economics* , 18 (March), pp. 161-174.

6. Ball, Ray and Brown, Philip, 1968, "An Empirical Evaluation of Accounting Income Numbers", *Journal of Accounting Research*, 6 (Autumn), pp. 159-178.

7. Banz, Tolf W. 1981, "The Relationship Between Return and Market Value of Common Stocks", *Journal of Financial Economics*, 9 (March), pp. 3-18.

8. Basu, S., 1977, "Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis", *Journal of Financial Economics*, 12 (June), pp. 129-156.

9. Bondt, Werner F. M. De and Thaler Richard H., 1987, "Further Evidence on Investor Overreaction and Stock Market Seasonality", *The Journal of Finance*, July pp. 557-581.

10. Brown, Stephen J. and Warner, Jerold B., 1980, "Measuring Security Price Performances", *Journal of Financial Economics*, 8, pp. 205-258.

11. Brown, Stephen J. and Barry, Christopher B., 1984, "Anomalies in Security Returns and the Specification of the Market Model", *The Journal of Finance*, (July), pp. 807-817.

12. Dwyer, Gerald P., Jr. and Hafer, R. W., 1988 "Are National Stock Markets Linked?" *Federal Reserve Bank of St.Louis*, November/December, pp. 3-14.

13. Eun, Cheol S. and Shim Sangdal, June 1989, "International Transmission of Stock Market Movements", *Journal of Financial and Quantitative Analysis* Vol 24, No. 2, pp. 241-256.

14. Fama, Eugene F., 1965, "The Behavior of Stock-Market Prices", *Journal of Business*, 38, pp. 35-105.

15. Fama, Eugene F. and Fisher, Lawrence and Jensen, Michael C. and Roll Richard, 1969, "The Adjustment of Stock Prices to New Information", *International Economic Review*, 10 (February), pp. 1-21.

16. Fama, Eugene F., 1970, "Efficient Capital Markets: A Review of Theory and Empirical Work", *The Journal of Finance*, 25 (May), pp. 383-417.

17. Fama, Eugene F. and MacBeth, James D., 1973, "Risk, Return, and Equilibrium: Empirical Tests", *Journal of Financial Research*, (May-June), pp. 607-636.

18. French, Kenneth R., 1980, "Stock Returns and the Weekend Effect", *Journal of Financial Economics*, 8, pp. 55-69.

19. Gordon, R. J. and King, S. R., 1982, "The Output Cost of Disinflation in Traditional Vector Autoregressive Models", *Brookings Papers on Economic Activity*

20. Grinblatt, Mark S. and Masulis, Ronald W., and Titman, Sheridan, 1984, "The Valuation Effects of Stock Splits and Stock Dividends", *Journal of Financial Economics* , 13, pp. 461-490.

21. Grubel, Herbert G., Dec. 1968, "International Diversified Portfolios: Welfare Gains and Capital Flows", *American Economic Review*, 58, no. 5, pp. 1299-1314.

22. Grubel, Herbert G. and Fadner, Kenneth, March 1971, "The Interdependence of International Equity Markets", *The Journal of Finance*, 26, No. 1, pp. 89-94.

23. Gultekin, Mustafa N. and Gultekin, N. Bulent, 1983, "Stock Market Seasonality: International Evidence", *Journal of Financial Economics*, 12, pp. 469-482.

24. Jacobs, Bruce I. and Lery Kenneth N., 1988, "Disentangling Equity Return Regularities: New Insights and Investment Opportunities", *Financial Analysts Journal*, (May-June), pp. 18-40.

25. Jaffe, Jeffrey and Westerfield, Randolph, 1985, "The Week-End Effect in Common Stock Returns: The International Evidence", *The Journal of Finance*, 40 (June), pp. 433-454.

26. Joy, O. Maurice; Panton, Don B.; Reilly, Frank K. and Martin, Stanley A., 1976, "Comovements of Major International Equity Markets", *The Financial Review*, pp. 1-20.

27. Kane, Alex and Lee, Young Ki and Marcus, Alan, 1984, "Earnings and Dividend Announcements: Is There a Corroboration Effect?" *The Journal of Finance* , 39 (September), pp. 1091-1098.

28. Kato, Kiyoshi and Schallheim, James S., 1985, "Seasonal and Size Anomalies in the Japanese Stock Market", *The Journal of Finance*, 40 (June), pp. 433-454.

29. Keim, Donald B., and Stambaugh, Donald B., 1984 "A Further Investigation of the Weekend Effect in Stock Returns," *The Journal of Finance*, July, pp. 819-840

30. Keim, Donald B., 1985 "Dividend Yields and Stock Returns - Implications of Abnormal January Returns", *Journal of Financial Economics*, 14, pp. 473-489.

31. Kwan, Clarence C. Y., June 1981, "Efficient Market Tests of the Informational Content of Dividend Announcements: Critique and Extension", *Journal of Financial and Quantitative Analysis*, 2, pp. 193-205.

32. Lethbridge, David G., 1984, *The Business Environment in Hong Kong*, Second Edition.

33. Lee, Kam-Hon and Vertinsky, Han, 1987/1988, "Strategic Adjustment of International Financial Centers (IFCs) in Small Economies: A Comparative Study of Hong Kong and Singapore", *Journal of Business Administration*, 17, pp. 151-172.

34. Levy, Haim and Sarnat, Marshall, Sep. 1970, "International Diversification of Investment Portfolios", *American Economic Review*, Vol. 60, No. 4, pp. 668-675.

35. Pettit, R. Richardson, December 1972, "Dividend Announcements, Security Performance, and Capital Market Efficiency", *The Journal of Finance* 5, pp. 993-1007.

36. Pettengill, Glenn N. and Jordan, Bradford D., 1988, "A Comprehensive Examination of Volume Effects and Seasonality in Daily Security Returns", *Journal of Financial Research*, (Spring), pp. 57-69.

37. Reinganum, Marc R., 1987, "The Collapse of the Efficient Market Hypothesis: A Look at the Empirical Anomalies of the 1980s", *Research Paper Series*, 87-3.

38. Reinganum Marc R. and Shapiro, Alan C., 1987, "Taxes and Stock Return Seasonality: Evidence from the London Stock Exchange", *Journal of Business*, 60, pp. 281-295.

39. Rogalski, Richard J., 1984, "New Findings Regarding Day-of-the-week Returns over Trading and Non-trading Periods: A Note", *The Journal of Finance*, 39 (December), pp. 1603-1614.

40. Roll, Richard, 1983, "Vas Ist Das?" *Journal of Portfolio Management*, 9 (Winter), pp. 18-28.

41. Roll, Richard, 1977, "A Critique of the Asset Pricing Theory's Tests", *Journal of Financial Economics*, 4, pp. 129-176.

42. Rozeff, Michael S. and Kinney, William R. Jr., 1976, "Capital Market Seasonality: The Case of Stock Returns", *Journal of Financial Economics*, 3 (October), pp. 379-402.

43. Sims, Christopher A., 1980, "Macroeconomics and Reality", Econometrica, 48, 1-48.

44. Smirlock, Michael and Starks, Laura, 1986, "Day-of-the-week and Intraday Effects in Stock Returns", *Journal of Financial Economics*, 17 (September), pp. 197-210.

45. Tinic, Seha M. and West, Richard R., 1984, "Risk and Return: January Vs. the Rest of the Year", *Journal of Financial Economics*, 13 (December), pp. 561-574.

46. Ziemba, William T., Nov. 1989, "Japanese Security Market Regularities: Monthly, Turn of the Month and Year, Holiday and Golden Week Effects", *Working Paper*

47. The American Chamber of Commerce in Hong Kong, 1988, *Doing Business in Today's Hong Kong*.

48. Securities Review Committee, 1988, *The Operation and Regulation of the Hong Kong Securities Industry*.

49. The Stock Exchange of Hong Kong Ltd., 1987, *Fact Book 1986*.

50. The Stock Exchange of Hong Kong Ltd., 1988, *Fact Book 1987*.

51. The Stock Exchange of Hong Kong Ltd., 1988, *Companies Handbook 1987*, I.

52. The Stock Exchange of Hong Kong Ltd., 1988, *Companies Handbook 1987*, II.

Vita

Enyang Guo was born April 20, 1951 in Shanghai, China. After receiving a BS in Economics in July 1982 from the Institute of Finance and Economics in Jiangxi, China, she spent one and a half years for advanced study in Finance at the Amoy University, China. She then worked as an instructor of finance at the Institute of Finance and Economics in Jiangxi, China. Enyang Guo entered the graduate business program at Virginia Polytechnic Institute in the spring of 1986 and received her MS in Finance in July 1987. She continued her study at Virginia Polytechnic Institute and earned a Ph. D. in Finance from the R. B. Pamplin School of Business in July 1990. Starting in the fall of 1990, Enyang Guo will be an assistant professor of finance at the University of Millersville, Pennsylvania.

Enyang Guo