On the Risk-Return Tradeoff in the Stock Exchange of Thailand: New Evidence

Komain Jiranyakul

School of Development Economics, National Institute of Development Administration

Bangkok 10240, Thailand

E-mail: komain_j@hotmail.com

Received: February 15, 2011 Accepted: March 9, 2011 doi:10.5539/ass.v7n7p115

Abstract

This paper provides new evidence on the positive risk-return tradeoff in the Thai stock market using monthly data. An AR(p)-GARCH-in-mean model is applied to the data from January 1981 to December 2009. Since stock prices and dividend series are not cointegrated, the excess returns are separately calculated as capital gain and dividend excess returns. By incorporating the dummy variables that capture the impact of the 1987 global stock market crash and the Asian 1997 financial crisis in the conditional variance equations, the results show that the persistence of excess return volatility is reduced. It is also found that there exists a positive risk-return tradeoff in the stock market in both capital gain and dividend excess returns. The size of the risk-return tradeoff is higher and more highly significant when the market dividend yield is used to obtain the excess return. Therefore, dividend is more important than capital gain. In addition, the impact of volatility on excess returns is not asymmetric implying that the AR(p)-GARCH-in-mean model is sufficient to detect the positive risk-return tradeoff.

Keywords: Risk-return, Emerging stock market, GARCH-M

1. Introduction

The existence of positive risk-return relationship in a stock market deems necessary since investors should be compensated for taking risk compared to investing in the risk-free asset. According to Merton (1973)'s intertemporal capital asset pricing model (ICAPM), the conditional expected excess return in a stock market is linearly and positively related to its variance. For empirical studies, Merton (1980) suggests that heteroskedasticity should be taken into account when ex-post returns are used to estimate return volatility. In measuring the expected market returns, the analysts' expectations can be used as a proxy. In addition, the implied cost of capital computed from analysts' forecast can be a proxy of market return. Numerous empirical studies employ the generalized autoregressive conditional heteroskedasticity (GARCH)-in-mean or GARCH-M model to explore the relationship between risk and realized return. However, there is no consensus on the risk-return relationship in both emerging and more mature stock markets. Using conditional variance as a measure of risk, some researchers find a positive relationship between stock market excess return and its risk while others find a negative one. The conflicting results may stem from the frequency of the data and the time span as well as different approaches used to model the conditional variance. Various types of GARCH models extended from the original model have been used in empirical work. This increases the flexibility of studies by relaxing the restriction in the original GARCH specification proposed by Bollerslev (1986). One of several models has been proposed for easing the symmetric restriction in the GARCH-M model is an exponential GARCH (EGARCH) model, which is the asymmetric GARCH model proposed by Nelson (1991). The impact of conditional variance on the excess return can be asymmetric. This model does not impose non-negativity constraints on the coefficients in the conditional variance equation. Previous empirical evidence shows that the risk-return tradeoffs in emerging stock markets display different patterns compared to well-developed stock markets. Expected returns and risk in emerging markets are higher than those of mature market (Harvey, 1995). Regime changes caused by economic crises are also important since the crises can affect investors' decision in a stock market. Some empirical studies show that the high persistence of volatility is reduced by incorporating dummy variables in the conditional variance equation (Hamilton and Susmel, 1994). For example, Choudhry (1996) investigates the impact of the 1987 stock market crash using monthly data during January 1976 and

August 1994. The impact could induce changes in the ARCH parameter, risk premia and persistence of volatility before and after the crisis.

The Stock Exchange of Thailand is one of emerging stock markets. After the 1992 financial liberalization, capital inflows to the stock market have been rising continuously. The 1997 financial crisis caused the adoption of flexible exchange rate system, which was believed to distort the portfolio investment by foreign investors due to exchange rate uncertainty. The Thai stock market is open to foreign investors. Foreign investors' investment accounted for approximately 24 percent of the trading. The Thai stock market is developing to more mature market. The data from the Stock Exchange of Thailand reveal that the market capitalization has been increasing. In 1981, the market capitalization was 23, 471.22 million baht. By the end of the decade, it jumped to 659,493.07 million baht and increased to more than 5 billion baht in 2009. Most of previous empirical studies using the daily and weekly data from the Thai stock market tend to confirm the positive-risk return tradeoff, but this tradeoff is insignificant in monthly data. The main objective of the present study is to provide new evidence on the risk-return tradeoff in the Stock Exchange of Thailand using monthly data. The time period is from January 1981 to December 2009. Since the present analysis employs a GARCH-M model to obtain the relationship between excess return and its volatility. The ex-post capital gain excess return is computed as the percentage change in the stock market index minus the risk-free rate. The other excess return is the market dividend yield subtracted by the risk-free rate. This study is closely related to the studies by Chiang and Doong (2001) and Shin (2005). The first study indicates no relationship between risk and return in monthly data while the latter study estimates both parametric and semi-parametric GARCH-in-mean model using Thailand's weekly stock market data from January 1989 to May 2003, and finds insignificantly positive risk-return tradeoff. The present study differs from the two studies in some aspects. First, the realized monthly stock market return contains two components: capital gain yield and dividend yield. The long-run relationship between capital gain and dividend is also examined if dividend determines stock market prices. If there exists no cointegration between the two series, the components of excess return can be calculated separately. Second, the relatively longer sample period is used to estimate the AR(p)-GARCH(1,1)-M model with dummy variables in the conditional variance instead of dividing the whole sample period into sub-sample periods. The conditional variance series are then used as a measure of excess return volatility or risk. Third, the excess returns are computed using government bond yield as a proxy of the risk- free rate. The results from the present study provide the evidence of significantly positive risk-return tradeoff in the Thai stock market. Additionally, the AR(p)-GARCH(1,1)-M model is sufficient to detect the positive tradeoff. The impacts of the 1987 global stock market crash and the1997 financial crisis on the conditional variance are observed. However, there is no asymmetric impact of the conditional variance on the excess market return. The next section reviews related studies. Section 3describes the data and estimation methods. Section 4 presents empirical results, and the last section concludes the study.

2. Review of the Literature

One of the widely explored topics in financial economics is the risk-return relation in the stock markets. However, the existence of a positive risk-return relationship for a stock market is still controversial. Most previous studies that investigate the risk-return relationship employ the GARCH-M model, and the data used are at different frequencies. French, Schwert, and Stambaugh (1987) estimate GARCH-M models on daily excess returns of the S&P composite index during 1928 and 1984. Their results show that there exists a significant positive relationship between excess return and risk. Baillie and DeGennaro (1990) estimate GARCH-M model using daily and monthly portfolio data and find weak risk-return relation. Glosten, Jagannathan, and Runkle (1993) use an asymmetric GARCH-M model and find a negative risk-return relationship, which confirms Nelson (1991)'s findings. Whitelaw (2000) examines the relation between excess return and risk in a general equilibrium exchange economy characterized by a regime-switching consumption process. The results show a positive linear relationship between excess returns and its variance in a single-regime model, but a non-linear relationship in a two-regime model. In addition, the long-run relationship is negative at the market level. Brant and Kang (2004) find a negative tradeoff under conditional correlation, but a positive tradeoff under unconditional correlation. Allowing for a hedge component, Guo and Whitelaw (2006) find a positive risk-return tradeoff. They indicate that investment opportunities change slowly at the business cycle frequency and expected returns are driven by a hedge component when monthly and quarterly data are used. Guedhami and Sy (2005) use an instrumental variables method to estimate a two-factor model, which includes the long-term government bond, and find a negative risk-return tradeoff. They suggest that the reported negative tradeoff is not caused by the omission of the hedge component associated with the ICAPM. Li, Yang, Hasiao, and Chan (2005) examine the risk-return tradeoff in 12 major international markets and find insignificantly positive relationship. Ghysels, Santa-Clara and Valkanov (2005) give an argument that different results of risk-return tradeoff stem from the different approaches used to model the conditional variance. However, Lundblad (2007) indicates that the mixed results are due to the time span of the observations being used. Lanne and Saikkonen (2006) employ a GARCH-M model and find no risk-return tradeoff in monthly US data due to unnecessary intercept in the ICAPM. Bali and Peng (2006) use daily data of several stock market indices to examine the risk-return tradeoffs. They find significantly positive tradeoffs. Guo and Neely (2008) employ 30 years of daily data from 19 major international stock markets, including the world market, and find that component GARCH (CGARCH) models strongly support a positive risk-return relationship. Lanne and Luoto (2008) use monthly U. S. stock market returns from 1928-2004 and find the existence of relatively robust positive relationship, but its strength depends on the prior belief concerning the intercept in the ICAPM. Using firm fundamentals (earnings and dividends) as alternative proxies for both the expected return and conditional variances, Jiang and Lee (2009) find a positive risk-return tradeoff.

Empirical evidence on the positive risk-return tradeoff in the Asian emerging stock markets tends to favor high frequency data. Harvey (1995) indicates that the risk-return relation in emerging stock markets displays different patterns compared to mature stock markets. This is due to high expected returns and risk in emerging markets. Michelfeder and Pandya (2005) also find that stock returns in emerging markets are more volatile than those of mature markets, which is consistent with the finding by Arora, Das, and Jain (2009). The ambiguous results from previous studies on emerging markets still remain. Theodossiou and Lee (1995) find no risk-return tradeoff in some Asian stock markets. De Santis and Imrohoroglu (1997) employ a GARCH(1,1) model and find no evidence on the positive tradeoff in the Asian stock markets. Chiang and Doong (2001) examine the relationship between stock returns and time-varying volatility by estimating an asymmetric GARCH(1,1)-M model using the data from Hong Kong, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand. Their findings show a significant positive relationship in daily data, but the impact of volatility (or risk) on market returns is weak in weekly data and insignificant in monthly data. Shin (2005) estimates both parametric and semiparametric GARCH-in-mean models using weekly data from January 1989 to May 2003 to investigate the risk-return tradeoff in Latin American, Asian, and European emerging stock markets. The Asian markets include India, Korea, Malaysia, the Philippines, Taiwan, and Thailand. The results from the Asian stock markets show a positive but insignificant tradeoff in most cases, including the case of Thailand. Karmakar (2007) estimates EGARCH model using the data from the Indian stock market during July 1990 to December 2004 and finds no relationship between return and risk. Guo and Neely (2008) find some evidence of a significantly positive relation in Hong Kong, but not in Singapore. Kong, Liu, and Wang (2008) assess the risk-return tradeoff for the Chinese stock markets. They find an evidence of the positive tradeoff in the second subsample, but not in the first subsample. They claim that the risk is priced properly when the stock markets are more mature.

3. Data and Methodology

3.1 Data

The monthly data from the Stock Exchange of Thailand during January 1981 to December 2009 are used in this study. Besides the stock market index (SET index) series, the dividend yield series is also available. According to Baillie and DeGennaro (1990), estimation with monthly data tends to reflect long-term movements in volatility (or risk) by offering the advantage of covering a longer period. Even though the size and significance of parameters in the conditional variance process are expected to depend on the data frequency being used, the time span for the analysis is also important. When monthly data are used, the coefficient of the GARCH term takes larger value. In the present study, the stock market returns are defined in two catagories: (1) the capital gain yield, and (2) the dividend yield. The rate of return from capital gain is defined as the percentage rate of change in stock market index and the rate of return from dividend is defined as the percentage rate of change in the constructed dividend index. Rozeff (1984) provides the evidence that dividend yields are able to predict future stock returns. Fama and French (1988) give the evidence that dividend yields can be used to forecast stock returns and the power of prediction increases with the return horizon. However, the contradictory results of Ang and Beckaert (2007) indicate that dividend yields predict excess returns only at short horizons and do not have any long-horizon predictive power. Therefore, the importance of dividend yield can also taken into account as the alternative of stock market return. The stock market excess returns are the two rates of returns subtracted by the risk-free rate. The government bond yield is used as a proxy of the risk-free rate. This series is available from IMF International Financial Statistics from January 1981 to December 2009. The number of observations is 348 in this study. Even though the stock market index series is available prior to 1981, the sample period is limited by the risk-free rate (government bond yield) series. It is also recognized that the more suitable proxies for the risk-free rate are T-bill rate and saving rate, but the data for the two series are not available during the whole sample period of investigation.

The impact of the 1987 stock market crash and the 1997 Asian financial crisis on the conditional variance should also be considered. The stock market crash dummy variable takes the value of one after September 1987, and zero otherwise. The 1997 financial crisis dummy variable takes the value of one after June 1997 and zero otherwise. Both dummy variables are used to detect the impact of the crises on the variance equations, which in turn affects the excess return volatility. These crises may not impact the intercept of the mean equation, but can cause a shift in the intercept of the variance equation.

3.2 Empirical model

The conditional expected excess return on the stock market should vary positively with its conditional variance. The linear equation implied by Merton (1973) intertemporal capital asset pricing model (ICAPM) can be specified as

$$E_{t-1}(r_t) = \alpha + \beta Var_{t-1}(r_t) \quad (1)$$

where r_t is excess return, and $Var_{t-1}(r_t)$ is its variance. According to ICAPM, the slope coefficient β should be positive. The positive risk-return tradeoff indicates that investors are compensated if they accept higher risk.

Many researchers employ the GARCH-in-Mean (GARCH-M) model for the excess stock return. In the present study, the AR(p)-GRACH(1,1)-M model is adopted. It should be noted that the empirical model of GARCH-M proposed by Engle, Lillian, and Robins (1987) is widely used in empirical studies on the relationship between expected returns and conditional volatility. This model allows for time-varying behavior of volatility. The AR(p)-GARCH(1,1)-M model is specified as

$$r_t = a_0 + \sum_{i=1}^{p} a_i r_{t-i} + \lambda h_t + \varepsilon_t \quad (2)$$

and

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} + \delta_1 D_1 + \delta_2 D_2 \quad (3)$$

where r_t is the realized excess return, and h_t is its conditional variance. Eq. (2) is the mean equation with a variance regressor, and Eq. (3) is the conditional variance equation. The coefficients α_0, α_1, and β_1 are equal to or greater than zero. The left-hand-side term is the time-varying residual variance representing a series of return volatility. This is a type of GARCH(1,1)-M model with one ARCH term (the past volatility, ε^2_{t-1}) and one GARCH term (the past forecast error, h_{t-1}). D_1 is the dummy for the 1987 global stock market crash, and D_2 is the dummy for the 1997 Asian financial crisis.

According to Lamoureux and Lastrapes (1990), infrequent shifts in the intercept of the variance equation are a type of persistence in variance. The persistence in GARCH term contains information about future revolution, but the persistence in the constant term contains no information. Regime changes caused by economic crises can affect investors' decision in a stock market. Therefore, policy makers should take in account the regime changes in their financial policy design. The high persistence of volatility is reduced by incorporating dummy variables in the conditional variance equation. Hamilton and Susmel (1994) and Malik (2003) test for a number of structural breaks in the different exchange rate series by fitting dummy variables to the constant term in the conditional variance equation. Accounting for the break dates, the estimated persistence of volatility shocks is reduced

4. Empirical Results

Some basic summary statistics of the stock market excess return series from January 1981 to December 2009 are reported in Table 1. The average monthly excess returns are both negative and positively skewed. The kurtosis measure indicates that both excess returns are leptokurtic relative to the normal distribution. The Jarque-Bera normality test rejects the null hypothesis of a normal distribution for both series, i.e., they are not normally distributed.

4.1 Unit root tests

The unit root tests (ADF and PP tests) are performed on the stock market index, dividend index and stock market excess return series, and the results are reported in Table 2. For r_1 and r_2 series, it is clear that the null hypothesis of a unit root in the series can be rejected at the 1 percent level of significance for both series. Therefore, the series are stationary. Furthermore, the market index and dividend index are integrated of order one, i.e., they are I(1) series. The same order of integration of these two series are suitable to test for cointegration or long-run relationship between them.

The test results reported in Table 3 are obtained from both the Engle and Granger (EG) approach and Johansen approach.

The EG test and Johansen tests show that the two variables are not cointegrated since the test statistics are lower than the critical values at the 5 percent level of significant. The critical value at the 5 percent level of significance for EG test is -3.368 while the critical values at the 5 percent level of significance for the maximum eigenvalue and the trace statistic are 14.265 and 15.495 respectively. Therefore, the null hypothesis of no cointegration cannot be rejected. This indicates that there is no long-run relationship between stock prices and dividend.

4.2 Results of the AR(p)-GARCH(1,1)-M estimates

Since there is no cointegration between stock prices and dividend, the relations between the two components of stock market excess returns and their volatility are estimated separately.

By the stationarity property of excess return series, the AR(3)-GARCH(1,1)-M model of Equations (2) and (3) is estimated and the results are reported in Table 4. It should be noted that estimations with only the intercept term in the mean equation show serially correlated residual series. Therefore, the AR(3)-GARCH-M model is used instead.

The estimated equations pass diagnostic tests since the Ljung-Box Q-statistics up to eight lags indicate that the null hypothesis of no serial correlation is accepted. The Q^2 statistics up to eight lags also indicate that the null hypothesis of no further ARCH effects is accepted. Therefore, there is no serial correlation and no further ARCH effect in the estimated equations. The risk-return coefficient is 0.261 for r_1, which is significant at the 10 percent level, while that of r_2 is 0.504 and significant at the 5 percent level. The AR(3)-GARCH(1,1)-M model is suitable because the sum of α_1 and β_1 does not equals or exceeds one in both estimated equations, i.e., the sums of the two estimated coefficients are 0.957 and 0.796 respectively. The two conditional variances series are stationary. Thus, the estimated mean equations are reliable. It should be noted that the size of the coefficient of $h_{1,t}$ in the mean equation is larger than that of $h_{2,t}$. This implies that dividend yield excess return is more important than the capital gain yield excess return.

The results in Table 4 show that the 1987 global stock market crash negatively affects the conditional variance equation of r_1, but positively affects the conditional variance of r_2 while the 1997 financial crisis positively affects the conditional variance equation of r_1, but negatively affects that of r_2. The impacts of the two financial crises are more pronounced in the r_1 conditional variance. As expected, incorporating the two dummy variables into the conditional variance equations substantially reduces the persistence of volatility. Without dummy variables in the conditional variance equation, the sum of the coefficients of the ARCH and GARCH terms exceed one. The AR(p)-EGARCH(1,1)-M model of Nelson (1991) is also estimated. However, no asymmetric impacts are detected, and thus the AR(p)-GARCH(1,1)-M model should be sufficient in this study. It is apparent that the two components of market excess returns are positively related to the market risk in the Thai stock market. The results can stem from a long time span in monthly data used in this study.

5. Conclusion

The data used in this study cover the 1981-2009 period with 348 observations. Using monthly data tends to show long-term movements in stock excess return volatility since it provides the advantage of covering a longer period as mentioned in Section 2. Previous studies show that the size and significance of parameters in the conditional variance process depend on the data frequency being used. Volatility clustering is higher in the long run than in the short run. In addition, estimations with monthly data can capture the long-term impact of the stock market shocks on excess return volatility. Taking into account the shifts in the conditional variance, the results from this study indicate that there exists high persistence of volatility, and that the two components of realized excess stock market return in the Stock Exchange of Thailand are affected by their conditional variances. The dividend excess return exhibits the larger size and more highly significant in the risk-return relation than the capital gain excess return. The results also show that investors might care more for dividend payments. The results are consistent to the notion that dividend is theoretically more important than capital gain when stock prices are not determined by dividend.

In summary, dividend yield is more important than capital gain yield. This implies that prevalent speculations in many emerging stock markets, including the Thai stock market, might not provide enough compensation for taking risk. Investors should be aware of the potential of structural changes that can affect the outcomes of their decision while policy makers should take into account of the impact of structural changes in financial policy design. Since financial liberalization has been in progress, the degree of openness of the Thai stock market should be carefully considered in order to prevent another financial crisis in the future.

References

Ang, A., Beckaert, G. (2007). Stock return predictability: Is it there? *Review of Financial Studies*, 20, 651-707.

Arora, R. K., Das, H., & Jain, P. K. (2009). Stock returns and volatility: Evidence from selected emerging markets. *Review of Pacific Basin Financial Markets and Policies*, 12, 567-592.

Baillie, R. T., & DeGennaro, R. P. (1990). Stock returns and volatility. *Journal of Financial and Quantitative Analysis*, 25, 203-214.

Bali, T. & Peng, L. (2006). Is there a risk-return tradeoff? Evidence from high-frequency data. *Journal of Applied Econometrics*, 21, 1169-1198.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics*, 31, 307-372.

Brandt, M. W., & Kang, Q. (2004). On the relationship between conditional mean and volatility of stock returns: A linear VAR approach. *Journal of Financial Economics*, 72, 217-257.

Chiang, T. C., & Doong, S. (2001). Empirical analysis of stock returns and volatility: Evidence from seven Asian stock markets based on TAR-GARCH model. *Review of Quantitative Finance and Accounting*, 17, 301-318.

Choudhry, T. (1996). Stock market volatility and the crash of 1987: Evidence from six emerging markets. *Journal of International Money and Finance*, 15, 969-981.

De Santis, G., & Imrohoruglu, S. (1997). Stock returns and volatility in emerging markets. *Journal of International Money and Finance*, 16, 561-579.

Engle, R. F., Lillian, D. M., & Robins, R. P. (1987). Estimating time varying risk premia in the term structure: The ARCH-M model. *Econometrica*, 55, 391-407.

Fama, E. F., & French, K. R. (1988). Dividend yields and expected stock returns. *Journal of Financial Economics*, 22, 3-26.

French, K. G., Schwert, G., & Stambaugh, R. (1987). Expected stock returns and volatility. *Journal of Financial Economics*, 19, 3-29.

Ghysels, E., Santa Clara, P., & Valkanov, R. (2005). There is a risk-return tradeoff after all. *Journal of Financial Economics*, 76, 509-548.

Glosten, L., Jagannathan, R., & Runkle, D. (1993). On the relation between expected value and the volatility of the nominal excess return on stocks. *Journal of Finance*, 48, 1779-1801.

Guedhami, O., & Sy, O. (2005). Does the conditional market skewness resolve the puzzling market risk-return relationship? *Quarterly Review of Economics and Finance*, 45, 582-598.

Guo, H., & Neely, J. (2008). Investigating the intertemporal risk-return relation in international stock markets with the component GARCH model. *Economics Letters*, 99, 371-374.

Guo, H., & Whitelaw, R. (2006). Uncovering the risk-return relation in the stock market. *Journal of Finance*, 61, 1433-1463.

Hamilton, J. D., & Susmel, R. (1994). Autoregressive conditional heteroskedasticity and changes in regime. *Journal of Econometrics*, 64, 307-333.

Harvey, C. R. (1995). Predictable risk and returns in emerging markets. *Review of Financial Studies*, 8, 773-816.

Jiang, X., & Lee, B. S. (2009). The intertemporal risk-return relation in the stock market. *Financial Review*, 44, 541-558.

Kong, D., Liu, H., & Wang, L. (2008). Is there a risk-return trade-off? Evidence from Chinese stock market. *Frontiers of Economics in China*, 3, 1-23.

Karmakar, M. (2007). Asymmetric volatility and risk-return relationship in the Indian stock market. *South Asia Economic Journal*, 8, 99-116.

Lamoureux, C. G., & Lastrapes, W. D. (1990). Persistence in variance, structural change and the GARCH model. *Journal of Business and Economic Statistics*, 8, 225-234.

Lanne, M., & Luoto, J. (2008). Robustness of the risk-return relationship in the U. S. stock market. *Finance Research Letters*, 5, 118-127.

Lanne, M., & Saikkonen, P. (2006). Why is it so difficult to uncover the risk-return tradeoff in stock returns? *Economics Letters*, 92, 118-125.

Li, Q., Yang, J, Hsiao, H., & Chang Y. (2005). The relationship between stock returns and volatility in international stock markets. *Journal of Empirical Finance*, 12, 650-665.

Lundblad, C. (2007). The risk return tradeoff in the long run: 1836-2003. *Journal of Financial Economics*, 85, 123-150.

Malik, F. (2003). Sudden changes in variance and volatility persistence in foreign exchange markets. *Journal of Multinational Financial Management*, 13, 217-230.

Merton, R. (1973). An intertemporal capital asset pricing model. *Econometrica*, 41, 867-887.

Merton, R. (1980). On estimating the expected return on the market: An exploratory investigation. *Journal of Financial Economics*, 8, 323-361.

Michelfelder, R. A., & Pandya, S. (2005). Volatility of stock returns: emerging and mature markets. *Managerial Finance*, 31, 66-86.

Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach. *Econometrica*, 59, 347-370.

Rozeff, M. (1984). Dividend yields are equity risk premiums. *Journal of Portfolio management*, 10, 68-75.

Shin, J. (2005). Stock returns and volatility in emerging stock markets. *International Journal of Business and Economics*, 4, 31-43.

Theodossiou, P., & Lee, U. (1995). Relationship between volatility and expected returns across international stock markets. *Journal of Business Finance and Accounting*, 22, 289-300.

Whitelaw, R. (2000). Stock market risk and return: An equilibrium approach. *Review of Financial Studies*, 13, 521-547.

Table 1. Summary statistics for monthly stock market excess returns

Variable	r_1(market excess return from capital gain yield)	r_2 (market excess return from dividend yield)
Mean	-7.595	-4.492
Standard deviation	9.612	2.907
Skewness	0.072	0.206
Kurtosis	4.032	2.323
Jarque-Bera	15.713 (0.000)	9.089 (0.010)

Note: The number in parenthesis is the probability of accepting the null hypothesis of normal distribution.

Table 2. Results of unit root tests

Tested series	ADF test for a unit root		PP test for a unit root	
	Without trend	With trend	Without trend	With trend
Market index	-2.110 [10]	-2.340 [10]	-1.767 [8]	-1.789 [8]
	(0.241)	(0.521)	(0.720)	(0.386)
ΔMarket index	-4.651 [9]	-4.648 [9]	-17.421 [10]	-17.401 [10]
	(0.000)***	(0.001)***	(0.000)***	(0.000)***
Dividend index	-1.174 [1]	-1.383 [1]	-1.256 [7]	-1.463 [7]
	(0.687)	(0.864)	(0.651)	(0.840)
ΔDividend index	-16.697 [0]	-16.676 [0]	-16.786 [6]	-16.766 [1]
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
r1	-9.889 [1]	-9.990 [1]	-15.147 [7]	-15.358 [6]
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
r2	-9.651 [1]	-9.201 [1]	-15.387 [8]	-15.483 [5]
	(0.000)***	(0.000)***	(0.000)***	(0.000)***

Note: The number in bracket is the optimal lag determined by AIC in ADF test, and is the optimal bandwidth for PP test. The number in parenthesis is the probability of accepting the null of a unit root. *** denotes significance at the 1% level.

Table 3. Tests for cointegration

Engle-Granger tests		
Lags	ADF statistic (no trend)	
1	-3.123	
2	-3.147	
3	-3.067	
4	-2.935	
Johansen tests	Maximum eigenvalue	Trace statistic
3	11.275	13.172

Note: The optimal lag length for Johansen test is determined by AIC.

Table 4. Estimates of the AR(p)-GARCH(1,1)-M model of section 3

Panel A: Market excess return from capital gain yield

Conditional mean equation (2):

$$r_{1,t} = \underset{(-4.879)}{-6.021^{***}} + \underset{(4.014)}{0.239^{***}}r_{1,t-1} + \underset{(2.204)}{0.134^{**}}r_{1,t-2} + \underset{(2.076)}{0129^{**}}r_{1,t-3} + \underset{(1.905)}{0.261^{*}}h_{1,t}$$

Conditional variance equation (3):

$$h_{1,t} = \underset{(1.871)}{1.369^{*}} + \underset{(4.236)}{0.148^{***}}\varepsilon^2_{1,t-1} + \underset{(21.525)}{0.809^{***}}h_{1,t-1} - \underset{(-1.665)}{4.726^{*}}D_1 + \underset{(2.884)}{8.070^{***}}D_2$$

Diagnostic tests: Q(4) = 0.349 (p-value=0.986), Q(8) = 6.703 (p-value=0.639)

$Q^2(4)$ = 2.867 (p-value=0.580), $Q^2(8)$ = 3.343 (p-value=0.911)

Panel B: Market excess return from dividend yield

Conditional mean equation (2):

$$R_{2,t} = \underset{(-2.255)}{-0.381^{**}} + \underset{(16.861)}{1.102^{***}}r_{2,t-1} + \underset{(0.011)}{0.001}r_{2,t-2} - \underset{(-2.151)}{0.135^{**}}r_{2,t-3} + \underset{(2.095)}{0.504^{**}}h_{2,t}$$

Conditional variance equation (3):

$$h_{2,t} = \underset{(2.553)}{0.063^{**}} + \underset{(5.852)}{0.068^{***}}\varepsilon^2_{2,t-1} + \underset{(8.838)}{0.809^{***}}h_{2,t-1} + \underset{(2.497)}{0.049^{**}}D_1 - \underset{(-2.426)}{0.048^{**}}D_2$$

Diagnostic tests: Q(4) = 0.235 (p-value=0.994), Q(8) = 6.295 (p-value=0.614)

$Q^2(4)$ = 2.333 (p-value=0.675), $Q^2(8)$ = 4.288 (p-value=0.830)

Note: The number in parenthesis is t-statistic. ***, **, and * denote significance at the 1, 5, and 10 percent respectively.