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TIME-VARYING BETA AND VOLATILITY IN THE KUALA LUMPUR STOCK EXCHANGE

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The paper analyzes the relationship between beta risk and aggregate market volatility for 12 sized-based portfolios for the case of Malaysia using daily data from January 1988 to December 2000. The analysis is conducted for the entire sample as well as various sub-samples corresponding to (i) the upward trend in the market from January 1988-December 1992 (ii) the huge influx of portfolio investments from January 1993 - June 1997, and (iii) the Asian crisis and its aftermath from July 1997- December 2000. The results generally suggest instability in beta risk due to its significant response to aggregate market volatility. Additionally, we also note that the direction of relationship between beta risk and market volatility seems to depend on stock market conditions or sub-samples used. Namely, beta risk seems to decrease with increasing market volatility for the whole sample as well as the first and the third sub-samples. However, for the second sub-sample, their relationship turns to be positive. Lastly, the author have evidence for the Malaysian case that size does not play significant role in the way beta risk responds to aggregate market volatility. These results have important implications for investment decisions as well as for event analyses employing the market model to generate abnormal returns.

Keywords: Augmented CAPM; Beta Risk; GARCH; Market Volatility

Introduction

The risk and return characteristics of individual security or portfolio of securities have received a great deal of attention in finance literature. While equity beta captures relative risk of the security or portfolio, its usefulness as a general advice for investments has recently been questioned due to its instability. In parallel, various studies have attempted to relate variable beta risk to various factors in an attempt to improve its prediction. Abell and Krueger (1989) and reference therein, for instance, explained time-varying beta using fundamental or macroeconomic factors. Kon and Jen (1978) noted different price behavior in the bull and bear markets. Likewise, Downs and Ingram (2000) showed that absolute values of betas for the up market are not equal to those for the down market. Additionally, Bhardwaj and Brooks (1993) documented different price behavior of small-firm stocks and large-firm stocks over the bull and bear markets. In specific, the differences of bull-market betas and bear-market betas are larger for small-firm stocks. Arguably, this result arises from higher volatility of the bear market (Schwert 1989; Nelson 1991; and Glosten et al. 1993), which leads to portfolio allocation by investors from small-firm stocks to large-firm stocks.

Augmenting Sharp-Lintner-Black single index market model (Sharp 1964; Lintner 1965; and Black 1972) to include a measure of market volatility, Schwert and Seguin (1990) established sized-dependent beta coefficients. Namely, using the US stock market, they found that the increase in market volatility is likely to increase (decrease) the systematic risk of small firms (large firms), leading to widening spread of the systematic risk of large-firm and small-firm stocks during periods of high market volatility. Applying Schwert and Seguin's (SS) model to 10 international stock markets, Koutmos et al. (1994) also found some evidence supporting the positive (negative) relationship between the systematic risk of small capitalization (large capitalization) markets and world market volatility. Using industry returns from the Toronto Stock Exchange, Episcopos (1996) documented findings that are quite consistent with those of Schwert and Seguin (1990). They, however, further noted the different effects of market volatility on safer and riskier stocks. Recently, Reyes (1999) examined the issue for the case of the UK stock market. Properly accounting for conditional heteroskedasticity, he found no evidence supportive of size-related beta. Moreover, beta estimates obtained by incorporating GARCH effects in the market model are markedly different from the ones obtained from the normal SS' model.

While interest on beta instability and the relationship between time-varying beta and volatility has directed some attention to emerging markets, the analysis for these markets is still limited. A few studies on beta instability include Bos and Fetherston (1992) for the Korean stock market and Brooks et al. (1996, 1998) for Malaysian and Singapore stock markets. While Bos and Fetherston (1992) found that 61 percent of 128 Korean stocks exhibit beta instability, Brooks et al. (1996, 1998) documented incidence of beta instability of around 20 percent for both the Malaysian and Singapore stock markets. Most recently, Grieb and Reyes (2001) applied the SS' model to the Brazilian stock market. They noted that the Brazilian stock market behaves like small capitalization stocks of the US market. Namely, regardless of size, the systematic risk of the Brazilian stocks increases with aggregate market volatility. Looking individually at 38 investable stocks in the sample, they established positive relationship between the systematic risk and market volatility for 32 stocks (14 from large capitalization stocks and 18 from small capitalization stocks). From these, 6 large capitalization stocks and 10 small capitalization stocks have significant beta risk - aggregate volatility relationship.

In this paper, the author attempt to enrich literature on time varying beta for emerging markets by investigating the relationship between beta risk and aggregate market volatility for the case of Malaysia for the recent period (1988 - 2000) and various subsamples. Emerging markets such as Malaysia are typically characterized by high market volatility as compared to matured developed markets. Accordingly, in line with the view of Brooks et al. (1998), analyzing the issue of time varying beta is of interest and highly relevant. In particular, knowledge about beta instability is crucial for both investors and academic researchers who have shown increasing attention to the emerging stock markets. Given the predictability of aggregate market volatility, the systematic risk of an individual stock or portfolio may be better predicted. Subsequently, investors can have a more accurate guide for investments based on the predicted beta values and their degrees of risk aversion. To researchers, the presence of significant beta-market volatility relationship may bias event analyses based on the single index market model. In other words, the dependence of beta on market volatility needs to be properly accounted for in any study using the market model.

The organization of the paper is structured as follows. In the next section, the author provide an overview of the market under investigation, the Kuala Lumpur Stock Exchange (KLSE). Section 3 presents the empirical approach and section 4 describes the data and discusses estimation results. The final section, contains a summary and conclusion.

Kuala Lumpur Stock Exchange

The history of the KLSE can be traced back to early 1930s. Initially, Malaysia and Singapore had a common market for stock exchanges with two trading rooms, one in Singapore and the other in Kuala Lumpur, that were linked by direct telephone lines. However, together with termination of currency interchangeability between Malaysia and Singapore in 1973, the KLSE was established as an independent stock exchange for Malaysia. Since then, a great deal of attention has been given to developing Malaysian equity market. In 1992, the trading on the KLSE was fully computerized. The implementation of the Computerized Order Routing and Execution (SCORE) automated trading system in the year greatly facilitates the share trading of stockbroking companies located all over the country. In 1993, a computerized book entry system, known as the Central Depository System (CDS), was implemented for the purposes of clearings and settlements.

Since its establishment, the KLSE has progressed to be one of fast-growing stock exchanges in the region. The development and growth of the market is impressive particularly over a decade of high growth from 1987 to 1996. Table 1 presents selected indicators of the KLSE — the number of listed companies, market index, market capitalization and turnovers. The number of listed companies is relatively constant over the early periods (1970s and 1980s). While average number of listed companies were only 154 during

Table 1. **Selected Indicators of the KLSE**

Years	No. of Listed Companies	Composite Index	Market Cap (RM Bil.)	Turnovers	
				Unit (Mil.)	Value (Mil.)
1974-2000	381	480.70	208.74	23757.37	92975.48
	(4.39)	(9.40)	(15.45)	(20.24)	(22.40)
1974-1996	317	448.13	169.09	15208.57	67708.48
	(4.06)	(13.83)	(20.97)	(23.34)	(29.38)
1974-1980	257	154	18.57	752.14	1981.00
1981-1990	276	355	85.00	4458.00	10440.50
1991-2000	573	835	465.60	59160.40	239206.60
1988	295	357	96	4005	6760
1989	307	562	158	10162	18535
1990	285	506	132	13138	29522
1991	324	556	161	12348	30097
1992	369	644	246	19265	51469
1993	413	1275	620	107756	387276
1994	478	971	509	60143	328057
1995	529	995	566	33979	178859
1996	621	1238	807	66461	463265
1997	708	594	376	72799	408558
1998	736	586	374	58287	115181
1999	757	812	553	85157	185250
2000	795	680	444	75409	244054

Note: numbers in parentheses are the average growth rate

1974-1980, it increased to 835 during the recent decade (1991 - 2000). The Kuala Lumpur Composite Index recorded an average growth rate of 9.4 percent over 1974-2000. Market capitalization has increased at a rate of 15.5 percent over the same period. During 1974-1980, average market capitalization of the KLSE was only RM18.6 billion. It then increased to RM85 billion during 1981-1990 and to RM465.6 billion during 1991-2000. Similarly, market turnovers (in units as well as in values) have recorded double-digit average growth rate, i.e. over 20 percent, over 1974-2000. Note that, if the recent crisis years are excluded, the average growth rates of these indicators (except the number of listed companies) are even higher.

The lower panel of the Table provides annual figures of the above indicators from 1988-2000. Note that a marked increase in the number of listed companies takes place only during the recent period. In specific, it increases from 295 in 1988 to 621 in 1996 (one year before the crisis) and to 795 in 2000. Other indicators of the KLSE, i.e. market index, capitalization, and turnovers, recorded a huge jump in 1993. The Kuala Lumpur Composite Index increased almost two-fold from 644 in 1992 to 1275 in 1993. Likewise, market capitalization increased more than two times from RM246 billion in 1992 to RM620 billion in 1993, while market turnovers increased more than five times. The drastic increases in these indicators reflect the huge capital inflows during the year. Prior to 1993, the ratio of portfolio investment to GDP was under 1 percent. However, it jumped to more than 6 percent in 1993. The performance of the Malaysian stock market remained buoyant until it faced Asian crisis in 1997, where both the market index and capitalization plunged abruptly to, respectively, 594 and RM376 billion. These characteristics of the market during 1988-2000, which covers our sample period, seem interesting for the investigation of market-pricing behavior. In the present analysis, the author focus on the relationship between beta risk and market volatility.

Empirical Approach

The author adopt a two-stage procedure to evaluate the time-variation in common stock betas. In particular, in the first stage, the author model the stock market return using the GARCH(1,1)-in-Mean process or its variants to obtain estimates of market volatility as follows:

$$r_{mt} = \alpha_0 + \alpha_1 r_{m,t-1} + \phi\sqrt{h_t} + \varphi A_t + \sum_{i=2}^{5}\delta_i D_{it} + \varepsilon_{mt} \quad \text{.....................(1)}$$

$$\varepsilon_{mt} \mid \Phi_{t-1} \sim N(0, h_{mt}) \quad \text{..................(2)}$$

$$h_{mt} = a_0 + a_1\varepsilon^2_{m,t-1} + a_2 h_{m,t-1} + bA_t \quad \text{.................................(3)}$$

where,

r_{mt} = the return of the stock market index at time t,

Φ_{t-1} = the set of all information available at time $t-1$, and

h_{mt} = the conditional variance of the index return.

Equation (1) is the conditional mean equation modeled as an AR(1) process to account for possible serial correlation in the return series, partly induced by nonsynchronous trading. The risk and return tradeoff is captured by the inclusion of square root of the conditional variance in the mean equation. Due to the possibility of day-of-the-week effect in the market return, the author adjust the return by incorporating daily dummy variables (*D*) in the equation. The author also include a dummy variable for the 1997/1998 Asian crisis (*A*) in the equation to account for the effects of this turbulent episode on the market return. Equation (2) specifies the stochastic process of the error term with time-varying variance conditional on the information set available up to time $t-1$. Then, equation (3) explicitly specifies the conditional variance as a GARCH(1,1) process. Again, the 1997/1998 Asian crisis dummy variable is included in the equation to capture its influence on the volatility process. It is equal 1 for the period July 1997-December 1998 and 0 otherwise.

Then, in the second stage, the author estimate the market model (CAPM), in specific the SS' model, for each sized portfolio. There are three essential issues in the estimation of the CAPM model, as noted by Solibakke (2002). *First*, the beta may be nonconstant or time-varying. *Second*, the residuals of the error terms may not be homoskedastic. And *third*, beta estimates may be biased due to nonsynchronous trading. In the present study, the author focus on the first issue by looking at whether beta depends on market volatility. The writer incorporate heteroskedastic variance using GARCH methodology, i.e. the second issue, to improve the efficiency of the estimation and for robustness check. These two considerations are explained below.

In the case of biased beta, Hartono and Surianto (2000) have provided convincing evidence that beta for emerging markets are biased. In their works, various methods to account for the bias are considered. Since our focus is on whether beta varies over time depending on the condition of the market and not on getting unbiased estimates of beta, the issue of nonsynchronous trading and potential bias in beta is not considered. More importantly, our work may be considered as an alternative way of looking at how beta from the standard CAPM model can be biased. Namely, it is biased due to incorrect assumption that the beta coefficient is constant. Accordingly, the present work is a complement to the work by Hartono and Surianto (2000) by offering the second reason why beta may be biased.

The SS' model the author employ takes the following form:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \delta_i \left(\frac{r_{mt}}{h_{mt}}\right) + \lambda A_t + e_{it} \quad \text{...(4)}$$

where,

r_{it} = rate of return on portfolio *i*,

r_{mt} = contemporaneous return on the market index, and

h_{mt} = aggregate market volatility.

The crisis dummy variable is included in (4) when appropriate. Equation (4) is simply the extension of the CAPM model, allowing stock betas to vary over time depending on the aggregate market volatility. The term δ/h_{mt} is the time-varying term for portfolio/stock betas. From (4), the dependence of stock betas on the aggregate market volatility can be assessed based on the significance and magnitudes of δ_i. A positive δ_i indicates that the portfolio's systematic risk decreases with aggregate volatility. Meanwhile, a negative δ_i reveals a positive association between the portfolio's beta and market volatility.

As the author noted above, an important consideration that needs to be given in estimating (4) is on the specification of its variance process. While early studies assume constant variance, recent studies argue for modeling conditional heteroskedasticity in the SS' model. Namely, models that do not properly account for the presence of conditional heteroskedasticity in the data may yield misleading results due to inefficient estimates and inconsistent test statistics (Bera et al. 1988; Diebold et al. 1993). Moreover, beta estimates from the ARCH-type models may be markedly different from the normal SS model (Reyes 1999). Accordingly, to add reliability to our results, the author estimate (4) by assuming constant variance process as well as by allowing its variance to be conditionally heteroskedastic using the GARCH (1,1) specification normally adopted in existing studies.

Data and Results

Data

The sample consists of daily data on the Malaysian market index, the Kuala Lumpur Composite Index (KLCI), and 60 individual share prices from January 5, 1988 to December 26, 2000. In the selection of individual share prices, the author consider only those stocks that are currently components of the KLCI and have data over the entire sample period. These shares are actively traded with trading of more than 250 lots (then, starting in 1992, more than 1000 lots) per calendar year. Moreover, they are not subject to nontrading for more than 3 consecutive months. Lastly, these stocks are not from newly listed companies, subsidiary companies, and companies with drastic changes in capital structure. Accordingly, they add suitability to our investigation since they are least likely to suffer from the problem of infrequent trading. From the 60 individual stocks, the author form 12 equally weighted stock portfolios, each consisting of 5 stocks. The portfolios are formed based on market capitalization, which are ranked from smallest (portfolio 1 or P1) to largest (portfolio 12, or P12) market capitalization-based portfolios. The author analyze the relationship between systematic risks of these sized-based portfolios and market volatility using data for the entire sample as well as various subsamples.

Figure 1 provides a graphical plot of the KLCI while Table 2 presents various descriptive statistics for the index as well as the 12 stock portfolios. The index witnessed an upward trend in early period with a drastic jump in 1993 due to the huge influx of portfolio investments. The daily return (annualized return) of the KLCI was 0.07 percent (19.04%) over the period January 1988-December 1992. The index hovered around 800-1200 marks from January 1993 onwards and before the Asian financial crisis that began in July 1997. Its daily return (annualized) during the period was 0.05 percent (12.0%). During the crisis, the stock market skydived from above 1000 points before July 1997 to below 300 points in September 1998. It then recovered from the plunge to record roughly 700 points by the end of the year 2000.

Figure 1. **The Kuala Lumpur Stock Exchange Composite Index (January 4, 1998-December 26, 2000)**

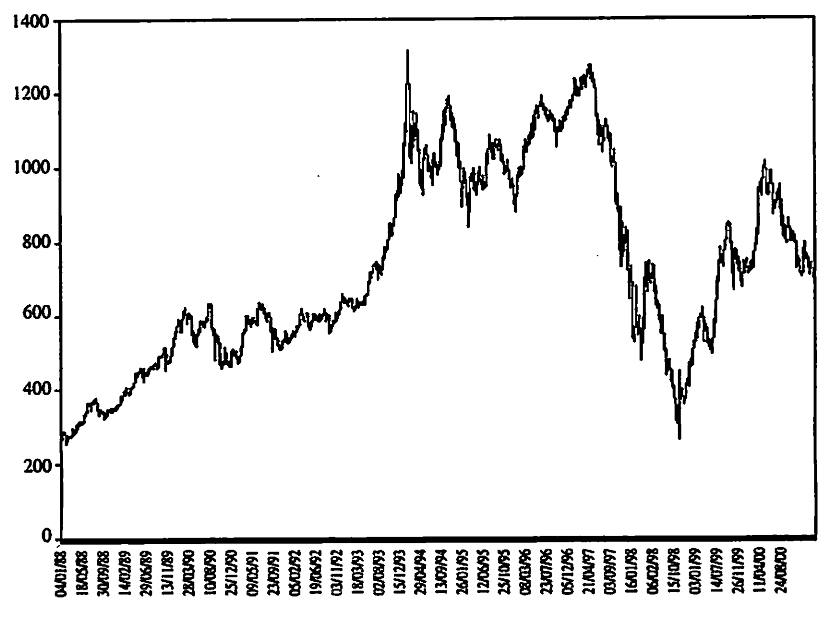

Table 2. **Descriptive Statistics**

Index/ Portfolio	Mean	Std. Dev.	Skewness	Kurtosis	Q(12)	$Q^2(12)$	ADF
			Kuala Lumpur Composite Index				
Jan88 -Dec00	0.0298	1.7217	0.3287	35.974	58.207	1505.5	-15.46
Jan88-Dec92	0.0739	1.1878	-1.1467	17.423	56.394	120.10	-9.07
Jan93-Jun97	0.0463	1.2157	0.1667	9.670	40.024	498.28	-8.87
Jul97-Dec00	-0.0532	2.6542	0.5293	22.044	27.934	382.21	-8.23
			Portfolios (Jan88-Dec00)				
P1	0.0169	2.1965	0.6427	10.103	108.88	949.73	-14.29
P2	0.0179	1.7112	0.1191	8.7424	357.04	1029.5	-13.29
P3	0.0243	2.1328	1.1700	22.337	221.78	519.69	-14.97
P4	0.0319	1.7004	0.9059	16.872	247.46	286.34	-14.39
P5	0.0208	1.5890	0.3288	24.050	287.73	497.64	-15.19
P6	0.0395	1.5687	0.0885	19.896	91.420	530.23	-14.70
P7	0.0253	2.2042	-0.3832	41.423	25.120	1009.4	-14.75
P8	0.0243	1.6588	0.2819	15.057	182.12	1007.9	-15.39
P9	0.0447	1.7929	-0.2529	17.333	213.17	442.22	-14.73
P10	0.0086	1.8141	-0.3562	23.513	136.17	587.68	-14.97
P11	0.0632	1.8768	0.9438	15.535	559.84	1189.7	-15.46
P12	0.0480	1.4694	-1.5320	32.037	129.79	332.77	-16.16

Note: Q(12) is Ljung-Box-Pierce Test Statistics for Serial Correlation for the return series with lag=12 and $Q^2(12)$ is Ljung-Box-Test Statistics for the squared return series. ADF is the augmented Dickey-Fuller Test for Unit Root.

Over the period of July 1997-December 2000, the market index has an averaged daily return (annualized return) of -0.05 percent (-13.8%). Based on these observations, the author divide the sample into the following three subsamples: (i) January 1988-December 1992, (ii) January 1993-June 1997; and (iii) July 1997-December 2000. In other words, *the first subsample* corresponds to the upward trend in the market while the *second subsample* marks years of huge influx of portfolio investments. *The third sample* begins with the Asian crisis to the end of the year 2000. Note from Table 2 that, as should be expected, the unconditional volatility for the third subsample, is the highest.

From Table 2, there seems to be no clear-cut patterns of returns or volatility for sized-based portfolios. The exception may be that the largest two portfolios have the highest returns while the smallest two portfolios, excluding portfolio 10, have the lowest returns. The index return (over the entire sample and the three subsamples) and all portfolio returns exhibit excess kurtosis. The Ljung-Box-Pierce statistics for the returns and squared returns suggest serial dependence and conditional heteroskedasticity for all return series. Accordingly, the GARCH specification is suitable for modeling both aggregate market volatility and individual return generating process. Lastly, the ADF unit root

Table 3. **GARCH Estimation Results for Market Index Returns**

$$r_{mt} = \alpha_0 + \alpha_1 r_{m,t-1} + \phi\sqrt{h_t} + \varphi A_t + \sum_{i=2}^{5}\delta_i D_{it} + \varepsilon_{mt}$$

$$h_{mt} = a_0 + a_1\varepsilon^2_{m,t-1} + a_2 h_{m,t-1} + bA_t$$

Estimated Coefficients	Sample Period			
	Jan88-Dec00	**Jan88-Dec92**	**Dec92-Jun97**	**Jul97-Dec00**
(a) Mean Equation				
α_0	-0.3145	-0.4683	-0.1758	-0.6930
	(0.0804)*	(0.1977)**	(0.0696)**	(0.2441)*
α_1	0.2064	0.2644	0.1586	0.1695
	(0.0194)*	(0.0337)*	(0.0301)*	(0.0388)*
ϕ	0.1451	0.3569	—	0.2347
	(0.0778)***	(0.1931)***		(0.1627)
φ	-0.4354	—	—	-0.4464
	(0.2150)**			(0.2929)
(b) Conditional Variance Equation				
α_0	0.1374	0.3221	0.0282	0.3297
	(0.0130)*	(0.0440)*	(0.0059)*	(0.0615)*
α_1	0.1652	0.2050	0.0892	0.1903
	(0.0145)*	(0.0316)*	(0.0132)*	(0.0345)*
α_2	0.7523	0.5487	0.8898	0.7016
	(0.0184)*	(0.0538)*	(0.0143)*	(0.0456)*
B	0.5919	—	—	0.6684
	(0.1232)*			(0.2278)*
Log-Likelihood	-5259.304	-1781.465	-1614.037	-1824.720
(c) Diagnostic Statistics				
Q (12)	9.0878	15.188	8.7669	5.3741
Q^2 (12)	1.4578	0.7938	3.2256	3.0213
Skewness	-0.8179	-2.423	0.064	0.3409
Kurtosis	17.506	34.193	4.9186	6.3237

Note: The diagnostic statistics are computed based on the standardized residuals.
Numbers in parentheses are standard errors.
*, **, *** denote significance at 1 percent, 5 percent, and 10 percent respectively.

test indicates stationarity for each return series.

Aggregate Market Volatility

Table 3 reports estimation results of the GARCH(1,1)-M model or its variants for the market return using the whole sample as well as three nonoverlapping subsamples. Diagnostic tests of standardized residuals, reported at the bottom of the table, indicate the suitability of GARCH specification in fitting Malaysian stock returns. The Ljung-Box-Pierce Statistics at 12 lags (Q Statistics) for the standardized residuals and squared standardized residuals suggest no serial correlation and conditional heteroskedasticity. However, there is still excess kurtosis in the return series for the whole sample and the first sample.

Several interesting observations from Table 3 are in order. *First*, the results suggest significant risk-return tradeoff only for the estimation using the whole sample and the first subsample (January 1988-December 1992). Namely, the coefficient of the conditional variance in the conditional mean equation is positive and significant at better than 10 percent significance level. The positive coefficient is intuitive since higher returns are required for increasing risks. However, for later two subsamples, the risk variable factor is not significant. *Second*, as expected, the Asian Crisis results in a reduction in stock market returns and, at the same time, an increase in its volatility. This documented phenomenon may account for insignificant in the risk-return relationship found for later subsample. Lastly, conditional volatility in the Malaysian return seems to have persistent effects on future volatility, as captured by the sum of ARCH and GARCH coefficients ($a_1 + a_2$). The sum equals 0.93 for the whole sample. Looking across the three nonoverlapping subsamples, the author may note that the degree of persistence increases from the first sample to the second sample and, then, reduces slightly in the third sample.

Beta Risk and Market Volatility

In this subsection, the author estimate model (4) to examine the relationship between market volatility, generated from models presented in Table 3, and beta risks for various size-based portfolios for the whole sample and the three subsamples. The results, which are summarized in terms of the number of positive, negative and significant coefficient of return-volatility (i.e. r_{mt}/h_{mt}), are given in Table 4. Note that the positive coefficient indicates negative relationship between market volatility and beta risk and vice versa. Generally, the results suggest significant relationship and accordingly time-varying beta risk with GARCH estimation providing more incidences of significant coefficients. However, while the pattern of the relationship between beta risk and market volatility seems to depend on the sample period, it does not seem to depend on portfolio size.

Using the whole sample from January 1988 to December 2000, the author find negative relationship between beta risk and market volatility (i.e. positive coefficient) for all size-based portfolios and it is significant in 9 (11) portfolios using OLS (GARCH) estimation. Thus, it seems that the beta risk of Malaysian stock portfolios behaves in a similar manner as large-capitalization stocks in the U.S. In the case of an emerging market of Brazil, by contrast, Grieb and Reyes (2001) documented positive relationship, which is consistent with the empirical tendencies of small-size stocks of the U.S. Our results are, thus, can be viewed as puzzling. How-

Table 4. **Beta Risk and Market Volatility Relationship**

	OLS Estimation		**GARCH Estimation**	
Period	**Positive [Sig.]**	**Negative [Sig.]**	**Positive [Sig.]**	**Negative [Sig.]**
January 1988 - December 2000	12 [9]	0 [0]	12 [11]	0 0
January 1988 - December 1992	11 [7]	1 [0]	11 [8]	1 [1]
January 1993 - June 1997	4 [2]	8 [5]	2 [1]	10 [6]
July 1997 - December 2000	10 [6]	2 [1]	11 [7]	1 [1]

Note: numbers in squared brackets indicate the number of significant coefficients based on 10 percent significance level.

ever, as the author described earlier, the author can roughly characterize the Malaysian equity market over the sample period into three different subperiods; namely, (i) the upward trend of the market, (ii) the high level of the index fueled by inflows of portfolio investments, (iii) and the crisis period. Accordingly, the observed positive coefficients of market return –volatility ratio may be driven by certain subsamples. In other words, since the values of beta may vary according to the conditions of the markets (Bhardwaj and Brooks 1993, and Downs and Ingram 2000), the relationship between beta and volatility may vary as well.

Indeed, the estimation of the SS model for the three subsamples indicate that beta risk, and market volatility relationship can vary across samples or market conditions. The negative relationship between beta risk and market volatility holds for the first subsample and third subsample. Namely, our focal coefficient is positive in most cases and significant in the majority of them for both subsamples. However, the author also observe in these subsamples positive and significant relationship between beta and market volatility (i.e. negative coefficient) for one portfolio. Interestingly, for the second subsample, the estimated coefficient for the market return –volatility ratio is in most cases negative, suggesting a positive relationship between beta risk and market volatility. During this period (January 1993 to June 1997), the Malaysian equity market was at its historical peak initiated by huge inflows of portfolio investments in 1993. Perhaps, the Malaysian equities were overvalued due to intense speculative activities during the time. Accordingly, increasing market volatility may have generated higher beta risk for Malaysian stock portfolios. Then, the negative relationship between beta risk and volatility may be due to the fact that component stocks of the KLCI, selected for the purpose of our investigation, are relatively safe stocks. As volatility increases, people may reallocate funds to these stocks and, accordingly, depress their beta risks.

Conclusion

It is generally noted that beta risk is time varying. In this paper, the author seek to examine as to whether market volatility is related to portfolio betas for the case of an emerging equity market of Malaysia. To this end, the author use variants of GARCH models to measure aggregate model and then apply the SS model to daily data sample that spans from January 1988 to December 2000. From the estimation using the entire sample, regardless of size, the author note negative relation between beta risk and aggregate market volatility, suggesting decreasing risk with increasing volatility in the market. When the author break the data sample to three subperiods, the negative relation between beta risk and market volatility continues to hold for the first subperiod (January 1988 and December 1992, the period of upward trend in the market) and the third subperiod (July 1997 - December 2000, the period of the Asian Crisis and its aftermath). Interestingly, for the second subperiod that spans from January 1993 and June 1997, their relation turns positive. The year 1993 is unique in the sense that it marks a drastic jump in inflows of portfolio investments. The active as well as speculative participation from institutional investors had since led to an equity market bubble (Athukorala 2000). Accordingly, volatility of the stock market during the time may signal speculative attack, leading the an increase in beta risk that the author observed.

These findings have at least two important implications. *First*, to the extent that market volatility is predictable due to its noted clustering behavior, portfolio betas can be better predicted. However, the instability or shift in the beta-market volatility relation may make investment decision difficult. Perhaps, analysts need to use information on market conditions for the purpose of gauging whether market volatility influences beta risk positively or negatively. *Second*, the observed time-varying volatility questions the use of the simple CAPM in event studies as a basis for generating abnormal returns.

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