Taking Stock at the New Millennium: A Study of Twelve Stock Markets

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Abstract

This paper studies stock market returns in twelve countries with special focus on Asian stocks and the Asian financial crisis under the turbulent conditions of 1997 and 1998. Our approach in this study is a conservative and cautious one. Thus we focus on constructing an international portfolio using a shortfall constraint approach, which is purposefully designed to minimize the 'probability of a loss'. We also use the tail index based on the Extreme Value Theory to analyze the distribution of extreme returns, particularly those included in the left hand tail. The approach adopted in this paper represents one of the recent developments in finance that explicitly accepts a departure from the long tradition of Normal distribution assumption, and thus it is consistent with the recent trend in the finance industry in emphasizing the value-at-risk approach for risk management. Specifically, the empirical evidence indicates that despite the great turmoil during the Asian crisis, Asian stocks continue to remain viable investment opportunities to the US investors. An ex ante optimal portfolio constructed using a simplistic method based on information available in the previous month, outperformed, in every respect, a portfolio consisting predominantly of US stocks. With the emergence of more sophisticated techniques for forecasting returns and risk, and with the Asian economies on course to full recovery from the crisis, the result reported here can only get stronger. Other findings in this paper include a positive relationship between correlation and volatility and a negative relationship between correlation and returns. The findings, however, would seem to indicate that during stock markets downturn, both correlation and volatility are likely to increase and thus erode some of the benefits gained from international diversification.

Key words: Emerging stock market, Extreme value theory, Tail index, Portfolio diversification

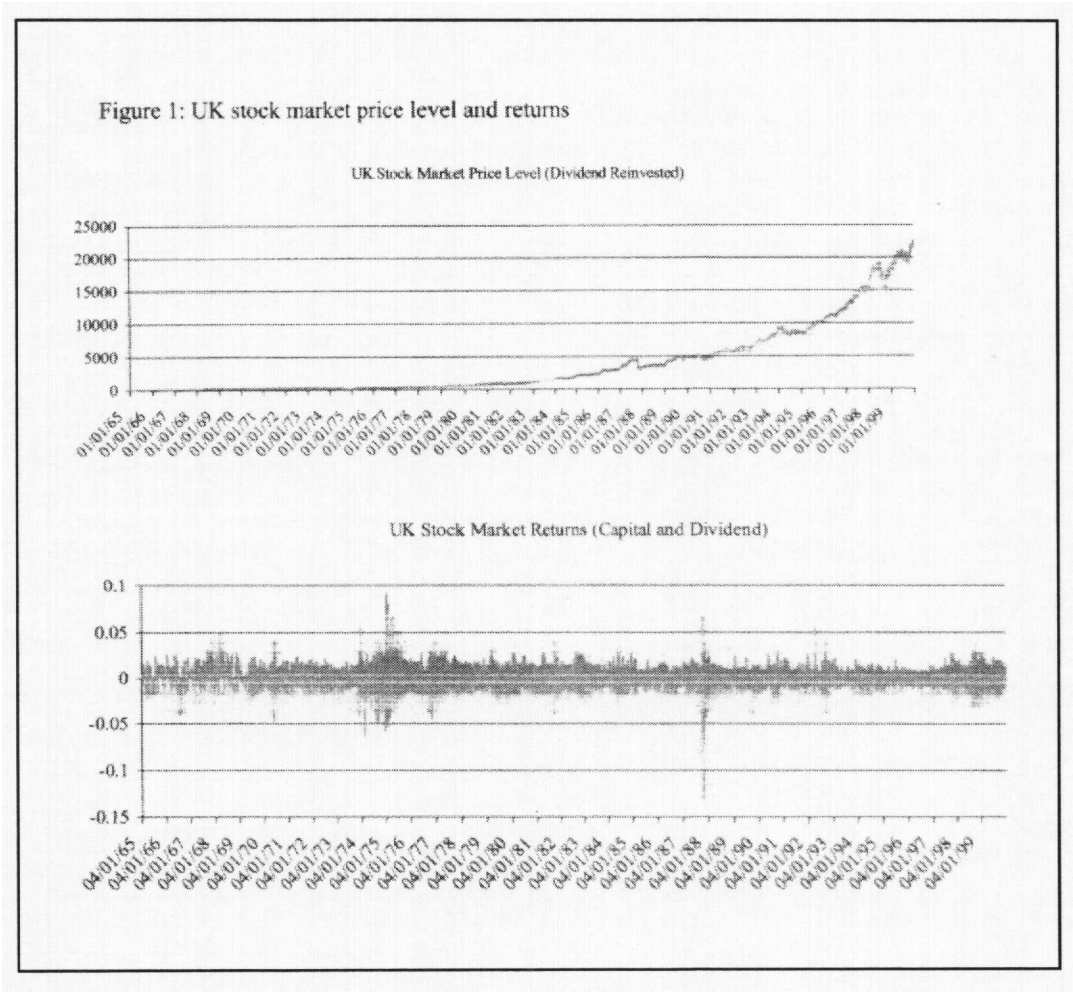
JEL classification: C22, F21, G11, G15

1. Introduction

The last millennium, or the last century to be more precise, has witnessed a series of panics and chaos across the world stock markets. Record[1] of share trading in England, for example, appeared as early as 1700 although databases of US and UK stock prices date back to 1929 or, more commonly, the 1960's. Figure 1 plots the UK stock market price level and returns for the last thirty five years. The computation assumes dividends are reinvested and so the returns include capital gain as well as dividend income.

From Figure 1, we can trace the impact on stock markets by major events such as, for example, the 1975 oil price crisis, black Monday, October 19, 1978, the liquidity crisis as a result of the collapse of Long Term Capital Management (LTCM) in 1998, just to name a few. The price movements in the earlier period from 1965 to 1985 are not noticeable in the

graph for stock index level due to the index scaling effect. The relative returns diagram in Figure 1, on the other hand, clearly puts the booms and busts in the right perspective. As can be seen, the 1998 downfall that is visually dramatic in the index level diagram is relatively modest in the diagram of the relative stock returns, compared with the effect of Black Monday in 1987 and the oil price crisis in 1975. In this paper, we focus primarily on the Asian financial markets and the impact of the 1997 Asian crisis although this event does not appear to be particularly dramatic as shown in Figure 1.



Specifically, we address the question of whether the Asian stock markets can still be considered as viable investment markets for westerners. Here we choose the perspective of an American investor and the US$ as a base currency.

Our main sample covers a 5.7 year period spanning May 4, 1994 through to December 31, 1999. The stock markets included in our sample are those of the so called "tiger economy", namely Malaysia, the Philippines, Indonesia and Thailand, and the "dragon economy", Singapore, Taiwan, Korea, Hong Kong and China, and three mature markets consisting of the US, UK and Japan that are more familiar to western investors. Because of

the desire to include China in a comparative study of this nature, we have omitted data from the earlier period since Chinese stock market return data is only available from May 4, 1994 onwards. There is no doubting that China presents great potential for investment and returns as marked by stock trading at both exchanges at Shenzhen and Shanghai which, in recent times, have grown at a tremendous pace[2] . The number of Chinese companies listed on the stock exchange increased from 13 in 1990 to 708 in 1997 reaching a total market value of 1.64 billion Ren Min Bi (RMB) and is set to continue to grow at a much faster pace over the next five years.[3]

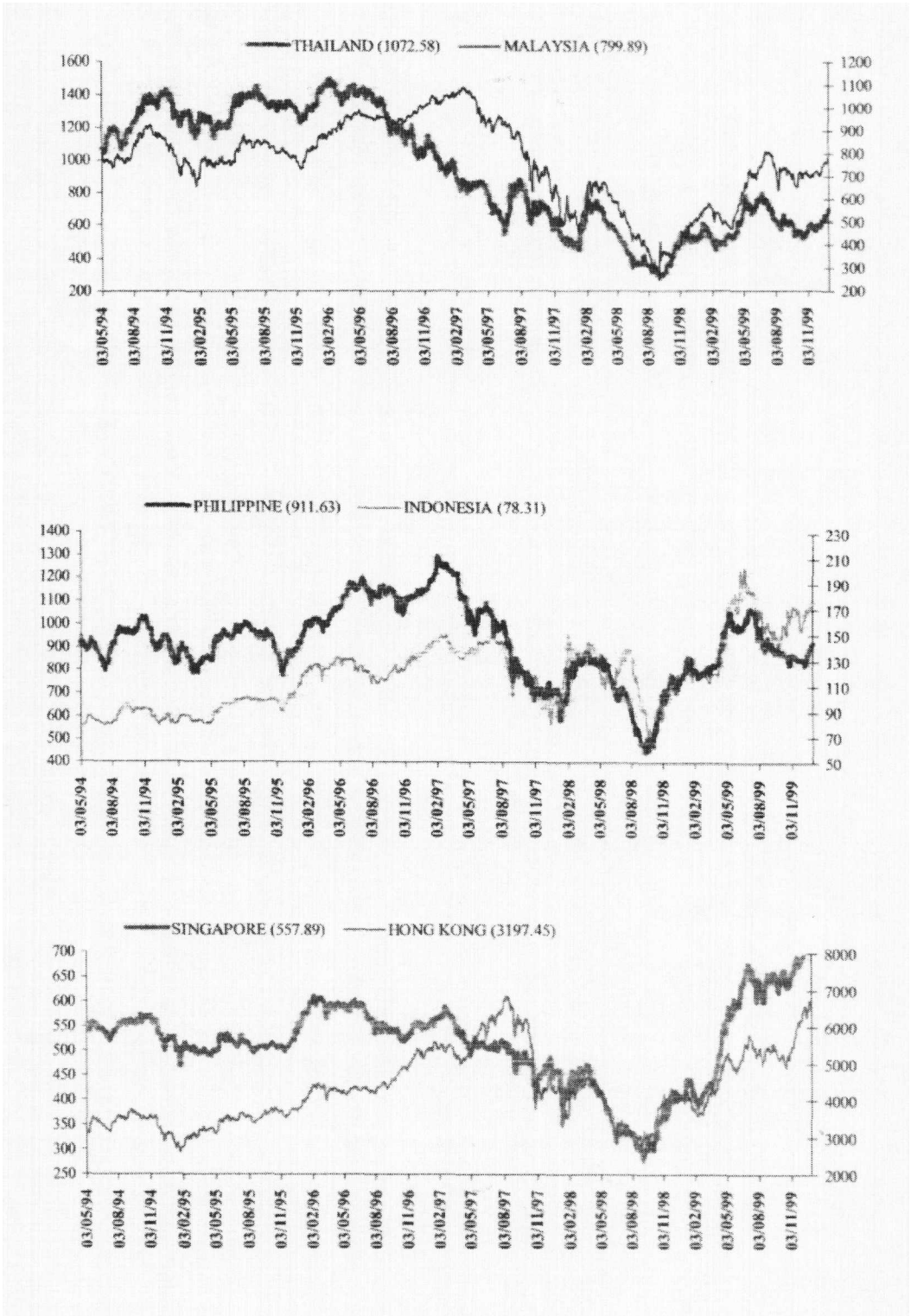
Given the great trauma experienced by stock markets and investors in the region, the approach of our analysis will be a conservative one. The investment strategy we analyzed is based on minimizing the 'probability of loss' and so we employ a tail index model in order to study the distribution of extreme returns for the twelve countries in our sample. This corresponds directly with the value-at-risk approach of risk management[4]. The results of our analyses suggest that the Asian markets cannot be ruled out as feasible investment opportunities for the American investors, especially when risk and diversification is of concern. Despite the high volatility of Chinese and Philippine stocks, both of these stocks have provided good return and diversification benefits, if only because they have low and, at times negative, correlation with US domestic market returns. An international portfolio constructed using previous month mean returns and variance-covariance information is superior to the US domestic return even during the difficult period marked by the Asian crisis. The international portfolio provides US$ returns 340 basis point above the US domestic returns with similar level of risk. The distribution of the international portfolio returns is positively skewed and has far fewer extreme negative returns as confirmed by the tail indices constructed based on Extreme Value Theory. Hence, from a risk management standpoint, it may be concluded that an international portfolio that includes Asian stocks is better than the US domestic stocks alone. Thus one would expect these results to be much stronger with better models for forecasting returns and risk, and especially when the Asian economies have fully recovered from the aftermath of the 1997 crisis.

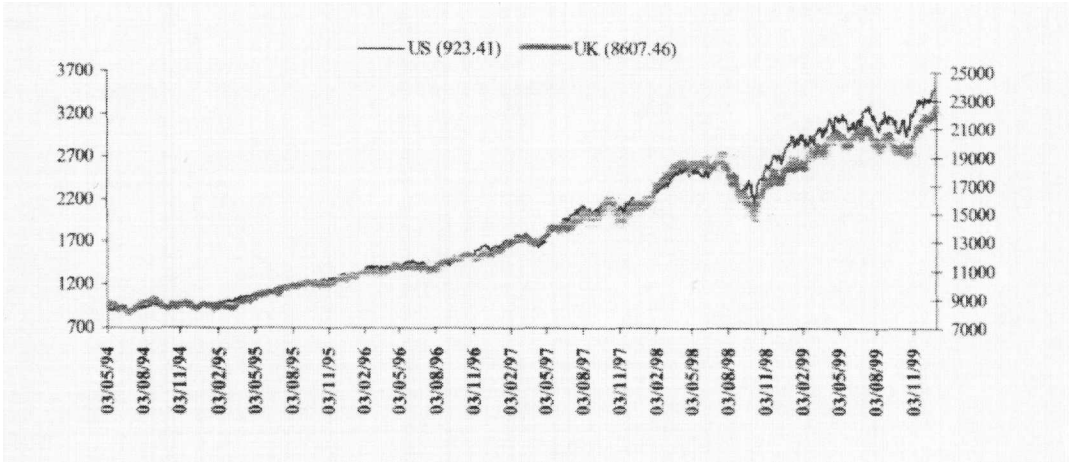
The rest of the paper is organized as follows: Section 2 provides a historical account of the risk, return and correlation profiles of the twelve stock markets for the last 5.7 years. In Section 3, we construct optimal portfolios and compare their risk return characteristics with the US stock market returns. In Section 4, we explain the way in which a tail index, based on Extreme Value Theory, can be used to study the distribution of extreme stock market returns. Section 5 summarizes and concludes.

2. Returns, Risk and Correlation: A Historical Perspective

In Figure 2, we combine the time series trend of the twelve stock markets in our sample. Different scales were used for each series in order to highlight the stock price movements of a particular stock market. The starting level of each index is noted in the legend.

It is true to say that the stock market downfall in Thailand took place about one year before the actual collapse of the Thai Baht on 2nd July 1997. The plague of the Thai stock market troubles spread to other Asian markets: namely Malaysia, the Philippines, Indonesia, Singapore, Hong Kong, Korea, Taiwan and Japan within six months, though with different degrees of severity being felt in each country. The fallout from the crash also marked China as the only country in the region whose stock market was not affected as a result of the crisis, as well as the only country in the region that managed to defy the pressure of a





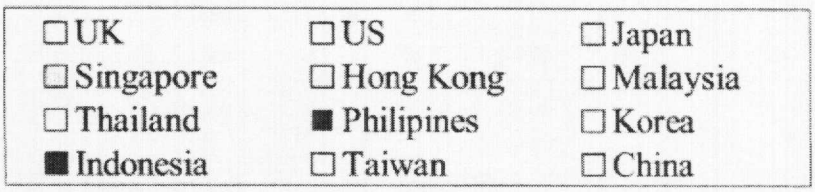
massive devaluation of the RMB during the Asian crisis of 1997. A worldwide recovery took place in the last quarter of 1998 and by the end of the last millennium, the Asian 'dragons'(Singapore, Honk Kong, Japan, Korea and Taiwan) had recovered most of the losses they incurred during the 1997 crisis. The Asian 'tigers' on the hand are still struggling to close the gap. Though it is interesting to note the contrasting differences between Malaysia and Thailand. For instance, Thailand received financial aid from the IMF, but its recovery rate was much slower than that of Malaysia who refused financial aid from the IMF. Since the price trend of the US is more or less close to that in the UK, both countries suffered a slight set back in 1998. On the whole both of these countries are less volatile and their economic growth rates have been more promising than the Asian markets over the 5.7 year sample period.

Figure 3 plots the twelve stock market returns measured in local currencies over five subperiods. These data periods are of different length and are determined primarily on the basis of the date on which a new data series became available. The detailed statistics e.g. skewness, kurtosis, max and min values are provided in Appendix A.

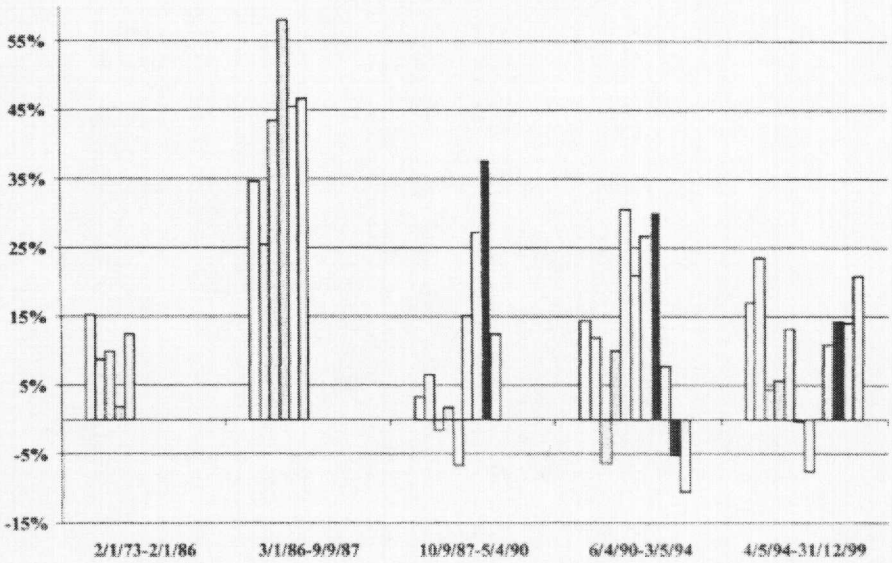
First, it should be pointed out that the average returns and risks over the ten year period from January 2, 1973 to January 2, 1986 are relatively low. While the following 7 year period, from 3 January 1986 to 9 September 1997, represents a golden age for equity investment. As can been seen from Figure 3, the annualized equity return range from 26% (in the US) to 59.4% (in Singapore), while risk was at a level comparable to the previous period. However, the stock market crash of 1997 changed the picture completely. Indeed, from 10 September 1997 onwards, the stock markets were swamped with unpredictable returns and high volatility. The situation in the Asian region was particularly severe and for the first time negative average returns were common in Asia. At the same time, the average volatility in Asian stock markets was about twice of that in the US and the UK[5].

Some researchers have claimed that markets are now more integrated and volatile than before, while others posit that correlation increases when volatility increases[6]. Figure 4 be-

Figure 3. Study sample: stock market returns in local currencies



(a) Annualised Stock Market Returns



(b) Annualised Stock Market Volatility

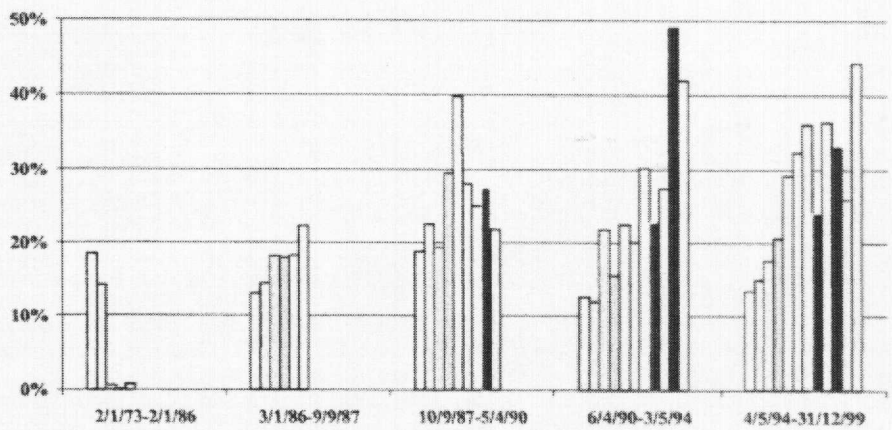
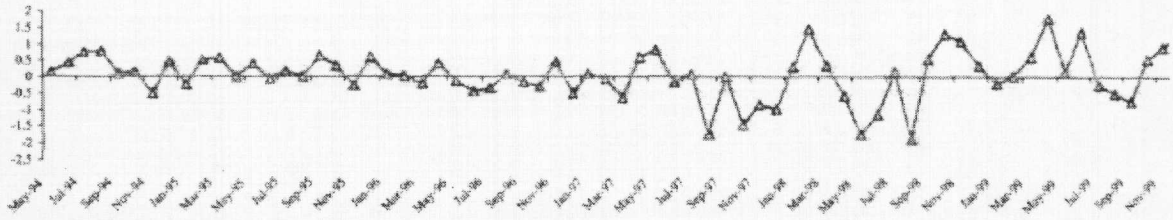
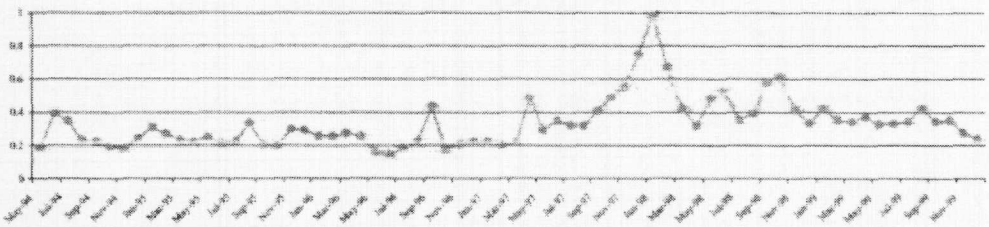


Figure 4. Study sample: monthly average returns, standard deviation, and correlation

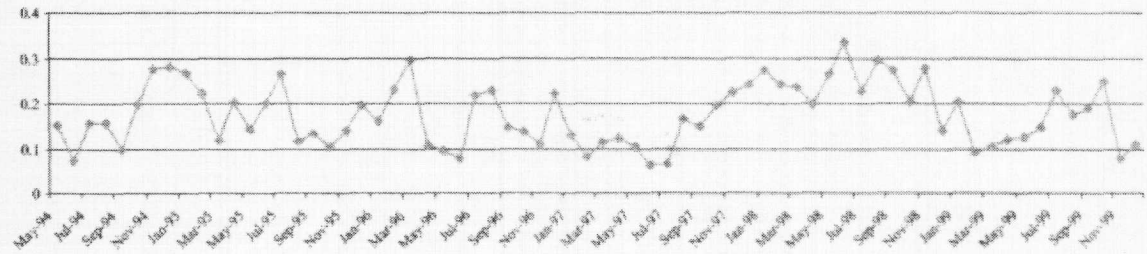
(a) Simple monthly average of twelve stock market returns



(b) Simple monthly average of twelve stock market standard deviations



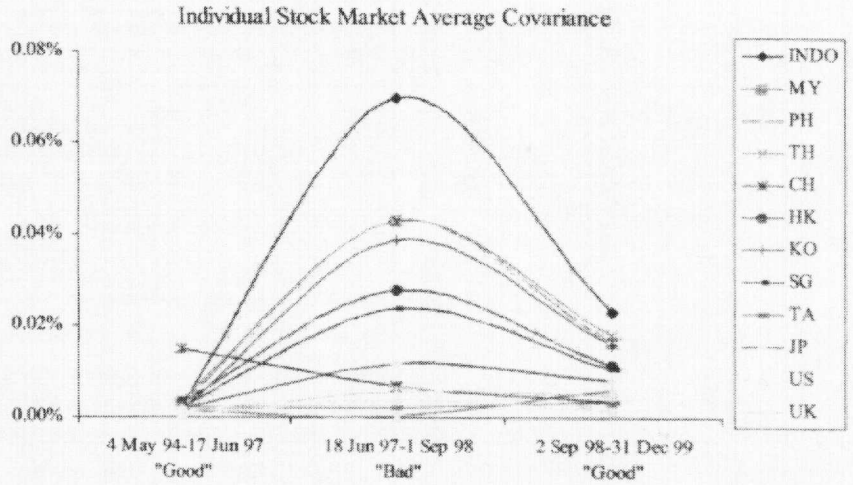
(c) Simple average of all individual stock market monthly correlation

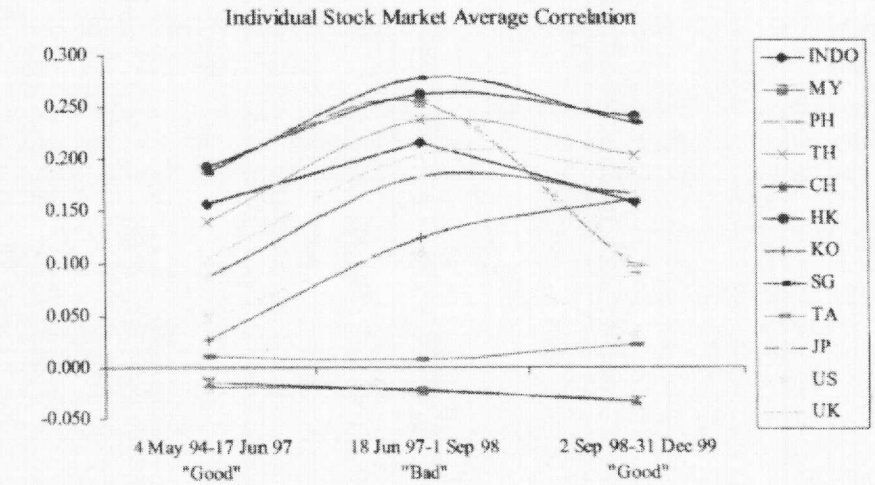


low plots the monthly average returns, standard deviation and correlation calculated from daily returns of each month, and appropriately annualized, for all twelve stock markets.

If we split the 68 months sample period into two halves, we cannot reject the null hypothesis that the two sub-periods have equal mean using a two-sample *t*-test. There is, however, a noticeable upward shift in volatility. A two-sample *t*-test clearly rejects the null hypothesis that the volatility is the same for the two sub-periods at the 1% significant level. There is no difference in the correlation coefficients estimated for the two sub-periods. The average correlation moves within the range of 0.06 to 0.33 with no distinct pattern evolving across time. When we regress average correlation against average standard deviation and

Figure 5. Average correlation of sample data





average returns, the regression coefficients are, respectively, 0.1695 (t-ratio=3.336 and p-value=0.001) and -0.0247 (t-ratio=-2.388 and p-value=0.020) with adjusted R-square equal to 18.75%. This result supports the conjecture that correlation is positively related to volatility and negatively related to returns. Thus, one may argue that the averaging process used in producing these graphs have removed interesting characteristics of individual stock markets.

In Figure 5, we plot the average correlation of the individual stock markets in our sample. Here we split the sample period into three zones. The first zone ends just before the Thai baht was devalued, which we shall refer to as a "good time". During this period, most Asian stocks, except Japan and Thailand, enjoyed relatively high growth. The second zone, referred to as "bad time" covers the entire period of the Asian crisis and ends at the trough in 1998. The third zone covers the period of recovery, which we refer to as a "good time" again.

There are, however, several interesting patterns that emerge in the disaggregate information. It is clear that correlation and covariance went up during "bad time" for almost every stock market except for China and the Philippines. The markets of Korea and Taiwan are the only two stock markets whose correlation continue to rise in the third zone. The average correlation for Malaysia fell dramatically in the third zone, but this was partly due to the exchange and capital controls imposed by the Malaysian authorities. Since the covariance is the product of the correlation and standard deviations of two countries, the relatively greater increase in covariance over the correlation may imply standard deviation in one or both stock markets have increased during a "bad time". This corresponds with our previous finding of a positive relationship between correlation and volatility and a negative relationship between correlation and return, though, in addition, it is possible that there is a second tier of correlation among volatility that is not captured by the correlation among returns. Further research will be required to verify this.

Scope for International Diversification

In the previous section, it was noted that in the last decade, the Asian stock markets have gone through a turbulent time. Among the "tigers", the markets of the Philippine and Indonesia are now making gradual recovery. Malaysia and Thailand have not yet, as at the end of 1999, made good the losses incurred during the Asian crisis. On the other hand, the "Dragon" economies have been relatively more buoyant with the Singapore, Hong Kong and Japanese stock markets surpassing their pre-crash heights. The impact of the Asian crisis on the Taiwanese, Korean and Chinese stock markets were not dramatic in the first instance. And likewise, the developed U.S and U.K markets were not significantly affected by the 1997 Asian crisis. The repercussion came in October 1998 when the Russian's default triggered sharp falls in both the US and UK stock markets forcing the NYSE to call for two trading halts on two consecutive days.

In the last decade, the dramatic swings in stock market performance worldwide were unprecedented. Capital flight took place withdrawing substantial amount of speculative money away from the Asian region. Later, in this paper, we shall show that despite the poor performance and high volatility of the Asian markets, Asian stock markets as a whole continue to present themselves as good investment opportunities for US investors, adding

value to a US$ equity portfolio. And providing the Asian crisis does not repeat itself, the prospect of the region as an opportunity for portfolio diversification is good.

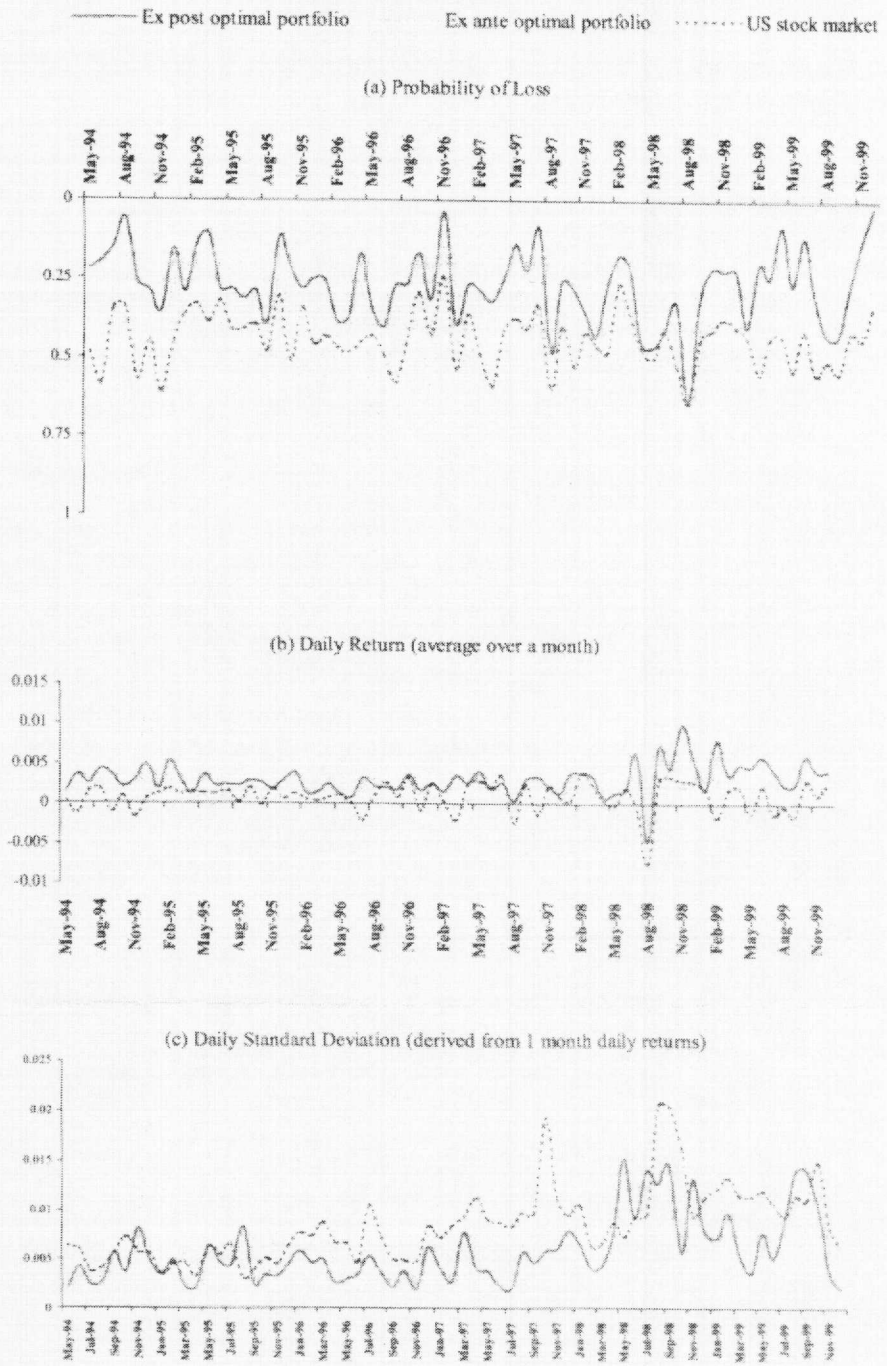
To demonstrate the benefits from diversification, we calculate stock market returns, as measured in US$, and form optimal portfolio by maximizing a modified version of the Sharpe ratio, R_p / σ_p, which can be interpreted as a "shortfall constraint" approach. The larger the portfolio return, R_p, with respect to risk, σ_p, the smaller is the probability of making a loss. For example, R_p must be greater than or equal to $1.96\sigma_p$ if we do not allow the probability of loss to be greater than 2.5% assuming of course that expected portfolio returns are normally distributed. Our optimal portfolio weights were revised every month. For the 'ex post' efficient portfolio, we used returns and risk information in the current month, while for the 'ex ante' portfolio we used information available in the previous month. The results are plotted on Figure 6 with the US domestic stock market returns added as a dotted line for ease of comparison.

As shown in Figure 6, the 'ex post' optimal international portfolio clearly dominates the US domestic stock market returns as (i) the probability of loss is always lower in Figure 6(a), (ii) its average daily returns for each month is almost always higher than the US domestic returns, and (iii) the standard deviations, derived from the daily returns in each month, were almost always the lowest. Unfortunately, this 'ex post' efficient portfolio is not likely to be feasible in practice. However, we included it here to reflect the upper limit of portfolio optimization. A fairer comparison should be made against a more realistic target such that the 'ex ante 'constructed optimal portfolio makes use of previous month information only. The 'ex-ante' version of the optimal portfolio appears to be at least comparable to the US domestic investment in terms of the 'probability of loss' and 'average daily returns' However, it has a smaller standard deviation than the US domestic returns for almost every month except for the month of December 1994, when the optimal portfolio weights shifted drastically to Asia (and especially China) for that particular month.

Table 1 reports the characteristics of the optimal portfolios and individual stock markets in our sample. Over the period May 4, 1994 to December 31, 1999, the US market yielded annualized returns equal to 20.4%. The only country in our sample that has a comparable stock market return is the market of China, though noticeably the Chinese standard deviation is about three times that of the US market. Measuring stock returns in US$ increases the individual stock market risk levels as there is now an additional component of exchange rate risk. The Chinese stock market return is now twice as large as the US stock market return (owing to the appreciating RMB), but it is now nearly four times as risky[7]. Ave rage weight s in the optimal portf olio

Remarkably, our simple but realistic portfolio strategy created an average return measured in US$ that is 340 basis point higher than the US domestic returns and also has less risk. The positive skewness and smaller kurtosis for this portfolio are both desirable, and, because of these, the maximum one-day loss is less than half of that of the US domestic stock market returns. The optimal portfolio weight profile in Table 1 shows that over 20% of the investment was placed in the US. None of the Asian markets were totally omitted. The average weights in both the Philippines and China were about 10%, slightly ahead of the UK at 9.5%.

Figure 6. Ex-post/Ex-ante Optimal Portfolio



Notes: The optimal portfolio weights were revised every month. 'Ex post' optimal portfolio uses current month information, whereas 'ex ante' portfolio uses previous month information. The probability of loss is calculated as N(d), where N(.) is the cumulative Normal density, and d is the mean return divided by the standard deviation.

Table 1
Summary statistics for twelve stock market returns for the 5.7 year period from May 4, 1994 to Dec 31, 1999

	Returns (p.a.)	Sigma (p.a.)	Skewness	Kurtosis	Max (p.d. %)	Min (p.d. %)
Returns measured in local currencies						
China	0.209	0.442	1.880	23.927	29.796	-17.974
Korea	0.108	0.363	0.405	3.688	11.348	-10.208
Thailand	-0.076	0.360	0.867	4.786	12.139	-11.814
Indonesia	0.143	0.330	0.447	8.643	14.180	-13.938
Malaysia	-0.003	0.324	0.716	29.072	20.402	-22.198
Hong Kong	0.132	0.291	0.239	11.014	15.552	-13.584
Taiwan	0.141	0.259	0.002	2.562	8.188	-7.757
Philippines	0.003	0.240	0.090	5.208	9.817	-8.558
Singapore	0.056	0.206	0.327	6.828	8.907	-7.772
Japan	0.044	0.176	0.164	3.125	6.387	-5.153
US	0.204	0.142	-0.407	6.133	4.875	-7.019
UK	0.171	0.134	-0.207	1.949	3.865	-3.255
Returns measured in US$						
China	0.428	0.601	0.197	17.732	29.831%	-39.520%
Korea	0.048	0.464	0.607	14.035	26.873%	-21.656%
Thailand	-0.147	0.414	0.709	6.199	16.372%	-15.878%
Indonesia	-0.067	0.568	-0.987	20.460	23.247%	-37.862%
Malaysia	-0.065	0.415	-1.241	42.295	22.997%	-36.754%
Hong Kong	0.131	0.291	0.253	10.936	15.574%	-13.563%
Taiwan	0.148	0.282	-0.072	3.748	7.059%	-12.293%
Philippines	0.007	0.285	0.076	5.829	13.517%	9.708%
Singapore	0.044	0.231	0.301	7.865	10.625%	-9.532%
Japan	0.042	0.220	0.591	5.061	11.538%	-5.793%
UK	0.182	0.133	-0.117	1.314	3.489%	-3.128%
Ex post optimal portfolio	0.819	0.114	0.154	4.287	4.448	-3.502
Ex ante optimal portfolio	0.238	0.141	0.177	4.057	5.099	-4.319

Notes: The twelve countries are sorted in the descending order of sigma. See Appendix A for statistics for other periods. 'Returns' and 'Sigma' are annualised figures assuming that there are 261 trading days in a year. 'Max' and 'Min' are maximum and minimum daily returns expressed in percentages.

4. Heavy Tail Distribution and Extreme Stock Returns

The problem with conventional risk return analysis and portfolio optimization is that a Normal distribution is assumed for stock returns. Indeed most statistical analyses are based on the central limit theorem and tend to focus on the central mess of the population located around the mean. It has also been the norm for researchers to truncate (or "dummy out") outliers from the data prior to any analysis. It is well documented in the literature that stock returns are leptokurtic or heavy tailed, meaning that there are more observations in the tail than that predicted by a Normal distribution, and thus there are more extreme returns and crashes than we would normally expect. Omitting the extreme events is no longer tolerable especially if the omission leads to an underestimation of the probability of large-scale losses. The value-at-risk approach of risk management is designed to curtail downside risk of this kind.

The importance of extreme events has been the central theme of studies in the insurance industry and natural sciences such as flood and river level modelling. Researchers in these fields have used Extreme Value Theory (EVT) to study extraordinary events and the 'tail index' to model specifically the distribution of extremals. Koedijk, Schafgans and de Vries (1990), Koedijk, Stork and de Vries (1992) and Longin (1996) are recent examples of EVT applications in finance studies. Figure 7 plots the return distributions of our ex ante optimal portfolio returns and that for the Indonesian stock market returns. As can be seen, the heavy tail phenomenon is much more pronounced for Indonesian stock market returns, which is captured by a larger Indonesian tail index.

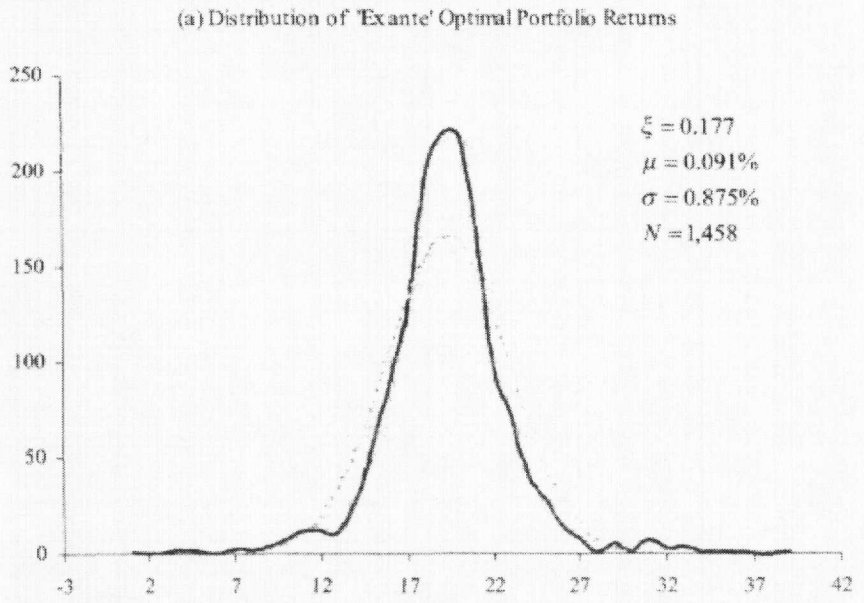
The Extreme Value Theory states that for independent and identically distributed random variables $\{X_1, ..., X_N\}$ of a distribution function $F(x)$, the maximum $X_{(n)} = Max\{X_1, ..., X_N\}$ converges weakly, upon suitable normalization, to one of three limiting distributions, viz. the Gumbel, Weibull and Frechet distributions. These three distributions may be combined into a single Generalized Extreme Value distribution below:

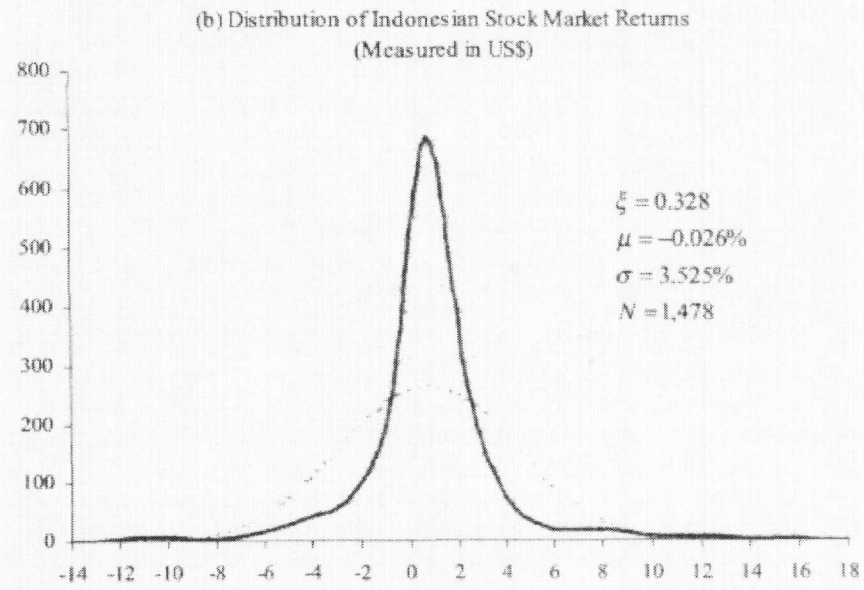
$$H_\xi = \begin{cases} \exp\{-(1+\xi x^{-1/\xi}\} & \xi \neq 0, \\ \exp\{-\exp(-x)\} & \xi = 0, \end{cases}$$

where $1+\xi x > 0$. The parameter ξ is called the tail index and $1/\xi$ is called the shape parameter. For heavy tail distribution, one would expect ξ to be greater than zero. Instead of sampling the periodic extremals, one efficient method for estimating the tail index is to fit the distribution of all observations that exceed a given threshold, t*, based on theory linking the distribution of the maxima and the distribution of the entire tail.

It has been shown in many discussions on Extreme Value Theory (see for example, Embrechts, Kluppelberg and Mikosch (1997)) that, provided that the threshold for tail distribution is high enough, the fit of a Generalized Pareto Distribution to the tail realizations will produce an estimate of the tail index. In practice, the Hill estimator (1975) is often used to estimate the tail index for financial data because of the well documented thick tail distribution among financial series. The use of Hill estimator immediately assumes a Frechet distribution where ξ is greater than zero. Specifically the Hill estimator, $\xi^H_{t,T}$, is computed as:

Figure 7. Distribution of ex-ante optimal portfolio returns





$$\xi^{H}_{t,T} = \frac{1}{t-1}\sum_{j=1}^{t-1} \ln(X_{j,T} / X_{t,T}),$$

where t is the number of extreme values in the tail, T is the total number of observations, and $x_{t,T}<...<x_{1,T}$ is an ordered sample. Provided that $t / T \to 0$ as $T \to +\infty$, $\xi^{H}_{t,T}$ is consistent and has asymptotic normality:

$$\sqrt{t}(\xi^{H}_{t,T} - \xi) \to N(0,\xi^{2}).$$

The way in which the optimal value of t, t* , is determined is based on a bootstrap method[8] due to Danielsson and de Vries (1997) and Jondeau and Rockinger (1999). Table 2 presents the Hill index for the left, right, and joint tail distributions.

Table 2 reports the tail index, ξ, the standard error of the Hill estimator, STD, the optimal number of observations included in the tail distribution, t*, and inThresholdl,, and the cut-off returns for the tail distribution. Panel (a) reports the statistics for individual stock market returns measured in local currencies. Panel (b) reports the statistics for individual stock market returns measured in US dollar. Statistics for the ex post and ex ante optimal portfolio are reported in Panel (c). There are several important observations to be made here. First, all the tail indices are significantly different from zero confirming the fact that extreme returns in stock markets are far more frequent than that predicted by a standard Normal distribution. The tail index and the "Threshold". are larger when returns are measured in US$ instead of .85 local currencies. This is to be expected since there is now an additional element of exchange rate risk when returns are measured in US$. There is also no clear pattern, which would allow us to distinguish the left tail from the right tail, which means that distributions of extreme positive and negative returns are roughly symmetrical and their occurrences are equally likely.

The Asian markets in our sample may, however, be split into two groups. The first group consisting of China, Thailand, Korea, the Philippines and Indonesia is the volatile group, while the second group, consisting of Taiwan, Singapore and Hong Kong, is the less volatile group with statistics for the tail distribution closer to those for the developed Japanese, UK and US markets. We exclude Malaysia in this comparison for the reason that there were capital and foreign exchange controls in Malaysia for about half of the sample period and which, in effect, distort its real risk and return characteristics.

The highlight of Table 2 is in the last two rows. Diversification with an objective of minimizing the 'probability of loss' has tamed the left tail. This is true whether we consider the ex post optimal portfolio or the, more realistic, ex ante optimal portfolio. For the optimal portfolio returns; the tail index is small, the "threshold". is less negative, and the number of extreme observations in the left tail was reduced to 9. All together, this is a much healthier set of figures compared with the returns on individual stock markets. The same observations can be made regarding the statistics of joint tail distribution.

5. Summary and Conclusion

This paper has examined the performance of twelve stock markets in the wake of the Asian crisis. Huge volume of investment capital flocked to the region in late 1980s and the early 1990s. This capital took flight when the Asian stock markets collapse triggered by a series

Table 2.
Hill estimates of tail index for returns in twelve stock markets for the period May 4, 1994 to December 31, 1999

	Left tail distribution				Right tail distribution				Joint tail d	
	ξ	STD	t*	Threshold	ξ	STD	t*	Threshold	ξ	STD
(a) Returns measured in local currencies (N=1478)										
China	0.288	0.0660	19	-6.888	0.441	0.0600	54	4.560	0.321	0
Thailand	0.237	0.0531	20	-4.876	0.288	0.0744	15	7.280	0.265	0
Korea	0.327	0.0607	29	-4.768	0.171	0.0474	13	7.434	0.158	0
Indonesia	0.325	0.0625	27	-4.641	0.270	0.0674	16	6.676	0.302	0
Philippines	0.189	0.0433	19	-4.250	0.327	0.0654	25	3.603	0.264	0
Hong Kong	0.301	0.0578	27	-4.043	0.424	0.0679	39	3.497	0.395	0
Taiwan	0.261	0.0533	24	-3.709	0.245	0.0500	24	4.019	0.222	0
Malaysia	0.369	0.0498	55	-3.019	0.493	0.0833	35	3.781	0.407	0
UK	0.155	0.0447	12	-2.622	0.257	0.0441	34	1.726	0.220	0
Singapore	0.353	0.0551	41	-2.374	0.409	0.0802	26	2.919	0.266	0
Japan	0.359	0.0582	38	-2.018	0.227	0.0568	16	3.062	0.222	0
US	0.276	0.0437	40	-1.851	0.278	0.0445	39	1.845	0.275	0
(b) Returns measured in US$ (N=1478)										
Indonesia	0.522	0.0870	36	-6.887	0.324	0.0897	13	12.526	0.328	0
China	0.426	0.0642	44	-6.063	0.377	0.0754	25	9.225	0.380	0
Philippines	0.230	0.0637	13	-5.506	0.318	0.0729	19	4.612	0.289	0
Thailand	0.280	0.0460	37	-5.056	0.364	0.0634	33	6.076	0.230	0
Korea	0.456	0.0644	50	-4.604	0.344	0.0888	15	9.114	0.339	0
Hong Kong	0.301	0.0580	27	-4.068	0.407	0.0628	42	3.308	0.374	0
Malaysia	0.464	0.0663	49	-3.905	0.532	0.0812	43	4.158	0.501	0
Taiwan	0.261	0.0476	30	-3.870	0.232	0.0454	26	4.480	0.204	0
Singapore	0.311	0.0558	31	-3.214	0.360	0.0608	35	3.008	0.324	0
Japan	0.215	0.0482	20	-3.111	0.255	0.0361	50	2.711	0.246	0
UK	0.244	0.0609	16	-2.021	0.219	0.0429	26	1.872	0.232	0
(c) Portfolio (N=1478*, 1458+)										
Ex post Optimal*	0.199	0.0663	9	-2.082	0.176	0.0507	12	2.579	0.166	0
Ex ante Optimal+	0.264	0.0880	9	-2.792	0.391	0.0643	37	1.827	0.177	0

Notes: ξ is tail index, STD is the standard error, t* is the optimal tail size estimated through bootstrapping, and "Threshold" is the cut-off point for the tail distribution. 'N' is the number of observations. The countries are sorted based on *the threshold for the left tail distribution.*

of speculative attacks on the Asian currencies. Putting all of these historical events into perspective, we address the question of whether Asian stocks remain attractive to westerners or, specifically, an American investor.

Intermediate level portfolio theory tells us that we need to know the utility function of individual investors in order to optimize portfolio choice. This, as is well known, is a formidable task, since every investor has a different utility function. Selecting the most efficient portfolio under the capital market line (CML) separate the problem of risk portfolio optimization and the determination of a portfolio that maximizes utility. The CML approach requires the assumption that all individuals can borrow or lend at unlimited amount at roughly the same rate. In this paper, we overcome these problems by adopting a shortfall constraint approach in choosing a portfolio that has the lowest 'probability of loss' which means optimizing the ratio R_p / σ_p. The results obtained confirm that despite the Asian crisis, Asian stocks provided the US investors opportunities for portfolio diversification and extra return performance. A study of the 'tail distribution' of our optimal portfolio returns and the US domestic stock market returns further confirmed that our optimal portfolio, which has substantial weights in both Chinese and Philippine stocks, possesses less extreme negative returns and has positive skewness. All together, our ex ante optimal portfolio, constructed using previous month information, is a more desirable portfolio than a portfolio consisting of US stocks alone. We also find a positive relationship between correlation and volatility, as well as a negative relationship between correlation and returns. There seems, moreover, to be an increase in correlation and volatility during stock markets downturn, which may erase the benefits gained from portfolio diversification. In addition, the results for the stock markets included in our sample are positively correlated except for the Chinese and Philippine markets. This, accordingly, would seem to explain why both of these markets played an important role in our optimal international portfolio, which excluded none of the Asian stocks in our sample. However, greater caution is required when Malaysian stocks are considered owing to exchange and capital controls imposed by the Malaysian authorities.

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Appendix A

Summary statistics for individual stock market returns measured in local currencies (for different periods subject to data availability)

	Returns (p.a.)	Sigma (p.a.)	Skewness	Kurtosis	Max (p.d. %)	Min (p.d. %)
4 Jan 65 - 1 Jan 73 (8 years)						
UK	0.152	0.125	0.106	5.642	4.873	-4.562
2 Jan 73 - 2 Jan 86 (13 years)						
UK	0.152	0.185	0.362	4.977	9.153	-6.286
US	0.087	0.142	0.273	1.847	4.723	-3.855
Japan	0.099	0.104	-0.355	4.675	3.311	-4.518
Singapore	0.018	0.249	0.287	9.993	13.353	-11.086
Hong Kong	0.124	0.322	-0.026	6.430	15.132	-14.795
3 Jan 86 - 9 Sep 87 (1.7 years)						
UK	0.344	0.131	-0.352	-0.147	2.187	-2.266
US	0.260	0.145	-0.648	2.492	2.475	-4.775
Japan	0.437	0.181	-0.210	2.777	5.437	-3.987
Singapore	0.594	0.178	0.452	1.443	5.496	-3.339
Hong Kong	0.449	0.182	-0.087	0.894	3.832	-3.500
Malaysia	0.467	0.222	0.360	1.002	5.782	-4.411
10 Sep 87 - 5 Apr 90 (2.6 years)						
UK	0.033	0.187	-3.295	33.624	6.508	-12.991
US	0.065	0.224	-5.302	78.774	8.361	-20.691
Japan	-0.015	0.193	-3.129	52.698	9.077	-15.737
Singapore	0.018	0.295	-5.296	79.448	13.995	-26.397
Korea	0.124	0.217	0.493	1.297	5.855	-4.092
Hong Kong	-0.066	0.396	-9.057	137.806	8.973	-41.409
Thailand	0.272	0.249	-1.085	8.465	7.582	-9.064
Philippines	0.379	0.274	0.807	11.638	13.700	-8.480
Malaysia	0.152	0.279	-3.094	30.767	10.928	-16.925
6 Apr 90 - 3 May 94 (4.1 years)						
UK	0.145	0.126	0.476	4.328	5.433	-3.836
US	0.119	0.120	-0.064	2.949	3.681	-3.673
Japan	-0.047	0.215	0.607	5.448	9.399	-5.961
Taiwan	-0.116	0.418	0.109	2.099	12.738	-9.158
Singapore	0.042	0.234	0.120	7.985	4.947	-6.520
Korea	0.085	0.274	0.299	2.369	8.603	-8.759
Hong Kong	0.310	0.224	-0.740	5.836	5.690	-8.706
Thailand	0.273	0.302	-0.165	5.885	9.240	-9.777
Philippine	0.303	0.228	-0.002	2.742	6.896	-6.269
Malaysia	0.222	0.200	-0.161	10.000	10.105	-7.092
Indonesia	-0.051	0.489	-0.257	212.431	52.228	-52.934

Notes: 'Returns' and 'Sigma' are annualised figures assuming that there are 261 trading days in a year. 'Max' and 'Min' are maximum and minimum daily returns expressed in percentages.

Endnotes

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1. See Kindleberger (1996) for a more general and historical account of "panics and crashes."

2. Information about trading of Chinese stocks is from Liu and He (1999).

3.There are now at least five types of Chinese stock labeled, respectively, as 'A', 'B', 'H' 'N' and 'L' Only the local Chinese people can trade on class 'A' shares. Foreign investors can only trade on class 'B' shares, which are traded in foreign currencies. In Shanghai, class 'B' shares are traded in American dollar, whereas in Shenzhen, they are traded in Hong Kong dollar. The Chinese Security Commission regulates and monitors stock trading in China. Class 'H' shares were launched in 1993 for trading Chinese stocks in Hong Kong. This was followed by class 'N' shares, which began trading in New York in September 1994, and class 'L' shares traded in London since March 1997.

4. For a formal study of value-at-risk based on tail density estimation, see Danielsson and de Vries (1997).

5. The statistics in Appendix A reveal that during this period, the Asian stocks were characterised by large negative skewness, high kurtosis and dramatic one-day falls and one-day rises.

6. See Login and Solnik (1999) for example.

7. In a study by Bekaert and Harvey (1997), it was found that countries with open economies have significant lower volatilities. Liberation of the capital market also decreases volatility. Hence, we would expect the Chinese stock market volatility will reduce, but of course the cost of this development will be an increase in return correlation reducing its potential for risk diversification..

8. Detail of this bootstrap method is summarized in an appendix in Jondeau and Rockinger (1999).

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