International Journal of Business and Social Research
Volume 05, Issue 01, 2015

The Co-Movement of U.S. Equity Returns with the Developed and Emerging Markets of Australasia and Asia

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ABSTRACT

This paper examines the behavior of the monthly and daily correlation coefficients and co-variances of a broad set of Pacific Basin equity markets compared to the S&P 500 index, showing that the correlations and co-variances vary greatly over time and across markets. Many discussions of international diversification focus solely on the recent correlations of returns of international equities. It seems clear from the evidence presented here that the near complete reliance on recent correlation coefficients to describe the diversification benefits of individual foreign markets is misdirected. Not only should correlations over several periods be examined but also other risk measures should be included in the examination. This research illustrates that the Pacific Basin markets which exhibit the lowest correlations with the U.S. market may not be the lowest risk markets when additional factors such as covariance, skewness, and kurtosis are taken into consideration.

Keywords: Asian equity markets, correlation of returns, international diversification.
JEL code: C40, E32, F30, G15.
Available Online: 28th January, 2015.
MIR Centre for Socio-Economic Research, USA.

1.0 INTRODUCTION

Discussions of portfolio diversification, particularly discussions of international diversification, tend to overemphasize the importance of the most recent correlation of returns between assets or groups of assets in recommending the best set of assets to hold. However, the correlation of returns is only one of several factors that should be considered in the selection of assets; and these correlations tend to vary over time. The focus on the correlation of returns alone, and often only the most recent correlations, may lead investors to hold a less than optimally diversified portfolio. Yet, it is common for discussions of international diversification tofocus onlyon recent correlations, with no mention of

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howthese correlations have changed over time and no mention of other risk- measures--such as covariance, skewness, and kurtosis.

The correlations of returns between stock markets around the world are often a topic of discussion in the popular press and in academic articles, but the topic has not recently been examined in any systematic fashion. Casual arguments point out that correlations are rising or are falling, but often the arguments are accompanied only by anecdotal evidence. The assertion that correlations are *falling* is made by those who observe that emerging economies do not mirror the economies of developed nations, by those who observe that troubles in one nation are not reflected in other markets, and by those who observe unique factors in one nation that may cause its markets to move to a different set of factors than those that affect the rest of the world. These observers often talk about "decoupling" of markets. Ten years ago it was China that was "decoupling" from the developed world and more recently it is Europe that is "decoupling" from the U.S. The financial crisis brought a temporary end to the notion of decoupling between the U.S. and China as all markets were in a tailspin. The assertion of *increasing* correlations is often accompanied by arguments of globalization, increasing interdependencies, and maturing economies becoming more like developed economies. Many investors have found out the hard way that when markets crash; there is no place to hide. Markets tend to crash together, with diversification providing little benefit.

The fact is that correlations of returns vary over time; they are higher in some periods and lower in others. Plus, the correlations of returns between two developed markets tend to be higher than those between a developed market and an emerging market or between two emerging markets. These trends may not be obvious to an observer who looks at only a five- or ten-year period, because over a short time period the relationship may be very period-specific. Observing the relationships over a 20- to 30-year period or longer (such as the study by Erb, Harvey and Viskanta, 1994), however, can help us see more clearly the historic co movement of markets.

The unique contribution of this paper is that it focuses on the linkages between the U.S. equity market, as measured by the S&P 500 Index, and the markets in Australasia and Asia. Most of the Asian market indexes for developing countries did not begin until the mid to very late 1990s. Therefore, the 10 to 15 years of data necessary to do this study was not available until recently. Since the data for most of the developing countries were not available when the earlier studies of the 1980s and 1990s were completed, those studies focused on the developed markets of the U.S., Japan, and European countries. We investigate the co-movement of equity asset returns in these Australasian and Asian markets, including the behavior of correlations and co-variances of returns. The co-movement is examined both over time and across markets.

2.0 LITERATURE REVIEW

2.01 INTERNATIONAL DIVERSIFICATION AND CORRELATION IN EQUITY MARKET RETURNS

The study of the benefits of international diversification dates back at least forty-five years when (Grubel, 1968) published his article in the AER,"Internationally Diversified Portfolios: Welfare Gains and Capital Flows." He includes an analysis of the monthly correlations of the returns for the stock markets in ten different countries compared to U.S. stock market returns. The correlations ranged from -0.16 (South Africa) to 0.70 (Canada). Heconcludes that substantial gains are available to investors through international diversification.

Another early study was that of (Levy and Sarnat, 1970), in which they examine the correlation of annual returns for 28 countries from 1951 to 1967. Using actual returns rather than expected returns they findthat their efficient portfolios consisted of investments in only nine of the 28 countries, including markets of both developed countries (Austria, Denmark, U.K. and U.S.) and developing

economies.[3]

Forty to sixty percent of the portfolio was invested in "developing or borderline income" countries, including Mexico, Japan, New Zealand, South Africa, and Venezuela. U.S. investors received little or no diversification benefits by including most of the developed markets of the European Common Market or Canada because of the high correlations of the U.S. market with those markets. (Levy and Sarnat, 1970, p. 673) state that:

> *…It is only when the American investor diversifies his portfolio to include such countries as Japan and South Africa and the developing countries of South America and Asia that a significant improvement in his portfolio results…*

Over the ensuing twenty years numerous additional studies document the benefits of international diversification. Many of these studies are reviewed by (Shawky, Kuenzel and Mikhail, 1997). One study of interest is that by (Longin and Solnik, 1995) who find that the correlations of monthly equity market returns in seven developed economies increase over the period from 1960 to 1990, thus diminishing diversification benefits among those seven countries.

Some of the more recent articles that discuss international diversification and the correlation of returns from world stock markets include those by (Fender, 2002), (Speidell, 2004), (Eun, Huang and Lai, 2008), (Fernandes and Ornelas, 2010), and (Asness, Israelov and Liew, 2011). (Fender, 2002) points out that monthly correlations between U.S. and foreign equities were rising over the 1998 to 2002 period; and, while recent foreign market returns had been poor, he saw foreign equities as undervalued in 2002. (Speidell, 2004) echoed many of the same sentiments in his examination of monthly correlations over the previous 25 years. Using monthly data from 1980 through 1999, (Eun, Huang, and Lai, 2008) show that small-cap international stocks are better candidates for portfolio diversification than are large-cap international stocks. (Fernandes and Ornelas, 2010) consider the role that risk aversion plays in the portfolio diversification process, and suggest that the benefits of international diversification are substantially reduced for more risk-averse individuals. Using over fifty years of data (Asness, Israelovand Liew, 2011) show that while diversification may not protect investors against short-term panics and crashes, it does protect investors over the long-run.

2.02 TIME-VARYING CORRELATIONS

Many empirical studies have examined the tendency of international return correlations to shift over time (time-varying correlations). Correlations can shift as two economies become more similar or dissimilar. Also, correlations tend to vary over the business cycle and over up- and down-states of the market within cycles. (Kaplanis, 1988) uses a sample of ten countries over the period 1967 to 1982 (dividing the period into four 46-month sub periods) to test the stability of both the correlation and covariance structure of returns. He finds that correlation matrices are relatively stable over this period, but that covariance matrices were unstable.When testing the forecasting ability of correlation matrices, he finds that Bayesian estimates outperformed a simple historic model. Forecasting of co-variances was best using a naïve model, rather than a historic model; however, he suggests that developing more accurate forecasts of variances, combined with Bayesian estimates of correlations will provide better covariance forecasts (since $Cov_{i,j} = corr_{i,j}*s_i*s_j$). The findings of (Longin and Solnik, 1995) suggest that the correlation matrix and the covariance matrix are *both* unstable over time, using monthly returns from seven developed countries over a 30-year period from 1960 to 1990. (Erb, Harvey and Viskanta, 1994) investigate the reasons why these correlations vary over time by looking at monthly return correlations from 1970 through 1993. Their findings suggest that changes in return correlations over time are linked to "economic activity," in particular the phase of the business cycle, the simultaneity of

[3] Using actual returns rather than expected returns will lead to more concentrated portfolios because ex-post (or actual) returns are more widely dispersed than ex-ante (or expected) returns and the portfolio selection model will overweight those asset markets with the highest actual returns and lowest variances and covariance.

business cycles phases (phase incongruity), the similarity of industrial structure between nations, and other economic factors that lead to differences in return (such as differences between nations in their political-economic policies). (Solnik, Boucrelle and Le Fur, 1996) also document the high variability in monthly return correlations by looking at the U.S. market compared to the markets in Germany, France, Japan, Switzerland, the U.K., and the EAFE Index from 1958 to 1995.

More recently, (Gupta and Mollik, 2008) document the changes in monthly return correlations between Australia's equity markets and those of emerging markets. Also, (You and Daigler, 2010a) examine the return correlations (called "constant correlations") for various world indexes relative to the U.S. (S&P 500 Index), splitting the 1997 to 2002 period into a bull market and bear market. Their analysis, which uses returns calculated from weekly stock index futures data, shows that there is significant variability in correlations over time; therefore, they suggest the use of "conditional correlations"--which are Bayesian calculations that include possible changes in correlations over time. Finally, (Horn, 2010) has recently documented the variability in monthly return correlations between the S&P 500 Index and the MSCI EAFE Index from 1970 through 2009, showing correlations that varied from 0.30 to 0.94 over that time period.

2.03 ASYMMETRIC CORRELATIONS AND MARKET VOLATILITY

Numerous studies also document that correlations are much stronger (higher) during down market periods than they are during rising markets. The old saying that "a rising tide lifts all ships" does not apply to rising stock markets, as all do not rise in unison. However, when a crisis or panic hits financial markets, all markets tend to tumble together as the herd stampedes to make its way to the exits. Also, a rise in the volatility of markets tends to be associated with higher correlations between markets.

(King and Wadhwani, 1990) look at the channels through which the market volatility of October 1987 was transmitted. Their empirical evidence suggests that the rise in volatility in the U.S. market led to the increase in the correlations of market returns after the Black Monday crash. (Erb, Harvey and Viskanta, 1994) examine correlations between G-7 countries from 1970 through 1993 for three different combinations of equity market "states" in each pair of countries. One state is when both markets went up, a second when both markets go down, and a third when they move in opposite directions. The average for the U.S. versus other countries was 0.26 in up-up markets, 0.42 in down-down markets (excluding October 1987), -0.56 in mixed markets, and an average correlation over the entire time period of 0.39. (Erb, Harvey and Viskanta, 1994, p. 33) discuss the implications of these asymmetric findings by saying:

> *…If a portfolio is formed based on average correlations, which implicitly assumes symmetry, the performance of the investment could be worse than expected in down markets because the correlations increase. The lesson is that portfolios need to be constructed on the basis of expected correlation rather than past averages.*

Further, they find that the variations in correlation coefficients over time is predictable, and their use of expected correlations based on their forecasts leads to much different asset allocations in an international portfolio context compared to using historical correlations.

(Longin and Solnik, 1995) add to the earlier research by finding that international correlations tend to increase when the volatility of markets is high, using data from 1960 to 1990. (Solnik, Boucrelle and Le Fur, 1996) confirm these findings using a similar study period from 1958 to 1995, and they go on to discuss the impact of rising volatility on co-variances of returns between markets. Because theco-variance is defined as $Cov_{i,j} = Corr_{i,j} * s_i * s_j$, if only the variances in markets increase, the covariance increases roughly in proportion to the increase in the average variance. However, if the correlation of markets increases when the variance of the markets rises, then the covariance of returns increases more than the variances increase. (Solnik, Boucrelle and Le Fur, 1996, p. 26) conclude that:

> *…The globalization of the world economy suggests that world factors are now a leading cause of market volatility, which explains the link between international correlation and market volatility. The strong link between conditional volatility and correlation is bad news for portfolio managers: It is precisely when the U.S. market drops markedly that U.S. investors desire the benefits of international diversification, but that is when the international correlation gets larger.*

(De Santis and Gerard, 1997, p. 1910) also find that a major drop in the U.S. market affects marketsaround the world. They conclude that international diversification "provides little protection against severe U.S. market declines," but that this is offset by the average long-term gains from international diversification that average over two percent per year, making international diversification attractive. (Li, 2007) shows that when markets are most volatile, the risk-reducing benefits from diversification are weakest. He also shows that a more efficient portfolio may be constructed by estimating correlations using his "state varying correlation framework."

Several more recent studies discuss this problem from the standpoint of the ongoing world financial crisis.(Bookstaber, 2007) says that the higher correlations during down markets are due to theincreased"complexity" of international financial markets and "tight coupling". The increased complexity comes from the use of derivatives, especially the prevalence of collateralized debt obligations; and tight coupling stems from the use of high levels of leverage. (You and Daigler, 2010b) use weekly returns for stock index futures (using sixteen stock index futures contracts) from 1997 through 2002 and find that the higher correlations during the bear market of the early 2000s are associated primarily with the largest "positive" market moves. They attribute this to the herding behavior of investors across markets. In a second study (You and Daigler, 2010a) measure risk not only by looking at the standard deviation of the returns on international index futures, but also by looking at the third and fourth moment (skewness and kurtosis) of the distributions. Their results show that the consideration of skewness and kurtosis of return distributions can be important when building diversified international portfolios and they find that international diversification is beneficial only for those who are diversifying from outside the U.S.

(Horn, 2010) shows the monthly correlations of returns between the S&P 500 Index and the MSCI EAFE Index for each bear or bull market from 1970 through 2009.(There were six complete bull markets and six complete bear markets over this time period.) All of the bull markets had lower correlations than existed in the previous bear market. The average bear market correlation was 0.73, and the average bull market correlation was 0.45. The bull and bear market correlations at the beginning of the sample period were 0.35 and 0.60, respectively; and they were 0.65 and 0.91 for the last two full bull and bear markets at the end of the sample period.

(Asness, Israelov and Liew, 2011) use monthly return data to calculate the returns in 22 individual countries from 1950 to 2008. They compare these country returns to an equal-weighted global portfolio, taking into account the country's currency returns and inflation. They show that for the month of the worst crash in each market, the average "local" return was -27 percent and a global portfolio would have had a return of -17.2 percent. This shows that markets tend to crash together, but that global diversification would have partially moderated the pain of the crash, on average. (In four of the 22 countries--France, Netherlands, Spain, and Switzerland, the global portfolio return was worse than the local market return in that one "worst" month). The focus of their research, however, is on long-run performance. They show that markets do not "crash at the same time" over the long-run, and that long-run returns are largely driven by country-specific economic performance.

3.0 DATA AND METHODOLOGY

One of the purposes of this study is to see if commonly available data can be used to investigate the interrelationships between international equity markets. The data we use comes from the "historical price" data freely available on the *Yahoo! Finance* website, and the Asia Pacific indices chosen for analysis are the ones that*Yahoo!* provides if you go to *Yahoo! Finance* and click on Investing/Market

Stats/World Indices/Asia Pacific.Three European indices were also chosen, mainly for comparison purposes.Table 1 shows characteristics of the market indexes used. Both monthly and daily closing values were collected for each index going back in time as far as possible for each index, with the Nikkei 225 having the longest series dating back to January 1984.The index values are based on eachcountry's local currency.For the monthly returns for each index, the index values are first adjusted for the U.S. dollar exchange rate. The daily returns are not adjusted for currency fluctuations.

The returns on each foreign index are matched with the corresponding returns on the S&P 500 Index for both the monthly and daily data series. For the monthly data we match the returns calculated from the month-end closing prices of the S&P 500 with the returns calculated from the beginning-of-the-month closing prices for the foreign indices. Doing this allows us to match the S&P 500 returns with the returns that follow in the Asian markets. (If returns in the Asian markets are calculated from end-of-month closing prices, the correlation coefficients with the S&P 500 Index are slightly lower, on average,because we would be comparingU. S. market closing prices with same-day earlier closings in the foreign markets).

In working with the daily data, the trading days forthe S&P 500 indexhad to be carefully matched witheach of the foreign indices due to the fact that different countries have different sets of market holidays. In working with each foreign index, that index was used as the base and returns on the S&P 500 were matched with it. For the S&P 500 the return on calendar day "t" was matched with the return on calendar day "t+1" for the foreign index, which means that the foreign market return is based on price changes that occur a few hours after the U.S. market closes. S&P 500 data was deleted for day "t" if the foreign market was on holiday on theday "t+1". However, if aforeign market is closed for one day or multiple days in a row, the S&P 500 return that is matched with the next opening day return in the Asian market is a multiple-day S&P 500 return. For example, if a foreign market is closed for one day, the S&P 500 return that is matched with it is a two-day return.[4]However, if the foreign market is closed for several days, such as the entire first week of October 2011 (as was the SSEC in Shanghai) the foreign market return for Monday, October 10, 2011, is the change from the closing price on Friday, September 30 to the closing price on the next trading day of Monday, October 10; and this is matched by the cumulative change in the S&P 500 from the closing price on Thursday, September 29 to the closing price on Friday, October 7.Also, any foreign market index return was eliminated for day "t+1" if the U.S. market was closed on theday "t". Thus, the Tuesday return in the foreign markets that follows the first Monday of September (Labor Day) holiday in the U.S. was deleted from the sample in all foreign markets.

4.0 EMPIRICAL FINDINGS

4.01 MONTHLY CORRELATIONS

We begin the empirical analysis by estimating the monthly correlations (Table 2) between the U.S. S&P 500 Index and the indices in eleven Pacific Basin countries and India, plus the U.K., Germany and France for comparison purposes.The data is broken into 5-year time periods, except for 1) the first time period which is determined by the beginning of data in Yahoo finance and 2) the last time period that is 7 years in length to include 2010 and 2011.These monthly correlations correspond to what is often examined when the objective is to suggest how an investor might attempt to achieve international diversification of a long-term U.S. stock portfolio. These monthly correlations correspond to what is often examined when the objective is to suggest how an investor might attempt to achieve international diversification of a long-term U.S. stock portfolio.

[4] Stated another way, if the S&P 500 return is deleted from the sample for Tuesday because the foreign market was not open on Wednesday; the S&P 500 return from the Monday close through the Wednesday close is matched up with the foreign market return calculated from the Tuesday close through the Thursday close.

Table 1: Market index used-opening and closing hours

Abbrev.	Index Name	City	Country	beginning date	Open	Close	Open	with NYSE	Open	Close
^GSPC	S&P 500	New York	U.S.	03-01-1950	9.30 AM	4.00 PM	6.5			
^N225	Nikkei 225	Tokyo	Japan	04-01-1984	7.00 PM	1.00 AM	6	0	9.00 AM	3.00 PM
^HSI	Hang Seng	Hong Kong	China	31-12-1986	9.00 PM	4.00 AM	7	0	9.00 AM	4.00 PM
^STI	Straits Times	Singapore	Singapore	28-12-1987	8.00 PM	4.00 AM	8	0	9.00 AM	5.00 PM
^AORD	All Ordinaries	Sydney	Australia	03-08-1984	7.00 PM	1.00 AM	6	0	10.00 AM	4.00 PM
^NZ50	New Zealand Exchg 50	Wellington	New Zealand	30-04-2004	5.00 PM	12.00 AM	7	0	10.00 AM	5.00 PM
^KS11	Kospi Composite	Seoul	Korea	01-07-1997	7.00 PM	1.00 AM	6	0	9.00 AM	3.00 PM
^TWII	Taiwan Composite (Wtd)	Taipei	Taiwan	02-07-1997	8.00 PM	12.30 AM	4.5	0	9.00 AM	1.30 PM
^JKSE	Jakarta Composite	Jakarta	Indonesia	01-07-1997	9.30 PM	4.00 AM	6.5	0	9.30 AM	4.00 PM
^KLSE	FTSE Malaysia	Kuala Lumpur	Maylaysia	03-12-1993	8.00 PM	4.00 AM	8	0	9.00 AM	5.00 PM
^THDOWD	Dow Jones Thailand	Bangkok	Thailand	03-01-2000	10.00 PM	4.30 AM	6.5	0	10.00 AM	4.30 PM
^SSEC	Shanghai Composite	Shanghai	China	04-01-2000	8.30 PM	2.00 AM	5.5	0	9.30 AM	3.00 PM
^BSESN	BSE 30	Mumbai	India	01-07-1997	11.30 PM	6.30 AM	7	0	9.00 AM	4.00 PM
^FTSE	FTSE 100	London	U.K.	02-04-1984	3.00 AM	11.30 AM	8.5	2h	8.00 AM	4.30 PM
^GDAXI	DAX	Frankfurt	Germany	26-11-1990	3.00 AM	2.00 PM	11	4.5h	9.00 AM	8.00 PM
^FCHI	CAC40	Paris	France	01-03-1990	3.00 AM	11.30 AM	8.5	2h	9.00 AM	5.30 PM

Table 2 shows that these monthly correlations have generally increased over time.Thesehigher correlations of the past seven years, compared to earlier periods, may be due to 1) the greater interconnectedness of those economies that has developed over the past 25 years, 2) the influence of the recent world financial crisis (correlation rise in downturns), and 3) the increased volatility in financial markets (as suggested by Solnik, Boucrelle and Le Fur, 1996).

Table 2: Correlations of monthly returns of foreign index (month-beg. prices) in month "t+1" vs. S&P 500 index (month-end prices) in month "t".

Yahoo Abbrev.	Index	2005-2011	2000-2004	1995-1999	1990-1994	Average Correlation	Standard Deviation
^N225	Nikkei 225	0.75	0.50	0.31	0.32	0.47	0.18
^HSI	Hang Seng	0.76	0.68	0.62	0.40	0.62	0.13
^STI	Straits Times	0.82	0.60	0.61	0.53	0.64	0.11
^AORD	All Ordinaries	0.89	0.68	0.63	0.69	0.72	0.10
^NZ50	New Zealand Exchg 50	0.80				0.80	
^KS11	Kospi Composite	0.77	0.66	0.36		0.60	0.17
^TWII	Taiwan Composite (Wtd)	0.76	0.45	0.54		0.59	0.13
^JKSE	Jakarta Composite	0.70	0.29	0.45		0.48	0.17
^KLSE	FTSE Malaysia	0.67	0.22	0.49		0.46	0.18
^THDOWD	Dow Jones Thailand	0.57	0.46			0.52	0.05
^SSEC	Shanghai Composite	0.43	0.01			0.22	0.21
^BSESN	Bombay SENSEX (BSE 30)	0.73	0.37	0.20		0.43	0.22
^FTSE	FTSE 100	0.88	0.78	0.67	0.65	0.74	0.09
^GDAXI	DAX	0.85	0.76	0.66	0.35	0.65	0.19
^FCHI	CAC40	0.85	0.73	0.52	0.47	0.64	0.16

The highest correlations in Table 2 are those of the U.S. with Australia, Hong Kong, Singapore, and the three countries in Europe; the lowest are those with developing Asian economies. The S&P correlation with the Shanghai Composite was 0.01 in the 2000-2004 period (a period when the term "decoupling" was widely used to describe the world's developed markets versus China), but it rose to 0.43 in the 2005-2011 period.

Table 2 confirms the finding of other studies that correlations between individual country's returns are not constant over time. The evidence in the table shows that it is not unusual for the correlation of these markets with the U.S. to change by a factor of 2 or 3 times over a period of five to ten years. For example, the correlation coefficient between the S&P 500 and the Nikkei moved from 0.31 to 0.50 and then to 0.75 during the last three time periods shown in Table 2. The correlation between the U.S. index and the Malaysian index moved from 0.49 to 0.22 and then to 0.67 over the same time periods.Thus, past correlations may be poor proxies for future correlations. Those who use only the most recent historical correlations to form portfolios of international securities may be making serious errors that could be mitigated by using a Bayesian estimate of correlations, as suggested by (Kaplanis, 1988), or by using a conditional correlation approach that considers potential changes in correlations over time and expectations regarding correlations for the future, as discussed in (You and Daigler, 2010a).

4.02 DAILY CORRELATIONS

Table 3shows daily return correlations with the S&P 500 Index for the same foreign markets shown in Table 2.These correlations may be more relevant for dealers, short-term traders, and others with a short-term portfolio orientation. The correlations are calculated only for those days when the S&P 500 absolute return was greater than or equal to 1 percent. Previous studies of daily returns (Becker, Finnerty and Gupta, 1990) have used filters of 0.5, 1.0, 1.5 and 2.0 percent. Generally, the correlations

are a bit lower with a filter of 0.5 percent and are higher when the filter is 2 percent. For example, for the 1984-2011 period the AORD vs. S&P 500 daily correlations were 0.64, 0.69, and 0.76 using filters of 0.5, 1.0, and 2.0 percent, respectively. The daily return calculations use close-to-close prices in all markets. The U.S. index return is for calendar day "t," and the foreign indexreturn is for calendar day "t+1". Of course most of these Pacific Basin markets open about four or five hours after the U.S. market closes, so the comparisons outlined above are based on trades within the same 24-hour period. While European market trading overlaps the U.S. market by 2 to 4 hours, the European market closing price on day "t+1" is within 24 hours of the New York close on theday "t".

Table 3: Correlations of daily returns of foreign index on day "t+1" vs. S&P 500 index on day "t" '--using S&P 500 returns of +/- 1% or higher.

Yahoo Abbrev.	Index	2005-2011	2000-2004	1995-1999	1990-1994	1985-1989	Average Correlation	Standard Deviation
^N225	Nikkei 225	0.70	0.58	0.47	0.46	0.69	0.58	0.10
^HSI	Hang Seng	0.52	0.58	0.56	0.52	0.41	0.52	0.06
^STI	Straits Times	0.49	0.47	0.49	0.49	0.71	0.53	0.09
^AORD	All Ordinaries	0.71	0.71	0.74	0.66	0.72	0.71	0.03
^NZ50	New Zealand Exchg 50	0.75					0.75	
^KS11	Kospi Composite	0.49	0.54	0.33			0.45	0.09
^TWII	Taiwan Composite (Wtd)	0.54	0.39	0.39			0.44	0.07
^JKSE	Jakarta Composite	0.50	0.21	0.41			0.37	0.12
^KLSE	FTSE Malaysia	0.52	0.35	0.45			0.44	0.07
^THDOWD	Dow Jones Thailand	0.36	0.34				0.35	
^SSEC	Shanghai Composite	0.30	0.03				0.17	
^BSESN	Bombay SENSEX (BSE 30)	0.34	0.24	0.29			0.29	0.04
^FTSE	FTSE 100	0.37	0.38	0.49	0.46	0.50	0.44	0.05
^GDAXI	DAX	0.29	0.18	0.52	0.47		0.37	0.14
^FCHI	CAC40	0.35	0.38	0.47	0.33		0.38	0.05

For the 2005-2011 time period the daily correlations with the S&P 500 Index shown in Table 3are lower than the Table 2 monthly correlations for all countries except New Zealand. Also, in general, the daily correlations do not increase over the 25-year period, in contrast to the monthly correlations. Therefore, it appears that the traders who rely on past correlation patterns will find that daily correlations are more predictable, compared to the monthly correlations used by long-term portfolio managers. Another interesting feature of these tables is that the daily correlations of the S&P 500 with European country indices are among the lowest of all the correlations in Table 3, whereas their monthly correlations in Table 2 were the highest.[6]Further, the correlations in Table 3 show much less variability over time than do the monthly correlations in Table 2. The standard deviations of the monthly return correlations in Table 2 are about double the standard deviations of the daily return correlations in Table 3. The markets with the highest average correlations with the U.S., based on daily returns, are those in Japan, Australia, and New Zealand; plus, the more developed Asian markets have higher average correlations than the less developed Asian markets.

The daily correlations for the S&P 500 with the Shanghai market in Table 3 follow a similar pattern to the monthly correlations in Table 2. Further analysis of these correlations shows a relatively steady annual movement upward for this U.S. - China (Shanghai) correlation over the past nine years, as shown in Table 4. The correlations were very low for 2000-2004, and they have risen over the past seven years.

[6]This may be due to the fact that the Asian markets now influence European markets more than in the past on a daily basis, while the influence of the U.S. market on Europe has waned. Certainly these low daily correlations should not be used in building long-term portfolios because the month-to-month correlations are a better measure of the co movement over a lengthy time period.

Table 4: Daily returned correlationsbetween the S&P 500 and selected foreign stock indexes: 1995-2011 (using S&P 500 returns of +/- 1% or larger).

Year	Correlations with ^SSEC	Sample Size for ^HSIX	Correlations with ^HSIX	Correlations with ^JKSE
1995		14	0.56	
1996		39	0.78	
1997		77	0.53	0.69
1998		78	0.49	0.33
1999		90	0.70	0.29
2000	0.00	101	0.67	0.18
2001	0.02	101	0.59	0.15
2002	0.13	124	0.57	0.18
2003	-0.13	80	0.50	0.37
2004	0.04	43	0.60	0.36
2005	0.08	31	0.68	0.44
2006	0.19	29	0.85	0.83
2007	0.43	66	0.76	0.67
2008	0.28	133	0.39	0.45
2009	0.28	114	0.58	0.47
2010	0.30	77	0.60	0.48
2011	0.40	96	0.73	0.61

This increase is most likely due to both the financial crisis and the integration of the Chinese economy with other world economies, especially the U.S. It will be interesting to see if this trend continues in the future. Table 4 also includes yearly correlations for two other Asian markets for comparison purposes. The Hang Seng Index (Hong Kong), a relatively developed market, shows moderately high (and relatively stable) correlations over time with the S&P 500; whereas, the Jakarta Composite has correlations with the S&P 500 that exhibit much more variability (though they have been a bit steadier over the last few years). The pattern of correlations for the Shanghai Composite compared to those for the Jakarta Composite suggests that the influence of the U.S. market on these markets not only varies over time, but also is very different from each market from period to period.

4.03 THE FOCUS ON CORRELATIONS IS PARTLY MISPLACED

Portfolio theory says that it is the covariance of returns that defines the risk of a portfolio, not the correlation.Co-variance is defined as: $Cov_{ij} = Corr_{ij}$* $StdDev_i$*$StdDev_j$, and the correlation is just part of the equation. If we are talking about adding a security or portfolio of assets to our U.S. market portfolio, then the equation can be written as: $Cov_{iM} = Corr_{iM}$* $StdDev_i$* $StdDev_M$. As an index of covariance, beta is defined as: $\beta_i = Cov_{iM}/Var_M = (Corr_{iM}$* $StdDev_i$* $StdDev_M) /Var_M = (Corr_{iM}$* $StdDev_i)/StdDev_M$. Since the standard deviation of the market is the same in all calculations, it is the $Corr_{iM}$ x $StdDev_i$ (i.e., the numerator of the equation) that determines the covariance risk of as anasset. Thus, a U.S. investor who is trying to find a low risk, foreign market asset (asset "i") to add to her domestic market portfolio (asset "M"), should measure risk as $Corr_{iM}$* $StdDev_i$, not simply as $Corr_{iM}$.

Looking only at the correlation coefficient (ignoring covariance) can, in many cases, be deceiving. To illustrate, let us look at the 2005-2011 (monthly return) correlations in Table 2 for the first five market indexes--all of which are in relatively developed markets. The correlation coefficients range from a low of 0.75 for Japan to a high of 0.89 for Australia.The correlations with the S&P 500 for the Nikkei (Japan)

and the Hang Seng (Hong Kong) are about the same (0.75 and 0.76, respectively). Thus, if one looks only at the correlation coefficient, it appears that these two markets are of similar risk for the U.S. investor. However, if we look at the betas shown in Table 6 for these markets (calculated relative to the S&P 500) we get a slightly different picture.[7]The beta (an index of covariance risk) for each of these markets is 0.87 and 1.20, respectively, indicating that the Hang Seng was much more risky than the Nikkei for the U.S. investor during this period of time. The reason for these differences, of course, lies in the different standard deviations of the markets. The standard deviation of the 2005-2011 monthly returns that were used in Tables 2 and 6 was 5.50 percent for the Nikkei (the standard deviations are shown in the Table 5), which is much lower than the 7.44percent standard deviation for the Hang Seng.[8] The higher standard deviations of returns for the Hong Kong market was the reason why the Hang Seng has a higher covariance of returns with the S&P 500 than does the Japanese market, making the Hong Kong market a poorer marketto use for diversifying a U.S. portfolio during that time period than was the Japanese marketfor the 2005-2011 time period.

Similarly, if we look at the nextseven markets (developing markets) in Table 2 for the 2005-2011 time periods, the correlation coefficients range from 0.43 in China (Shanghai) to 0.77 in Korea. However, Table 6 shows that the *lowest* beta (0.77) by a wide margin is for the Malaysian market, and the *highest* betas (1.63, 1.58, and 1.55) are for markets inKorea, India, and Indonesia, respectively. The Malaysian market standard deviation for this time period was only 5.42 percent, while the Korean, Indian, and Indonesian market standard deviationswere almost twice as high at 10.00, 10.25, and 10.46percent, respectively. Thailand, with one of the lowest correlation coefficients of the seven markets, has a relatively high beta of 1.21 due to its high standard deviation of 9.99 percent.

Also, comparing the Korean and Taiwanese markets, they have about the same correlation coefficient with the S&P 500 of 0.77 and 0.76, respectively. However, the Korean market, due to its much higherstandard deviation, has a much higher covariance with the S&P 500, as indicated by the beta of 1.63, compared to 1.25 for Taiwan. Also, looking at the three time periods shown for these two markets in Tables 2 and 6, the Kospi (Korea) has a much higher correlation of returns with the S&P 500 in only the 2000-2004 period (and it is much lower in 1995-99), yet the covariance with the S&P 500 is much higher than for Taiwan in all these time periods.These examples illustrate that the correlation coefficient alone can be a misleading indicator of the diversification benefits provided by an asset orasset class.

It seems clear that the near complete reliance on correlation coefficients to describe the diversification benefits of individual foreign markets is misdirected, and that far more reliance should be placed on covariance (or beta). But the correlation and covariance alone are not enough to determine the optimal portfolio, because the expected return should be considered as well. (Elton, Gruber and Padberg, 1978) developed a simple technique for ranking assets that should be considered for inclusion in a portfolio using the "excess return to beta ratio". Based on their methodology the expected return is calculated for each asset, and the risk-free rate is subtracted from that estimate to arrive at the expected "excess return". This number is then divided by the beta of the asset. This ratio illustrates that the return on the asset is just as important as the covariance (or beta) estimate in determining whether an asset should be added to a portfolio.

[7]The market index used to calculate beta should depend on a number of factors, including the nature of the portfolio that the investor currently holds. A market index of the world portfolio may be better in some cases.

[8]Using the formula $\beta_i = (Corr_{iM} \times StdDev_i)/StdDev_M$, the calculation of the beta for the Nikkei is 0.87 = (0.75 x .5.50)/4.70 the calculation for HSI is 1.20 = (0.76 x 7.44)/4.70. The S&P 500 (market) standard deviation of monthly returns was 4.70 percent.

Table 5: Moments of the return distributions for indices using monthly returns.

		2005-2011					2000-2004					1995-1999				
Yahoo Abbrev.	Index	Mean	Standard Deviation	Skewness	Kurtosis	N	Mean	Standard Deviation	Skewness	Kurtosis	N	Mean	Standard Deviation	Skewness	Kurtosis	N
^GSPC	S&P 500	0.16%	4.73%	-0.67	1.51	84	-0.21%	4.71%	-0.10	-0.29	60	2.04%	4.02%	-1.38	3.58	60
^N225	Nikkei 225	0.21%	5.50%	-0.30	0.51	84	-0.68%	6.76%	0.23	-0.53	60	0.19%	7.73%	0.72	0.79	60
^HSIX	Hang Seng	0.62%	7.44%	-0.10	1.07	84	0.06%	6.48%	-0.13	-1.02	60	1.45%	9.61%	0.29	2.30	60
^STI	Straits Times	0.94%	7.69%	-0.08	1.71	84	0.15%	6.82%	-0.55	1.46	60	0.23%	10.10%	1.32	5.77	60
^AORD	All Ordinaries	0.76%	8.02%	-0.52	1.45	84	0.87%	4.93%	-0.48	0.06	60	0.59%	4.87%	-0.39	0.17	60
^NZ50	New Zealand Exchg 50	0.42%	6.74%	-0.32	1.16	84										
^KS11	Kospi Composite	1.32%	10.00%	0.19	1.47	84	0.36%	9.22%	0.25	-0.74	60	2.02%	20.64%	0.51	0.16	29
^TWII	Taiwan Composite (Wtd)	0.62%	7.76%	0.18	0.52	84	-0.12%	8.99%	0.32	-0.12	60	-0.44%	10.18%	0.01	-0.72	29
^JKSE	Jakarta Composite	2.15%	10.46%	-0.14	1.93	84	1.00%	10.36%	0.03	-0.50	60	-1.82%	23.25%	0.67	0.28	29
^KLSE	FTSE Malaysia	0.94%	5.42%	-0.16	0.61	84	0.55%	6.05%	0.17	-0.34	60	-0.29%	13.21%	0.54	2.98	60
^THDOWD	Dow Jones Thailand	1.65%	9.99%	-0.24	0.52	84	0.88%	11.00%	0.17	0.20	59					
^SSEC	Shanghai Composite	1.53%	10.14%	-0.32	0.43	84	0.08%	5.85%	0.20	-0.34	59					
^BSESN	Bombay SENSEX (BSE 30)	1.49%	10.25%	-0.07	0.15	84	0.80%	8.31%	-0.08	-0.54	60	-0.09%	8.15%	-0.15	-0.79	29
^FTSE	FTSE 100	0.12%	6.03%	-0.24	1.69	84	-0.17%	4.37%	-0.29	-0.18	60	1.40%	3.45%	-0.03	0.70	60
^GDAXI	DAX	0.78%	8.21%	-0.28	1.06	84	0.18%	7.87%	0.03	1.45	60	1.40%	5.09%	-0.81	1.34	59
^FCHI	CAC40	0.09%	7.89%	-0.29	0.76	84	0.07%	6.27%	-0.36	0.61	60	1.31%	5.46%	0.28	0.89	59

Table 6: Regression coefficients for regressing the foreign index (month-beg. prices) monthly returns on the S&P 500 index (month-end prices) [E.g., Nikkei 225 = f(S&P 500)]--using all S&P 500 monthly returns

Yahoo Abbrev.	Index	2005-2011 Coefficient	t-stat	2000-2004 Coefficient	t-stat	1995-1999 Coefficient	t-stat	1990-1994 Coefficient	t-stat	Average Coefficient	Standard Deviation
^N225	Nikkei 225	0.87	10.22	0.72	4.38	0.60	2.52	0.85	2.58	0.76	0.11
^HSI	Hang Seng	1.20	10.66	0.90	7.06	1.49	6.00	0.91	3.36	1.13	0.24
^STI	Straits Times	1.33	12.88	0.81	5.68	1.57	5.89	0.99	4.61	1.18	0.30
^AORD	All Ordinaries	1.51	17.62	0.70	6.98	0.77	6.23	1.80	3.95	1.20	0.47
^NZ50	New Zealand Exchg 50	1.15	12.17							1.15	
^KS11	Kospi Composite	1.63	10.93	1.28	6.67	1.47	2.06			1.46	0.14
^TWII	Taiwan Composite (Wtd)	1.25	10.64	0.85	3.87	1.12	3.42			1.07	0.17
^JKSE	Jakarta Composite	1.55	8.80	0.62	2.30	2.07	2.63			1.41	0.60
^KLSE	FTSE Malaysia	0.77	8.17	0.28	1.76	1.62	4.26			0.89	0.55
^THDOWD	Dow Jones Thailand	1.21	6.26	1.07	3.97					1.14	0.07
^SSEC	Shanghai Composite	0.93	4.32	0.01	0.08					0.47	0.46
^BSESN	Bombay SENSEX (BSE 30)	1.58	9.72	0.63	3.00	0.34	1.09			0.85	0.53
^FTSE	FTSE 100	1.12	16.41	0.72	9.38	0.57	6.88	0.92	6.45	0.83	0.21
^GDAXI	DAX	1.48	14.74	1.24	8.90	0.87	6.60	0.55	2.53	1.03	0.36
^FCHI	CAC40	1.42	14.79	0.96	8.20	0.71	4.57	0.73	4.02	0.96	0.29

The most desirable assets (those that make up a portfolio on the efficient frontier of risky assets) are those that have the highest excess returns for a given level of risk. Thus, the covariance of an asset is an appropriate measure of risk, not the correlation coefficient; but theexpected return needs to be an additional factor that is considered. Assets are not selected solely on the basis of covariance risk (and correlation).[9]

In light of the findings of (You and Daigler, 2010a), that the third and fourth moment (skewness and kurtosis) of the distributions are important when building diversified international portfolios, we provide evidence of the first four moments of the return distributions of the market indices used in this study. Table 5 provides the mean, standard deviation, skewness, and kurtosis for the monthly distributions of returns for the period from 1995 through 2011 (broken into 3 time periods).[10]As the table illustrates the values vary greatly across the country indices and across time. InTable 5, most markets show negative skewness and all show positive kurtosis from 2005-2011. For the previous two time periods there is a mix of positive and negative values for these moments. The markets with lowest downside risk (positive skewness and negative kurtosis) are the Australian market for the 2005-2011 period and the Singapore market for the 2000-2004 period. The highest downside risk is exhibited by the Japanese market in 2005-2011 and the Korean market in 2000-2004.

4.04 INDIVIDUAL MARKET LINKAGES

Table 6presents "beta" estimates, using the S&P 500 Index as the market index for all the foreign market indices and for four time periods shown in Table 2. The betas were calculated using the monthly S&P 500 return as the "market" return, sothe betas show the average monthly reaction of the foreign market index to changes in the S&P 500 index. The monthly return for the S&P 500 was measured using month-end closing values; whereas, the foreign index returns were calculated using beginning-of-month values, in order to use index values in the foreign market that immediately follow the month-end values of the S&P 500. As in Table 2 the foreign index returns were adjusted for exchange rate changes.

The betas in Table 6 range widely from a high of 2.07 forthe Jakarta Compositefor 1995-1999 to a statistically insignificant 0.01 for the Shanghai Composite from 2000-2004.During the 2005-2011 period most of the betas were above one, while during the previous period most were below one. All but three of the forty estimates of the beta coefficients have a strong statistical significance. During each of the four time periods, there were some markets that reacted much more strongly to changes in the S&P 500 than did other markets--and different markets had the highest betas in different periods. The market with the most consistently high betas was Korea, with an average beta over the 17-year period of 1.46. The market with the highest volatility in beta over time was Indonesia(with a beta of 2.07 in 1995-1999, followed by a beta of 0.62 in 2000-2005), followed closely by Malaysia (with a beta of 1.62 in 1995-1999, followed by a beta of only 0.28 in 2000-2005).Also, the monthly betas for the 2005-2011 period (a period of greater market volatility and higher market correlations) tend to be higher than the average over the entire 27-year period corroborating the findings of (Bennett and Kelleher, 1988).

5.0 SUMMARY AND IMPLICATIONS

This paper has examined the behavior of the monthly and daily correlation coefficients and covariance's of a broad set of Pacific Basin equity markets compared to the S&P 500 index. These correlations and covariance's vary greatly over time and across markets.The countries that have the lowest correlations

[9]Analyses that focus on correlation coefficients as being the primary factor that investors should examine in determining which international assets to add to their portfolio are misleading at best. Covariance should be one focus, not correlation coefficients. In addition, the importance of expected return should be acknowledged. In international markets two components of expected return should be estimated. First, it is the return in the foreign market measured in the local currency. Second, the impact of currency exchange rates on return. Also, it should be noted that in a capital asset pricing model framework, those assets with the highest covariance risk "should" provide the highest expected returns.

[10]The skewness and kurtosis values are those calculated in Excel where the coefficients of skewness and kurtosis are centered at "0".Thus, negative skewness is a negative number.

of returns with the S&P 500 Index in one period are not the same countries in another time period, and the correlations with the U.S. market for a single country can fluctuate by a factor of two to three times from one five-year period to the next.

These findings suggest that the construction of an internationally diversified portfolio of assets is a lot more complex than merely looking at a set of correlation coefficients for the last five to ten years. This paper illustrates the fallacy of looking only at the correlation coefficient as an indicator of the diversification benefits of an asset or set of assets. One problem is the instability of correlation coefficients over time. The second problem is that if investors look only at the correlation, they are ignoring a complete measure of risk in a diversified portfolio--the covariance. Modern portfolio theory says that the diversification benefit of an asset depends on the covariance of returns of that asset with the existing portfolio. Covariance takes into account the standard deviation of the new asset's returns as well as thecorrelation. As an index of covariance, beta may be a better indicator of low risk than is correlation. Of course, the expected return needs to be considered, as well, in deciding which asset(s) to add to an existing portfolio. Finally, if we consider real-world distributions of asset returns that can exhibit negative fat tails (negative skewness and positive kurtosis), the portfolio diversification decision becomes even more complex. The point is that the correlation coefficient is just the beginning, not the end; and those who focus only on correlations are missing the bigger picture.

REFERENCES

Asness, Clifford S., RoniIsraelov and John M. Liew (2011). International diversification(Eventually), *Financial Analysts Journal*, 67(3), 32-45.

Becker, Kent G., Joseph E. Finnerty, and Alan L. Tucker (1992). The intraday interdependence structure between U.S. and Japanese equity markets. *The Journal of Financial Research,*15 (1), 27-37.

Bennett, Paul and Jeanette Kelleher (1988). The international transmission of stock price disruption in October 1987. Federal Reserve Bank of New York Quarterly Review, 13(2), 17-33.

Bookstaber, Richard (2007). The Myth of Non Correlation. Institutional Investor, 32(7) 80-82.

De Santis, Giorgio, and Bruno Gerard (1997). International Asset Pricing and Portfolio Diversification. *Journal of Finance*, 52 (5), 1881-1912.

Elton, Edwin J., Martin J. Gruber, and Manfred W. Padberg (1978). Optimal portfolios from simple ranking devices. *Journal of Portfolio Management*, 4 (3), 15-19.

Erb, Claude B., Campbell R. Harvey, and Tadas E. Viskanta (1994). Forecasting international equity correlations. *Financial Analysts Journal*, 50(6), 32-45.

Eun, Cheol S., Wei Huang, and Sandy Lai (2008). International diversification with large and small cap Stocks. *Journal of Financial and Quantitative Analysis*, 43 (2), 489-523.

Fender, William E. (2002). Why international equities belong in a diversified investment portfolio. *Journal of Investing*. 11 (4), 63-66.

Fernandes, Jose L. B., and Jose R. H. Ornelas (2010). The benefits of international portfolio diversification. *Journal of International Finance and Economics*, 10(4) 72-79.

Grubel, Herbert G. (1968). Internationally diversified portfolios: Welfare gains and capital flows. The *American Economic Review*, 58(5), 1299-1314.

Gupta, R., & Mollik, A. T. (2008). Volatility, time varying correlation and international portfolio diversification: An empirical study of Australia and emerging markets. *International Research Journal of Finance and Economics*, 18.

Horn, Bernard R. (2010). International diversification: why it still makes sense. *American Association of Individual Investors Journal*, 32 (10), 7-10.

Kaplanis, Evi C. (1988). Stability and Forecasting of the co movement measures of international stock market returns. *Journal of International Money and Finance*, 7 (1), 63-75.

King, Mervyn A. and Sushil Wadhwani (1990). Transmission of volatility between stock markets. *The Review of Financial Studies*, 3 (1), 5-33.

Levy, Haim and Marshall Sarnat (1970). International diversification of *investment* portfolios. *The American Economic Review*, 60(4), 668-675.

Li, Ming-Yuan L. (2007). Volatility states and international diversification of international stock markets. *Applied Economics*, 39, 1867-1876.

Longin, Francois and Bruno Solnik (1995). Is the correlation in international equity returns constant: 1960-1990? *Journal of International Money and Finance*, 14 (1), 3-26.

Shawky, Hany A.,Rolf Kuenzel, and Azmi D. Mikhail (1997). International portfolio diversification: A synthesis and an update. *Journal of international financial markets, Institutions and Money*, 7(4), 303327.

Solnik, Bruno, Cyril Boucrelle, and Yann Le Fur (1996). International market correlation and volatility. *Financial Analysts Journal,* 52(5), 17-34.

Speidell, Lawrence (2004). Why Non-U.S. Investing is essential, not optimal. *Journal of Investing*, 13 (4), 7-11.

Von Furstenberg, George M. and Bang Nam Jeon (1989). International stock price movements: Links and messages. Brookings Papers on Economic Activity, 1, 125-179

You, Leyuan, and Robert T. Daigler (2010a). Is International diversification rally beneficial? *Journal of Banking and finance*, 34(1), 163-173.

You, Leyuan and Robert T. Daigler (2010b). The strength and source of asymmetric international diversification. *Journal of Economics and Finance,* 34(3), 349-364.