INTERACTION MODELING OF THE U.S, CHINA AND PHILIPPINE EQUITY MARKETS

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ABSTRACT

Using daily closing prices from May 2007 to December 2009, the researchers examined the correlation of the Philippine stock market with the stock markets of the world's top three economies---the United States, China, and Japan. Based on the correlation analysis conducted in this research, it was found that the Philippine equities market, thru the PSE Composite Index, is most correlated to the US equities market thru the NYSE Composite Index and the S&P 500 Index. The PSE is correlated to the Japanese and Chinese equity markets as well.

From the correlation analysis, a forecast model for the PSE was developed using the NYSE Composite Index and the SSE Composite Index. The model shows that when the NYSE goes up by 1 percent, the PSE would go up by 0.486 percent, when the SSE is fixed. Similarly, when the SSE goes up by 1 percent, the PSE would go up by 0.304 percent, holding NYSE fixed. Since the US stock market closes about six hours before the Philippine market opens, investors can simply use this model to forecast the Philippine stock market.

Key Words: Philippine Stock Market, Forecasting Model, Constant Elasticity Model, Decoupling, International Diversification

CHAPTER I

INTRODUCTION

The often cited adage "when America sneezes, the world catches a cold" was never truer than during the financial crisis in 2008, as most economies posted at least two consecutive quarters of negative GDP growth. Aside from the United States, some of the economies which contracted at some point during the crisis were Brazil, Hong Kong, Japan, New Zealand, Russia, Singapore, Spain, Switzerland, Taiwan, and United Kingdom, just to name a few. Only a handful of economies did not enter recession such as China, Bangladesh, India, Lebanon, and the Philippines. It is interesting to note that despite lower growth, China led the world out of the crisis and in the 2nd quarter of 2010 overtook Japan to become the 2nd largest economy by Purchasing Power Parity (PPP).

In its June 2009 International Economic Bulletin, the Carnegie Endowment for International Peace ranked 38 economies on the basis of the effects of the crisis through financial channels, namely: currency performance, sovereign bond spreads, and equity market performance. It concluded that China was the least affected country. With China leading the global economic recovery, talks of a decoupling have emerged.

Decoupling can also be seen in the stock market. Take for example the case of the Philippines. As of November 2010, while the Dow Jones Industrial Average (DJIA) and S&P 500 are still below their pre-crisis level, the Philippine stock market has been breaking historical record levels. It should be noted that the Philippine equities market has historically been shown to follow the US market performance. Other stock markets that have been trading at new highs are Indonesia, and Thailand, just to name a few.

The stock market often moves ahead of the broad economy as it serves as a barometer of investor sentiment on the general health of the latter. Former Fed Chairman Alan Greenspan, in a July 1, 2010 CNBC Squawk Box interview, even put it this way, "The stock market is not merely an indicator, but a cause of economic activity." Using the Philippine stock market as an example, its stock market started declining in the 1st quarter of 2008. However, its GDP growth (measured on a Year over Year basis) started only slowing down in the 4th quarter of 2008. By the same token, its stock market started going up in the 1st quarter of 2009 but the broad economy started picking up only in the 1st quarter of 2010.

Since stock markets generally lead the broad economy, it is therefore important to know how markets move. Knowing what moves the markets will give economic managers a heads up as to how the broad economy will perform in the months ahead.

1.1 Motivation of the Research

This research aims to examine the performance of the Philippine stock market in relation to the stock markets of the top 3 world economies (IMF 2010)—United States, China, and Japan. In particular, the researchers would want to know which stock market the Philippine stock market is most correlated to. As was stated above, it has historically been shown that it is most correlated to the US. However, with the recent performance of the Philippine stock market vis-à-vis the US equities market, the weakening influence of the United States on the global economy, and the emergence of China

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as the 2nd largest economy in the world, this long-held belief is being challenged.

With the emergence of China as the world's 2nd largest economy and the number one creditor nation in the world with approximately 20.7 percent in US Treasury Bonds (as of September 2010), the rest of the world will be closely monitoring its economic performance. Since stock markets generally lead the broad economy, therefore, another area of interest would be to find out which equities market—US or Japan—it is most correlated to.

In fact, some economies have become increasingly dependent on China's economic might. South Korea, the world's 12th largest economy, is a good example. In a November 2010 economic report by the Korea Institute for Industrial Economics and Trade, it was revealed that 2.2 percentage points or more than half of the growth in its GDP from 2008 up until the first half of 2010 can be traced to increased exports to China. From a pre-crisis level of 27 percent, the proportion of Korean exports to China, as of September 2010, now stands at 31 percent. This dependence suggests that a slowdown in the Chinese economy will affect the Korean economy. It is no doubt imperative to keep an eye on the Chinese economy.

Other areas of interest would include the US and Japanese case. Given the fact that the US influence on the global economy is weakening, it would be interesting to find out which stock market—China or Japan—the US market is most correlated to. Despite its demotion to third place amid a weakening economy and stock market, Japan still plays a vital role in the global economy. As such, the researchers would also want to know which stock market—US or China—it is most correlated to.

It should be mentioned that this research will be measuring stock market performance using stock market indices of the four economies. The Philippine equities market is represented by the Philippine Stock Exchange Index (PSE). The Chinese equities market is represented by the Shanghai Stock Exchange Composite Index (SSE Composite). For the US equities market, the S&P 500 and the NYSE Composite Index will be used. Nikkei Average Index 225 for the Japanese equities market.

1.2 Importance of the Research

The results, conclusions, as well as the limitations of this research are seen to benefit the policy makers of the aforementioned four economies, and the global investing community as well. Policy makers will benefit from this research by being able to implement the right mix of macroeconomic policies. The investing community will benefit from this research by being able to make a more "informed" investment decision. Furthermore, the academic community is also seen to benefit from this research as this will add to the ever-growing repository of worldly knowledge.

Since the broad economy typically reacts with a lag to the stock market performance, central banks and governments will have time to thoroughly assess the implications of the impending economic event. Thus, the former will be more effective in deciding which monetary policy it is going to implement in the months to come. By the same token, governments will be more effective in deciding which fiscal policy it is going to implement in the months ahead.

By knowing which stock market the local stock market is most correlated to, the index investor

will be able to make a more "informed" buying and selling decision. Of course, it should be pointed out that relying only on the results of this research does not make a good investment strategy. Other indicators of buying and selling decisions—such as technical analysis, among others—should confirm the conclusions reached using this "investing on correlations" strategy.

1.3 Objectives and Structure of the Research

This study aims to examine the performance of the Philippines stock market in relation to the stock markets of the U.S., China and Japan. By knowing this, a forecasting model for the Philippines stock market will be created.

The remainder of this research is organized as follows: Chapter Two sums up previous researches regarding the topic. Chapter Three and Four present the Research Method, and Results and Findings, respectively. Finally, Chapter Five gives out some Conclusions and Recommendations.

CHAPTER II
LITERATURE REVIEW

2.1 A Primer on the Philippine Stock Exchange

The Philippine Stock Exchange, Inc., also known as PSE, is a shareholder-based, revenue-generating private corporation that facilitates the buying and selling of Philippine securities. It is the only stock exchange in the country with over 200 listed firms. PSE shares are also listed on the stock exchange.

It is actually the unified stock exchange of the two former stock exchanges of the country. The Manila Stock Exchange (MSE), founded in 1927, was the first stock exchange in the country and one of the oldest in Asia. It moved its headquarters from downtown Manila, the capital city, to Pasig City in 1992. On the other hand, the Makati Stock Exchange (MkSE), established in 1963 and based in Makati City, the financial capital of the country, was the second stock exchange in the country.

The two traded the same listed securities while remaining separate entities for almost thirty years. This created confusion among prospective investors because they had different policies and stock prices for the same listed stocks. They were unified in December 23, 1992 and became known as the PSE. It currently trades simultaneously on two trading floors—one in its head office, Pasig City and one in Makati City. It maintains a "one-price, one market" exchange through the use of two different trading systems at two different points in its history.

From 1993 up until July 23, 2010, the exchange used the MakTrade System, which was developed by the Chicago Stock Exchange. The MakTrade system is a single-order system, composed of hardware, software and network, that tallies all orders into a single main computer and ensures that the orders match with the best bid or best offer regardless which trading floor the orders were placed. After matching, it will then store trade records and generate notice of the transaction to the user. It also maintains market regulation and surveillance databases.

Then in July 26, 2010, it migrated to the New Trading System (NTS), which uses the NYSE Technologies SAS-developed Nouveau Système de Cotation (NSC) V900 Trading platform. The new trading platform was designed to trade a wide range of cash, debt and derivative instruments not possible

through the previous trading system. Furthermore, it was also designed to reduce the fluctuations of the stock prices and postings per fluctuations. Under the old system, a stock worth Php 10.00 would rise and fall by Php 0.25 or a fluctuation of 2.5 percent. Under the new system, every movement is only Php 0.02.

Composed of the 30 largest companies and most active common stocks (See Table 2.1.1), the PSEi, formerly known as the Phisix and the PSE Composite Index, is the main index of the PSE and as such is the most followed index among the 8 indices of the exchange (See Table 2.1.2) as it provides a snapshot of the general condition of the market. It measures the relative changes in the free float-adjusted market capitalization of the 30 companies. Its base level was pegged at its base date of February 28, 1990 closing value at 1,022.045 points.

SECURITY NAME	TICKER SYMBOL	% WEIGHT
ABS-CBN CORPORATION	ABS	0.91
AYALA CORPORATION	AC	4.69
ABOITIZ EQUITY VENTURES, INC.	AEV	6.59
ALLIANCE GLOBAL GROUP, INC.	AGI	3.14
AYALA LAND, INC.	ALI	6.63
ABOITIZ POWER CORPORATION	AP	3.59
BANCO DE ORO UNIBANK, INC.	BDO	3.74
BANK OF THE PHILIPPINE ISLANDS	BPI	6.65
CHINA BANKING CORPORATION	CHIB	1.78
DMCI HOLDINGS, INC.	DMC	1.93
ENERGY DEVELOPMENT CORPORATION	EDC	4.42
FIRST GEN CORPORATION	FGEN	0.95
FILINVEST LAND, INC.	FLI	0.9
FIRST PHILIPPINE HOLDINGS CORPORATION	FPH	1.26
GLOBE TELECOM, INC.	GLO	1.66
INTERNATIONAL CONTAINER TERMINAL SERVICES, INC.	ICT	2.61
JOLLIBEE FOODS CORPORATION	JFC	2.43
JG SUMMIT HOLDINGS, INC.	JGS	3.07
LEPANTO CONSOLIDATED MINING COMPANY "A"	LC	0.74
LEPANTO CONSOLIDATED MINING COMPANY "B"	LCB	0.53
METROPOLITAN BANK & TRUST CO.	MBT	5.06
MEGAWORLD CORPORATION	MEG	1.55
MANILA ELECTRIC COMPANY	MER	2.8
METRO PACIFIC INVESTMENTS CORPORATION	MPI	2.07
MANILA WATER COMPANY, INC.	MWC	1.61

PHILEX MINING CORPORATION	PX	1.56

Table 2.1.1 PSEi Composition

SECURITY NAME	TICKER SYMBOL	% WEIGHT
ROBINSONS LAND CORPORATION	RLC	1.27
SM INVESTMENTS CORPORATION	SM	6.06
SM PRIME HOLDINGS, INC.	SMPH	3.29
PHILIPPINE LONG DISTANCE TELEPHONE COMPANY "Common"	TEL	14.8
UNIVERSAL ROBINA CORPORATION	URC	1.73

Notes: As of April 4, 2011.As was stated above, the index is composed of 30 companies. A quick glance at this list, however, reveals that there are 31 shares. It should be pointed out that Lepanto Consolidated Mining Company has A and B shares, making the count of companies add up to 30.
Source: Philippine Stock Exchange.www.pse.com.ph

Table 2.1.2 Other Indices of the PSEi

Other Indices	Base Date	Base Value
Financials	14-Nov-96	1,000.00
Industrial*	28-Nov-90	1,422.20
Holding Firms	29-Dec-05	1,000.00
Property**	30-Sep-94	1,000.00
Services	29-Dec-05	1,000.00
Mining & Oil*,***	28-Feb-90	4,752.45
All Shares	14-Nov-96	1,000.00

Notes:
* Base date shown is the date when the market capitalization method was first used to compute the indices. Base value refers to the average index level quoted at that time by PSE's two precursors, the MSE and MKSE.
** Originally 100.00 but the index was realigned to the 1,000.00 level starting November 15, 1996 (all prior values x 10).
***Previously separate, the Mining and Oil sectors, along with their respective indices, were folded together on January 2, 2006, with the combined index continuing the level of the Mining index.
Source: Philippine Stock Exchange.www.pse.com.ph

The year 2007 was a banner year for the PSE amidst the country's outstanding economic performance. Economic growth, measured in terms of GDP, surged by 7.1 percent, the fastest pace in 31 years. Other factors that had favorable and beneficial effects to the local stock market include: (1) the average headline inflation rate was just 2.8 percent, compared to the previous year's 6.2 percent; (2) the central bank's reduction of its key overnight borrowing and lending rates; (3) the appreciation of the local currency against the US Dollar; (4) improved fiscal management, which prompted Moody's Investor Service to upgrade its outlook for the country from "stable" to "positive".

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The performance of the PSEi during that time rewrote the previous all-time high mark by 12 times. Its record-setting run started on May 18 when it closed at 3,449.18 points to topple the previous all-time high record of 3,447.60 points, which previously stood unchallenged since February 3, 1997. The last all-time high came on October 8, when it reached the 3,873.50-point mark. At the end of the year, it gained 639.06 points ---or 21.4 percent more than its level in 2006 --- and closed at 3,621.60 points, the highest yearend level in the history of the local stock market.

In 2008, the main index shed 12.3 percent or 239.66 points, the biggest single-day percentage drop in its history, on October 27, which prompted the PSE to implement the so-called Circuit breaker rule for the first time. It basically called for the suspension of trading for 15 minutes when the main index dropped by at least 10 percent during intra-day trading. At the end of the year, it closed at 1,872.85 points or 48.29 percent lower than the previous year's close.

In 2009, it closed the year at 3,052.68 or 62.9 percent higher than the previous year's end. This 62.9 percent increase, the highest annual gain since 1994, was achieved despite GDP growth slowing down to 1.1 percent from 3.8 percent in 2008. Majority of the market movements were triggered by a combination of positive domestic and international events such as the easing of key interest rates by central banks, among others, and positive local stock-specific events.

Furthermore, local investors provided most of the action for stocks, as they made up more or less two-thirds of the bellwether index's traded volumes. Citing the country's healthy financial system and resilience against the impact of the global recession, Moody's Investors Service upgraded the country's credit rating to Ba3 from the previous B1, or to "Non-investment grade speculative" from "Highly speculative grade". Likewise, the country's sovereign outlook was upgraded to "stable" from "positive".

In 2010, the bellwether index broke the previous all-time high of 3,873.50 points by closing at 4, 4397.30 on November 4.It then finished the year at 4,201.14. This local stock market record-shattering year was made possible by the country's 7.3 percent GDP growth, the largest annual growth in the post-Marcos regime, coupled with a robust performance from the export sector as it reached its target for the year. The country's gross international reserves, which serve as cushion against external shocks, was also a factor as it hit a record high of $62.1 billion during the year.

Source: Yahoo Finance. http://finance.yahoo.com/

Chart 2.1 PSEi performance (2007-2010)

Table 2.1.3 GDP growth Rate of the Philippines (2007-2010)

2007	2008	2009	2010
7.1	3.8	1.1	7.3

Source: National Statistical Coordination Board.www.nscb.gov.ph

2.2 The Case for International Diversification

According to Fitz-Gerald (2010), decoupling is a commonly misunderstood and commonly misapplied term as most people think it is exclusively tied to the financial markets. This is consistent with Rossi (2009) where she pointed that it is a broad term used in myriad of scientific fields, ranging from Astronomy to Economics. It basically implies a break or a disconnection in a previous relationship. In Economics, this term is most commonly used to refer to the changes in global growth correlations.

Specifically, it refers to the likelihood that GDP growth in Emerging Market Economies (EME's) is becoming less dependent on the US and OECD GDP growth, possibly making GDP growth rates appear less correlated than they historically were. However, as previously mentioned, decoupling is also present in the stock market.

Stock market correlations among international markets has been a popular topic among researchers ever since Grubel (1968) applied Markowitz's (1952) Modern Portfolio Theory (MPT) on international stock markets, where the national

stock markets of the US, Canada, United Kingdom, Germany, France, Belgium, Italy, Holland, Japan, Australia and South Africa were studied. His results showed that a portfolio composed solely of US stocks had a lower efficient frontier than a portfolio composed of stocks from all the eleven countries, which means it would be more efficient for an investor to invest domestically and internationally. Furthermore, if stock returns in international markets are not perfectly correlated with one's national stock market and the correlation structure is stable, the more beneficial international diversification becomes. Results from numerous early studies on the interdependence among major national stock market indices found that there was low or negative correlation among national stock indices, making the case for international diversification.

Research by Solnik (1974) found that international diversification is much better than inter-industry diversification. Using the monthly return rates of the United States market and nine other Pacific Basin markets--- the islands in the Pacific Rim and in the Pacific Ocean, Bailey and Stulz (1990) found that Pacific Basin investing lowered the risks of US investors by one-third. Furthermore, using daily return rates reduced the risks by up to fifty percent. Chan, Gup, and Pan (1992) examined the national stock markets of Hong Kong, South Korea, Singapore, Taiwan, Japan, and the US. Using pairwise and higher-order cointegration tests, their research found no evidence of co-integration among the stock prices.

2.3. Interdependence

However, Willett, Liang, and Zhang (2010) pointed that in recent years Advanced and Emerging Market Economies (EME) are becoming increasingly interdependent owing to communication and technological improvements, increased in the liberalization of financial sectors, and the popularity of diversification, among others. In fact, some financial experts even argued that the interdependence, and consequently correlations, among stock markets are so high that it nullifies the merits of international diversification. One could simply look at the recent financial crisis to see that financial markets are indeed interconnected.

The US equity market is the largest stock market in the word, with 29.7 percent of the world's market capitalization. In light of this, it should not come as a surprise that the US market has a strong impact on other national stock exchanges. Research by Eun and Shim (1989) validated that the US is the most dominant stock market in the world as they found substantial multi-lateral interaction among the nine largest stock markets in the world—Australia, Canada, France, Germany, Hong Kong, Japan, Switzerland, the United Kingdom, and the US. Specifically, they documented the effects of US news on these national stock markets and found that US news are transmitted to the other markets in a clear and recognizable fashion; and no single foreign market can explain the US market performance in a significant way.

A correlation between the US markets and three central European markets was observed by Gilmore and McMannus (2002). Using daily prices of S&P 500 and the Istanbul Stock Exchange (ISE) 100 index from October 23, 1987 to June 8, 2004, Berument and Ince (2005) found that a positive shock to the US markets has a positive effect on ISE return that lasts up to four days. Using granger causality test and monthly stock price of the NYSE Composite

Index and the PSE index from 1996 to 2006, Quijano-Arsenio, Corpus, Kim, and Rola (2009) found that there is synchronicity between the two markets; in particular there is a unidirectional causality from NYSE Composite Index to PSE.

Sy (2009) noted that there is a strong correlation between the PSE and the S&P 500 Index due to the global financial system becoming more and more tightly knit than ever, primarily made possible by financial innovations in securitization the past few years. He went on to point out the S&P 500 Index peaked in October 2007 and dropped as much as 57 percent before bottoming out at 666 on March 6, 2009. Likewise, the PSE peaked in October 2007 and similarly plunged by 57 percent before bottoming out at 1,684.75 on October 28, 2008.

2.4. Multiple Connections

The Japanese equity market has 7.97 percent of the world's market capitalization, second only to the US markets' 29.7 percent. In light of this fact, the Japanese market has also some clout over the national stock markets of other countries. Researches conducted by Cheung and Mak (1992), Liu and Pan (1997), Wu and Su (1998) validated this as they concluded that both the US and Japanese stock markets affect Asian countries.

Ghosh, Saidi, and Johnson (1999) found that a number of Asian Pacific stocks are moved by the US and some are moved by the Japanese markets, while the rest of the Asian Pacific countries are moved by neither of the two. Cha and Oh (2000) found that the stock markets of Hong Kong, Korea, Singapore and Taiwan are affected by the US markets and the Japanese market. Research conducted by Tokic (2003) found that there is a long run

relationship between five Asian markets-- Australia, Japan, Hong Kong, New Zealand, and Singapore-- and the US.

Examining the co-movement phenomenon between the national stock markets of Taiwan, Japan, Hong Kong, and the US by analyzing the 2000-2005 daily closing price of the said indices, Chi (2006) found that the Hong Kong and US markets have significant influence on the Taiwanese stock market; however the effect from the latter may not be significant in the long run. It was also found that the Japanese market only has a small effect on the Taiwanese stock market.

Research by Lee (2002) investigated the relationships between the matured stock markets in the U.S., Japan and Germany and the emerging markets in the Middle East and North African (MENA) region by using wavelet analysis. It was found that there is not only price but also volatility spillover effects emanating from the mature stock markets to the MENA stock markets. Using the daily stock price of the national stock markets of Mongolia, US, Russia, and China from 1995 to 2010, Bumaa (2011) found that the Mongolian market is highly correlated with the US, Russian and Chinese markets.

Research by Dooley and Hutchison (2009) delved on the US and fourteen Emerging Market Economies (EME)--Argentina, Brazil, Chile, Colombia Mexico, China, South Korea, Malaysia, Czech Republic, Poland Hungary, Russia, South Africa, and Turkey. After meticulously studying the financial markets data —equity, forex, and credit--- of the 15 countries from 2007 to 2009, they found that EME's were decoupled during the initial stages of the crisis, defined as the period from February 2007 to May 19, 2008. During this stage all emerging

market assets outperformed the US. However, as the crisis dragged on and turned for the worse, culminating in the Lehman Brothers bankruptcy, EME's recoupled with the US. This stage saw EME and US equity markets fell to levels 40 percent below their pre-crisis levels. Rossi (2009) concurs, noting that decoupling worked albeit for a short time as emerging markets stayed strong up to mid 2008.

Kose and Prasad (2010) examined the correlations of weekly stock returns between and among the advanced countries group and EME group, and across the country groups from the late 80's up until 2009.They found that the co-movement of stock returns has been rising for all country groups and also for different regional groupings of emerging markets, invalidating the belief that EME's have decoupled from the Advanced Economies.

CHAPTER III
RESEARCH METHOD

3.1 Data Collection

Daily closing prices from May 2007 to December 2009 of the aforementioned stock indices were downloaded from Yahoo Finance. To check for accuracy and to account for national holidays and other non-trading days, the Yahoo Finance dataset was manually counter-checked with the dataset of the online version of the Asian Wall Street Journal. Except for some minor differences with the dating system, there were no major differences between the two data sources.

This date range was chosen because it envelops the global financial crisis, which started in December 2007 and worsened in September 2008 with the collapse of Lehman Brothers. Another reason is that the indices covered in this research

were in the midst of a bull run in 2007 and bottomed out sometime in 2009. Finally, it also covers the 2007-2008 world food price crisis, which caused social unrest, economic and political instability across the globe.

Since the US equity market is the largest stock market in the word, it is then reasonable to consider both the S&P 500 and the NYSE Composite Index. The S&P 500, owned and maintained by Standard & Poor's, is widely regarded as the single best proxy for the US equities market as it is composed of the 500 most widely-held US-based companies listed in the NYSE and NASDAQ. It is often replicated by index funds by buying and holding the same stocks in the same proportions as the S&P 500. Consequently, a company whose stock is added to the list of S&P 500 stocks may see its stock price rise, as index fund managers normally choose to purchase that company's stock in order to continue tracking the S&P 500 index. Furthermore, it is often used as a performance benchmark for equity fund managers. It reached its highest closing value of 1,565.15 points on October 9, 2007.

The S&P 500's base period is 1941-43. The actual total market value of the stocks in the Index during the base period has been set equal to an indexed value of 10. This is often indicated by the notation 1941-43=10.

On the other hand, the NYSE Composite Index is a broad-based benchmark that tracks the movements of all common stocks listed in the NYSE, American Depositary Receipts (ADR), and Real Estate Investment Trusts (REIT) included. From 2004 to 2006, it outperformed the Dow Jones Industrial Average, S&P 500, and the NASDAQ Composite. It reached its highest closing value of 10,311.61 points

on October 31, 2007. Its base level was originally pegged at its base date of December 31, 1965 closing value of 50 points. It was then re-introduced in January 2003 with a value of 5,000 points.

At the end of 2010, the Chinese equity market makes up 6.89 percent of the world total, making it the world's third largest stock market behind the US and the Japanese market. The SSE Composite Index, launched in July 1991 is a broad-based index that tracks the movements of all stocks (the A shares and the B shares) listed in the Shanghai Stock Exchange. Its base level was pegged at December 19, 1990 at 100 points .It reached its highest closing value of 6,092.06 points on October 16, 2007.

The oldest and the most popular Asian index in the world, the Nikkei Average Index 225 is the single best proxy for the Japanese equities market as it tracks the top 225 blue-chip Japanese stocks listed in the Tokyo Stock Exchange (TSE). In fact, it was dubbed the "Nikkei Dow Jones Stock Average" from 1975 to 1985. It reached its highest closing value of 38,916 points on December 29, 1989, two years before the advent of the Japanese Lost Decade (1991-2000). It was first calculated on September 7, 1950 but was retroactively calculated back to May 16, 1949.

3.2 Correlation Analysis

Using the statistical package PASW Statistics 18.0 (previously known as SPSS), the analysis begins with the calculation of Pearson Product-Moment Correlation Coefficient (PMCC), also known as Pearson's r. Often denoted by r, this correlation coefficient measures the strength of the linear relationship between two sets of interval-scaled

or ratio-scaled variables.

This coefficient has a lower value of -1.00 and an upper value of +1.00. A perfect negative correlation has a value of -1.00 while a perfect positive correlation of +1.00. If the variables have no linear relationship, then $r = 0$.

A caveat would be the direction of the relationship. A negative sign indicates a negative relationship between the variables such that if X increases, then Y decreases and vice versa. On the other hand, a positive sign indicates a positive relationship between the variables such that if X increases, then Y also increases and vice versa.

Another caveat would be the strength of the relationship. The strength of the relationship is not in any way related to the direction of the relationship. The closer r is to -1.00, the stronger the negative relationship is. Similarly, the closer r is to +1.00, the stronger the positive relationship is.

Building on Cohen's (1988) work on categorizing the strength of linear relationships, Hopkins (2002) came up with the table below:

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Table 3.1

Strength of Linear Positive/ Negative Relationship	*r* values
Trivial	+/- 0.0
Small	+/- 0.1
Moderate	+/- 0.3
Large	+/- 0.5
Very Large	+/- 0.7
Nearly Perfect	+/- 0.9
Perfect	+/- 1.00

Source: Will Hopkins (2002)

http://www.sportsci.org/resource/stats/index.html

If a third variable has been shown to be related to one or both of the main variables and there are some theoretical grounds for the distortion caused by the third variable, then a partial correlation analysis is conducted. Partial correlation analysis measures the net correlation between the dependent variable and one independent variable after controlling for the effect of other independent variables in the model. Just like Pearson's *r*, its values range from -1.00 to +1.00. Furthermore, it takes the sign of the corresponding estimated parameter.

3.3. Simple Regression Analysis

Johnson & Bhattacharyya (2011) defined regression analysis as the study of relationships between quantitative variables with the goal of identifying, estimating, and validating the relationship. The estimated relationship is then used to predict the dependent variable Y from the value of the independent variable(s) X There are different types of regression analysis.

Simple regression analysis is a type of regression analysis where there are only two variables being studied---one dependent variable Y and one independent variable X. It usually begins by

plotting the XY data set on a scatter diagram and trying to fit a straight line that runs through all the points.

Mathematically, it is represented by equation (1)

$$Y_i = \beta_0 + \beta_1 X_i$$

(1)

Where:

Y is the dependent variable/ response variable

X is the independent variable/ predictor variable/ explanatory variable

β_0 is the intercept or the value of Y when X is set to zero

β_1 is the slope or the change in Y per unit change in X

It is reasonable to assume that the points on the scatter diagram will not fall in a straight line. Therefore, equation (1) is transformed into equation (2) by adding the error term u.

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$$Y_i = \beta_0 + \beta_1 X_i + u_i$$

(2)

The Ordinary Least Squares (OLS) Method minimizes the sum of the squared deviations of each observed point on the scatter diagram from the straight line, thus giving the "best" fitting straight line. Once the five summary statistics of the OLS have been computed, the least squares estimator of β_0 and β_1 can now be computed. Furthermore, the coefficient of correlation r and the coefficient of determination r^2 can be computed from the five summary statistics as well.

The coefficient of determination r^2 is a measure of the goodness of fit of the model or the proportion of the total variation in the dependent variable Y explained by the estimated regression equation. It has a lower value of 0 and an upper value of 1, where 0 means the estimated regression equation explains none of the variation in the dependent variable and where 1 means the estimated regression equation explains all of the variation in the dependent variable.

3.4. Constant Elasticity Equation Model

If the coefficient of determination r^2 is low or if it is obviously evident by merely eyeballing the scatter diagram that the relationship between the variables is not linear but rather a curved, then a non-linear regression analysis is warranted. There are many types of non-linear regression models. One type is the so-called Constant-elasticity equation (3).

$$Y = AX^b u$$

(3)

Where:

X is some continuous variable that's always bigger than 0

A determines the scale

b is the elasticity of Y with respect to X (Specifically, the percentage change in Y when X changes by 1percent

u is the error term (it has a mean of 1 and is always bigger than 0)

Basically, the use of this non-linear regression is warranted if:
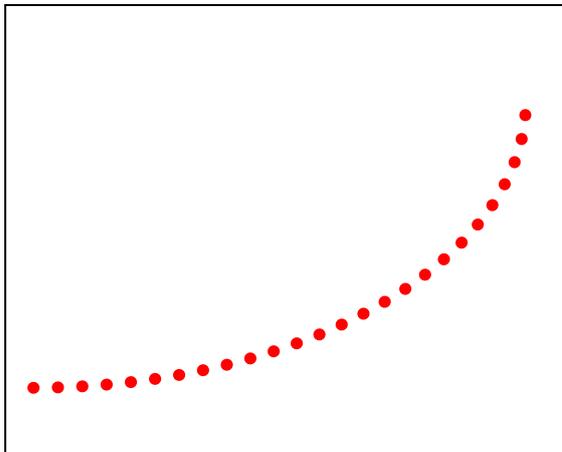
1. X and Y are always positive. X and Y cannot be 0 or negative.

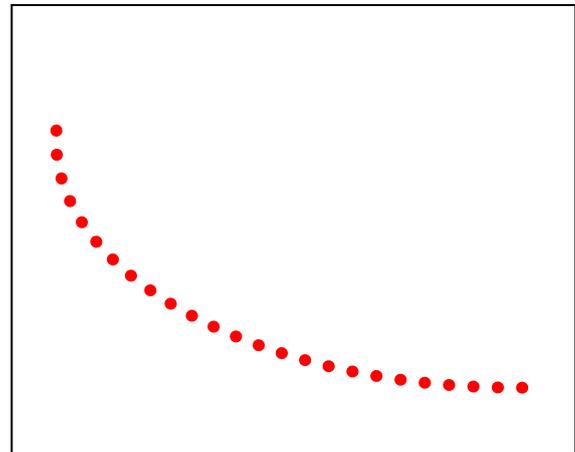2. Diminishing ($|b|<1$) or increasing ($|b|>1$) returns to scale is suspected

3. If it is reasonable that the percentage change in Y caused by a 1 percent change in X is the same at any level of X (or any level of Z, if running a multiple regression).

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The pattern if b is positive   The pattern if b is negative

The trick here is to transform the non-linear equation to a linear equation by taking the logarithm of both sides of equation (3), which results in equation (4)

$$\ln(Y) = \ln(A) + b^* \ln(X) + \ln(u)$$

(4)

Proxies are then created for the variables in equation (4) such that y= ln (Y),
α = ln (A), x=ln (X), and v= ln (u) and results in equation (5)

$$y = \alpha + bx + v$$

(5)

After making the necessary transformation, the linear regression can now be used to analyze the data.

CHAPTER IV

RESEARCH RESULTS

4.1 Correlation Analysis

It has been found that the PSE is highly and positively correlated to the four stock indices as the strength of all the correlation coefficients in Table 4.1 are categorized as somewhere between "Large" and "Very Large" in the Hopkins correlation magnitude scale. Comparing the PSE to other indices, this research has found that the PSE is most linearly and positively correlated to the S&P 500 and the NYSE Composite Index with Pearson correlation value of 0.880 and 0.878, respectively, at a 0.01 significance level. In addition, the PSE is also positively correlated to other two major Asian indices, the Nikkei Average Index 225 and the SSE (Shanghai Stock Exchange) Composite Index with Pearson correlation values of 0.848 and 0.833, respectively.

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Table 4.1 Correlation Analysis among the PSE and Four Other Indices

		PSE	S&P	NYSE	Nikkei	SSE
PSE	Pearson correlation	1	.880[**]	.878[**]	.848[**]	.833[**]
	Significant (two-tailed)		.000	.000	.000	.000
	Number	641	641	641	641	641
S&P	Pearson correlation	.880[**]	1	.998[**]	.955[**]	.726[**]
	Significant (two-tailed)	.000		.000	.000	.000
	Number	641	641	641	641	641
NYSE	Pearson correlation	.878[**]	.998[**]	1	.942[**]	.736[**]
	Significant (two-tailed)	.000	.000		.000	.000
	Number	641	641	641	641	641
Nikkei	Pearson correlation	.848[**]	.955[**]	.942[**]	1	.649[**]
	Significant (two-tailed)	.000	.000	.000		.000
	Number	641	641	641	641	641
SSE	Pearson correlation	.833[**]	.726[**]	.736[**]	.649[**]	1
	Significant (two-tailed)	.000	.000	.000	.000	
	Number	641	641	641	641	641

Source: From this Research

It should be noted that up until this point in this research, the US equities market is represented both by the S&P 500 and the NYSE Composite Index. However, there are significant differences between the two that blindly following the convention of using the former as a proxy for the US market is not appropriate for the purposes of this research.

As was mentioned in Chapter III, the S&P 500 is widely regarded as the single best proxy for the US equities market while the NYSE Composite Index is a broad-based benchmark that tracks the movements of all common stocks listed in the NYSE, American Depositary Receipts (ADR), and Real Estate Investment Trusts (REIT) included.

The reason this research uses the NYSE Composite Index as the lone proxy for the US market is that one of the component stocks of the PSE, the Philippine Long Distance Telephone Company (PSE: TEL) is listed in the NYSE as an ADR (NYSE: PHI).In addition, Chi (2006) used the aforementioned index as a lone proxy for the US market as well when studying the relationship between Taiwan and the US stock market.

Although Japan has been the second largest economy until the 2nd quarter of 2010, behind only to the United States, it has not been an engine of global or Asian growth for some time. In fact according to the World Bank Statistics for GDP from 1999-2009, Japan's contribution to the world economy shrank significantly from 14.5 percent to 8.7 percent by nominal price or a fall from 7.8 percent to 6.0 percent adjusted for purchasing power. On the other hand, China's contribution rose from 3.3 percent to 8.6 percent by nominal price or a rise from 6.9 percent to 12.6 percent adjusted for purchasing power. Furthermore, Japan is also becoming quite dependent on China. In 2010, 18.88 percent of total Japanese exports went to China while 22.22 percent of total Japanese Imports came from China. It is for these above-mentioned reasons that the researchers decided to drop the Nikkei Average Index 225 and whatever effects it has on the PSE from the subsequent analysis and modeling.

After studying the relationship between the

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Philippines and the US stock market, one should be aware of the economic role of the Philippines in terms of its geographic location. First of all, the Philippines is one of the major trade countries in Asia, the influence of China's role in the economy and thus the PSE intuitively must be quite large. In fact, a 2010 European Central Bank report calculated that the Philippines, South Korean and Taiwanese economies are now less dependent on American demand and is becoming more and more dependent on Chinese demand. The honorary chairman of the Philippine Chamber of Commerce and Industry (PCCI) concurred noting that the country's exporters rely heavily on Chinese products. Based on official Philippine records, the Philippines imports $7 billion worth of products from China and exports about $6 billion worth of products, which translates to a trade deficit of nearly $1 billion in 2010. On top of that, from Table 4.1, it is shown that the NYSE Composite Index is correlated to both the SSE Composite Index and the PSE. As a result, a partial correlation analysis was conducted in Table 4.2 with the NYSE Composite Index as the control variable.

**Table 4.2 Partial Correlation Analysis between the PSE and SSE**

		PSE Index
SSE	Correlation	.277
	Significant (two-tailed)	.000

Source: From this Research

From Table 4.2, it is shown that the PSE is significantly partially correlated to the SSE Composite Index. However, one thing can be noticed when comparing Table 4.1 and Table 4.2. Before controlling the NYSE Composite Index, the correlation between the PSE and the SSE Composite Index is 0.833. After controlling the factor, the correlation is 0.277, which is a lot lower than before. Therefore, the correlation between the PSE and the SSE Composite Index is influenced by the NYSE Composite Index.

4.2. Scatter Diagram between the PSE vs. the NYSE Composite Index

According to the above analysis, it is shown that the PSE is highly correlated with the NYSE composite index and the SSE Composite Index. That means, we can actually forecast the PSE by using the SSE Composite Index and the NYSE Composite Index. In order to achieve this, a scatter diagram must be plotted, shown in Figure 4.1.

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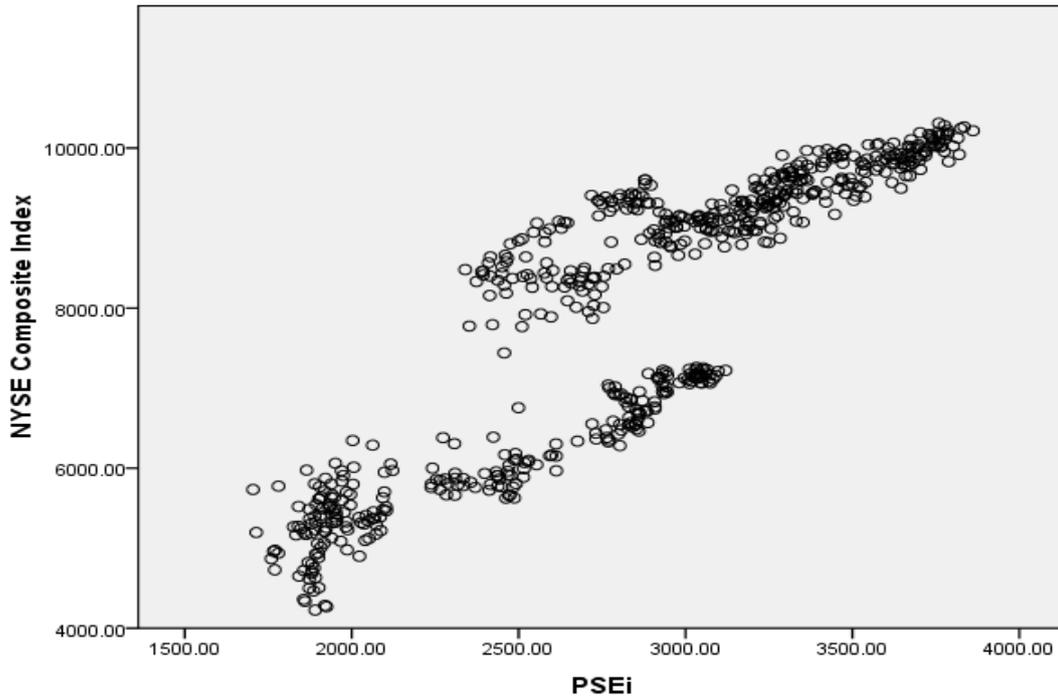
Source: From this Research

Figure 4.1 Scatter Diagram between the PSE and the NYSE

Figure 4.1 reveals a pattern far from being linear, namely a broken S-shaped pattern, and therefore suggests a transformation between the two indices. By taking the logarithm on both sides, also known as the constant-elasticity equation, a more linear pattern is shown in Figure 4.2. Similar method is applied to the data between the PSE and SSE Composite Index.

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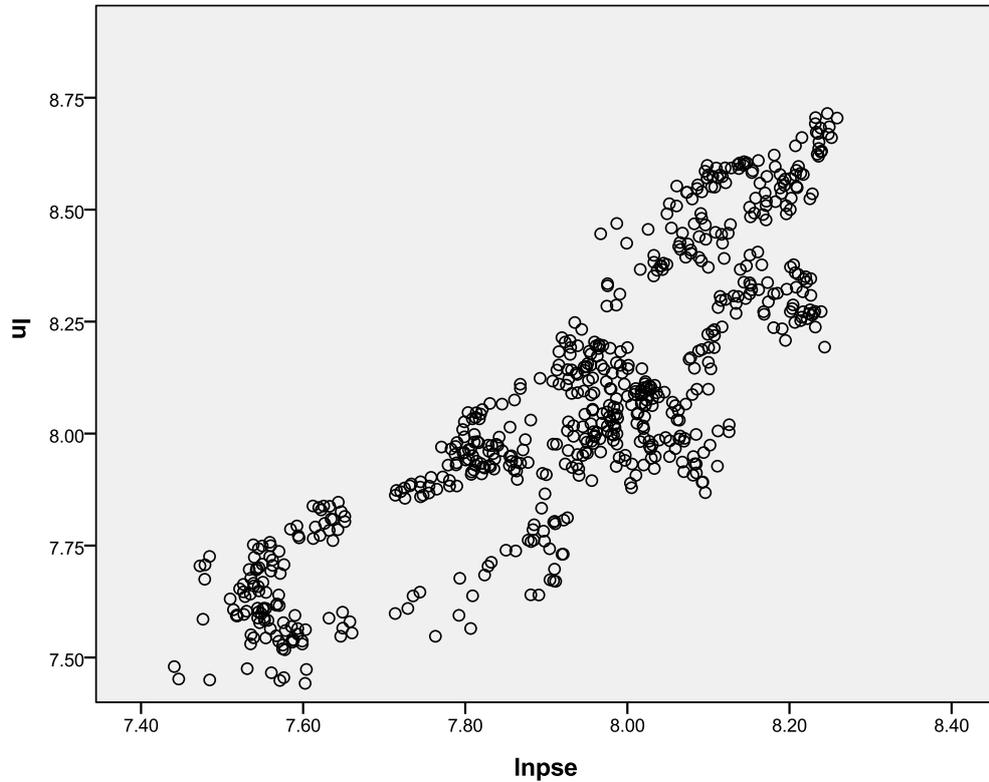
Source: From this Research

Figure 4.2 Scatter Diagram after the Taking Log on the PSE and the NYSE

4.3. Forecast the PSE by Using the SSE and the NYSE

Combining the above analysis, a constant-elasticity equation can be shown to predict the PSE. That is,

$$PSE = A \times NYSE^{\alpha} \times SSE^{\beta}$$

(6)

Where:

A is constant

α is the unbiased estimate of the elasticity of the PSE with respect to the NYSE

Composite Index, ceteris paribus

β is the unbiased estimate of the elasticity of the PSE with respect to the SSE

Composite Index, ceteris paribus

Transforming Equation (6) into logarithm format, Equation (7) is produced.

$$\ln PSE = \ln A + \alpha \ln NYSE + \beta \ln SSE$$

(7)

A regression is conducted using equation (7). According to the regression analysis, shown in Table 4.3, the PSE can be predicted using the NYSE and SSE Composite Indices. The R-square or coefficient of determination for the model is 0.869, which means the regression equation explains about 86 percent of the total variation in the Philippine market. Even the conservative measure of R-square is high, also at about 86 percent. The Durbin-Watson test reveals a

test statistic of 0.067, meaning there is a sequence between the error terms of the regression. From the ANOVA Table (Table 4.4), it is shown that the model is significant at the 0.01 level.

Table 4.3 Analysis for Equation (7)

Model	R	R -square	Adjusted R-square	Std. Error of the Estimate	Durbin-Watson Test
1	.932[a]	.869	.868	.07682	.067

a. Independent Variables: lnNYSE, lnSSE
b. Dependent Variable: lnPSE
Source: From this Research

Table 4.4 ANOVA Analysis for Equation (7)

Model		Sum of Squares	Df	Average Sum of Squares	F	Sig.
1	Regression	24.889	2	12.445	2108.972	.000[a]
	Residual	3.765	638	.006		
	Sum	28.654	640			

a. Independent Variables: lnNYSE, lnSSE
b. Dependent Variable: lnPSE
Source: From this Research

On top of that, a forecast model for the PSE can be shown in Table 4.5, which can be written as Equation (8).From that table, it can be seen that the model is not plagued by multicollinearity problem as the Variance Inflation Factor (VIF) for the two independent variables are 2.3, way below the standard cut-off of 10 and below the conservative cut-off of 5.

Table 4.5 Forecast Model for the PSE

Model		Unstandardized Coefficients		T	Sig.	Collinearity	
		B	Std. Error			Tolerance	VIF
1	Constant	1.125	.114	9.875	.000		
	lnSSE	.304	.015	20.443	.000	.435	2.300
	lnNYSE	.486	.019	25.282	.000	.435	2.300

Source: From this Research

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$$\frac{dPSE}{PSE} = 0.486 \frac{\alpha NYSE}{NYSE} + 0.304 \frac{\partial SSE}{SSE} \qquad \textbf{(8)}$$

Specifically, α is the percentage change in the PSE when the NYSE Composite Index changes by 1 percent and the SSE Composite Index does not change. The model shows that when the NYSE goes up by 1 percent, the PSE would go up by 0.486 percent, when the SSE is fixed. Similarly, when the SSE goes up by 1 percent, the PSE would go up by 0.304 percent, holding the NYSE fixed. Since the US stock market closes about six hours before the Philippine market opens, investors can simply use this model to forecast the Philippine stock market.

This lends support to the research of Arsenio, Corpus, Kim, & Rola (2009) where they found that there is synchronicity between the two markets; in particular there is a unidirectional causality from NYSE Composite Index to PSE. It also validates the research of Dooley & Hutchison (2009) where they found that from early 2007 to the summer of 2008, emerging markets decoupled but recoupled by late summer or early fall of 2008.

CHAPTER V

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This research examined the relationships among the stock markets of the United States, Japan, China, and the Philippines. Based on the correlation analysis conducted in this research, it was found that the Philippine equity market, thru the PSE Composite Index, is most correlated to the US equities market thru the NYSE Composite Index and the S&P 500 Index. The PSE is correlated to the Japanese and Chinese equity markets as well.

From the correlation analysis, a forecast model for the PSE was developed using the NYSE Composite Index and the SSE Composite Index. The model shows that when the NYSE goes up by 1 percent, the PSE would go up by 0.486 percent, when the SSE is fixed. Similarly, when the SSE goes up by 1 percent, the PSE would go up by 0.304 percent, holding NYSE fixed. Since the US stock market closes about six hours before the Philippine market opens, investors can simply use this model to forecast the Philippine stock market.

Part of the motivation for this research is to investigate the correlation among the American, Chinese, and Japanese equities market. This research found that the other three national stock markets are highly and positively correlated to one another. In fact, all the correlation coefficients are categorized as somewhere between "Large" and "Very Large" in the Hopkins correlation magnitude scale.

In the case of the Chinese equities market, it was found that the SSE Composite Index is most correlated to the PSE with a Pearson's r value of 0.833. After the PSE, the NYSE Composite Index has been shown to be most correlated to the Chinese market. This result is not surprising considering the fact that the NYSE Composite includes all the ADR's listed in the New York bourse. In fact, there are 41 Chinese ADR's, comprising 1.257 percent of the NYSE Composite Index.

For the Nikkei Average Index 225, it was found that it is most correlated to the US equities market via the S&P 500 Index. In second place is the Philippines thru the PSE. It is least correlated to the

Chinese markets.

The two US stock market indices, namely the S&P 500 and the NYSE Composite Index are very much correlated to one another. This discovery validates the long-held claim that these indices represent the US equities market. Furthermore, this suggests to the index investor that there is no merit in diversifying between the two indices as they are positively highly correlated to one another. On the international front, the US equities market is most correlated to the Nikkei Average Index 225. It is then followed by the PSE.

5.2 Recommendations

To the researchers' best knowledge, this research is the first to examine the correlation among the national stock markets of the US, Japan, China, and the Philippines covering data during the 2007 Financial Crisis. Furthermore and also to the researchers' best knowledge, this is the first research to ever develop a forecast model for the present-day Philippine stock market. However, being the first does not imply being perfect. As such, the researchers' would want future researchers, hopefully one with real-world investment experience, to improve this research by making the following modifications:

First, expand the date coverage of the data to cover more economic shocks like the Asian Financial Crisis and the dot-com bubble burst. The longer the date range, the better.

As an oil-importing country, the Philippines is hostage to the increasing price of oil. Therefore the second recommendation is to factor in the impact of oil prices as Arsenio, Corpus, Kim, & Rola (2009) did. A by-product of this recommendation is the US Dollar- Philippine Peso exchange rate. Since oil per barrel is quoted in US Dollars, it would be interesting to see how oil price and the exchange rate affect the Philippine equities market. Leeb (2007) prophesized, due to Marion King Hubbert's peak oil theory, there will be a time in the near future where oil demand outstrips oil supply. This period will have very severe repercussions to the world, most notably rising food prices. Economic-wise, this is a catch 22 for most governments. An increase in the price of oil creates inflation, which slows down the economy and drives up the unemployment rate. To solve the unemployment problem, governments are tempted to lower interest rates to spur the economy. However, this reinforces the problem of inflation. During this period, it is best to avoid investments in cash, bonds, stocks, and small-cap stocks as they will give out negative returns. He advised the readers to invest in gold and gold shares, oil and oil shares, real estate, Chindia (China & India), and alternative energies as they will not only give out positive returns but also superior returns.

Third, explore if there is any relationship between the Philippine index and the Chicago Board Options Exchange's volatility index (VIX) or the so-called investor fear gauge. It basically measures the level of near-term implied volatility in the market. Since the Philippine market is correlated to the US market, it would be interesting to see how this index is correlated or not-correlated to the Philippine market.

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