Journal of Asia-Pacific Studies Vol. 22. No. 4 (2015)

The Impact of US Macroeconomic Information on World Stock Market Returns: Evidence from Asia-Pacific

Ilhyun Yoon*

| Contents |

| Abstract |

This study examines the impact of the US macroeconomic information on stock market returns in Asia-Pacific countries in the age of economic globalization. Macroeconomic indicators used for analysis are consumer price index, industrial production index, initial jobless claims, total nonfarm payrolls, 10-year treasury maturity rate, civilian unemployment rate, trade-weighted US Dollar index and JPY/USD exchange rate. GARCH model estimation is employed to investigate the effect of changes in these variables on stock market returns in Asia-Pacific countries using monthly data of the period from July 1997 to September 2015.

The results show that all stock market returns in sample countries are affected by one or more variables from the US. Both trade-weighted US Dollar and Japanese Yen are the factors that affect stock markets in Asia-Pacific region most extensively. As to volatility spillover effect, the volatility in consumer price index is found to be transmitted into the stock markets in several countries.

* Associate Professor, Division of Business Administration, Dongseo University.

▪ Key words: Asia-Pacific, GARCH Model, Macroeconomic Indicators, Stock Returns, Unit Root

Ⅰ. Introduction

The US economic dominance is believed to have been gradually declining as China has emerged as world economic power in the past decades. According to the estimates of International Monetary Fund (IMF) announced in December 2014, China finally took over the US as the world's biggest economy. The IMF calculation of the US economy, based on the purchasing power parity (PPP), is slightly surpassed by that of China. Be that it may be, global financial markets still keep an eye on every news and report on US economic activities. Global investors pay attention to US economic data for their investment decision-making. It is because of the fact that the US economy is the largest in the world in nominal dollars. In fact, the US economy is estimated at U$17.4tn without the PPP adjustment, far more than China's U$10.3tn. Besides, with nearly 300 million consumers, the US is the largest market so that the country is the largest import destination in the world. According to the World Trade Organization (WTO), US imports totaled $2.3 trillion in 2012, which constituted 12.7 percent of the world total. Against this backdrop, it would be greatly meaningful to examine to what extent the US macroeconomic information affect world capital markets.

Theoretical frameworks behind the association between macroeconomic variables and stock market movements have been employed by many researchers. Fama (1970, 383-417) developed the efficient market hypothesis (EMH), which is based on the random walk theory of

Samuelson (1965, 41-49). Ross (1976, 341-360) developed the Arbitrage Pricing Theory (APT) as an alternative method of measuring asset returns to the capital asset pricing model (CAPM). The EMH assumes that stock market prices accurately reflect all available information and respond instantaneously to new information in the efficient market because the information affect market-player' expectations regarding the firms' future cash flows and future earnings. Fama (1970, 383) defined three different forms of market efficiency: weak form, semi-strong form and strong form. A market has weak efficiency if prices fully reflect any information contained in past price data. In a semi-strong efficient market, prices reflect all publicly available information about economic fundamentals as well as the content of financial reports, economic forecasts, company announcements, and so on. A market has strong efficiency if prices fully reflect all public and private information. Among the three forms of market efficiency, Fama (1991, 1577) showed that the semi-strong form provides the most significant support and least controversial evidence in favor of the stock market efficient hypothesis empirical studies on the efficient market hypothesis strongly supported semi-strong market efficiency. The arbitrage pricing theory (ATP) is an extension of the capital asset pricing model (CAPM) introduced by Sharpe (1964, 425-442). While the CAPM is based on one factor that there is only one independent variable which is the risk premium of the market, the APT is a multi-factor asset pricing theory that the expected return of a financial asset can be modeled as a linear function of various macroeconomic factors.

Depending on the theoretical frameworks of the semi-strong EMH and the APT, this paper attempts to explore whether and to what extent the US macroeconomic indicators significantly affect stock price returns in Asia-Pacific region. Selected stock markets include Korea,

Japan, China, Taiwan, Malaysia, Indonesia, India, Russia and Australia. Eight major macroeconomic indicators are used as explaining variables: consumer price index, industrial production index, initial jobless claims, total nonfarm payrolls, 10-year treasury maturity rate, civilian unemployment rate, trade-weighted US Dollar index and JPY/USD exchange rate. GARCH model estimation is employed to test the impact of US macroeconomic data on the stock market returns in Asia-Pacific with monthly data for the period from July 1997 to September 2015. Differently from the existing studies, which mostly focused on the impact of a country's economic variables on its national stock market, this paper examines the influence of the US macroeconomic data on the stock markets outside the US, Asia-Pacific region. Therefore, the current study is expected to add valuable contributions to the existing literature.

The rest of the paper is organized as follows. Section 2 reviews the existing studies and Section 3 presents the data and preliminary analysis. Section 4 discusses empirical findings before concluding the study in Section 5.

Ⅱ. Literature Review

Macroeconomic variables are excellent candidates for undiversifiable risk factors, because macroeconomic changes simultaneously affect all firms' cash flows and may influence the risk-adjusted discount rate. Economic conditions may also influence the number and the types of real investment opportunities available (Flannery & Protopapadakis 2002, 751-782). A number of studies have tried to show the relationship between macroeconomic variables and security returns.

Chen et al. (1986, 383-403) used several macroeconomic variables to

explain stock returns in the US stock markets to find industrial production, changes in risk premiums and changes in the term structure to be positively related to the expected stock returns, while both the anticipated and unanticipated inflation rates were negatively related to the expected stock returns. Following the study by Chen et al. (1986, 383-403), similar studies examined whether the observed relationships between macroeconomic variables and stock market returns are applicable when the analysis is conducted in the Japanese market (Hamoa 1988, 45-61) and in the United Kingdom (Poon & Taylor 1991, 619-636). Hamoa (1988, 45-61), with addition of international trade variable, found that the results are consistent with Chen et al. (1986, 383-403) study apart from industrial production appearing insignificant in stock returns. However, Poon & Taylor (1991, 619-636) showed that macroeconomic variables did not appear to affect stock returns in the United Kingdom as they did in the US, suggesting that either different macroeconomic factors have an influence on stock returns in the United Kingdom or the methodology employed by Chen et al. (1986, 383-403) is inefficient. They emphasized the importance of representing only the unexpected component of stock returns and macroeconomic variables in the model and argued Chen et al. (1986, 383-403) findings might be an example of a spurious regression. Wongbangpo & Sharma (2002, 27-51) tested the relationship between the stock returns for the ASEAN-5 countries of Indonesia, Malaysia, the Philippines, Singapore and Thailand and five macroeconomic variables including gross national product, the consumer price index, the money supply, the interest rate and the exchange rate. They found that all five stock price indices were positively related to gross national product growth and negatively related to the consumer price index. But a negative relationship between stock prices and interest rates was observed for the Philippines, Singapore and Thailand and was found to

be positive for Indonesia and Malaysia. Gay (2008, 1-8) investigated the relationship between stock market index price and macroeconomic variables of exchange rates and oil prices in emerging countries to find no significant role of these variables in explaining the stock market index prices in any of the countries. Kurihara & Nezu (2010, 8-15) examined the relationship between Japanese stock prices and macroeconomic variables during a period of unprecedented recession and deflation for more than 10 years and found that domestic interest rate has not influenced the Japanese stock prices, nor has the exchange rate been a significant determinant of the Japanese stock prices.

A growing number of studies have been tried to examine the effect of macroeconomic information on cross-border stock returns. Becker et al. (1995, 1191-1210) showed that UK stocks reacted to US macroeconomic news. Vrugt (2009, 611-627) reported that US and Japanese macroeconomic news significantly affected conditional variance of equity returns in Japan, Hong Kong, South Korea, and Australia. Wongswan (2006, 1157-1189) showed that the US and Japanese macroeconomic news significantly affected the volatilities of Korean and Thai stocks. Mixed evidence existed with respect to the impact of US macro shocks in developed markets. For example, Connolly & Wang (2003, 67-69) showed that macro surprises originating in the United States, Japan and the United Kingdom only weakly affected stock returns in foreign markets. Nikkinen & Sahlström (2004, 201-215) reported that while domestic news had no significant impact on the implied volatility of German and Finnish stocks, the US macro information significantly affected stock return volatilities in these markets. Nikkinen et al. (2006, 92-104) showed that while developed European and Asian countries were significantly affected by US news, Latin American and transition economies were not. Hayo et al. (2010,

172-174) offered evidence of material effects of US monetary policy communications across European and Pacific Equity markets. They also reported that US macroeconomic surprises affected Canadian equity returns more than Canada's own surprises do. While Aijö (2008, 242-258) provided evidence that US macroeconomic announcements influenced FTSE-100 implied volatilities, Dimpfl (2011, 389-398) reported similar findings for DAX volatilities. Singh et al. (2013, 476-485) explored how US macroeconomic variables affected stock markets in ten major developed economies as well as in China and India and did not find strong enough evidence of impact of US macroeconomic shocks on stock returns and volatilities in these markets. Differently from Singh et al. (2013, 476-485), this paper focused on the stock markets in Asia-Pacific region.

Ⅲ. Data and Preliminary Analysis

The sample consists of stock market indices from nine countries in Asia-Pacific region for the period from July 1997 to September 2015. The macroeconomic data considered here are major economic indicators which include consumer price index, industrial production index, initial jobless claims, total nonfarm payrolls, 10-year treasury maturity rate, civilian unemployment rate, trade-weighted US Dollar index and JPY/USD exchange rate. The selected stock markets and macroeconomic indicators are summarized in <Table 1>, with the abbreviations used.

<Table 1> Summary Information for Variables

Type	Abbreviation	Frequency	Unit
US Macroeconomic Data			
Consumer Price Index for All Urban Consumers: All Items (1982-1984=100)	CPI	Monthly	CCARC
Industrial Production Index (2012=100)	IP	Monthly	CCARC
Initial Jobless Claims, 4-Week Moving Average	JOBLESS	Monthly	CCARC
All Employees: Total Nonfarm Payrolls	PAYROLL	Monthly	CCARC
10-Year Treasury Constant Maturity Rate	TREASURY	Monthly	CCARC
Civilian Unemployment Rate	UNEMP	Monthly	CCARC
trade-weighted US Dollar Index: Broad (Jan 1997=100)	USD_CHG	Monthly	CCARC
Japanese Yen to One US Dollar	YEN_CHG	Monthly	CCARC
trade-weighted US Dollar Index: Broad (Jan 1997=100)	USD	Monthly	Index
Japanese Yen to One US Dollar	YEN	Monthly	Exchange rate
Sample Stock Markets in Asia-Pacific region			
Korean Stock Market Index	RT_KOSPI	Monthly	CCRC
Japanese Stock Market Index	RT_NIKKEI	Monthly	CCRC
Chinese Stock Market Index	RT_SSE	Monthly	CCRC
Taiwanese Stock Market Index	RT_TWII	Monthly	CCRC
Malaysia Stock Market Index	RT_KLSE	Monthly	CCRC
Indonesian Stock Market Index	RT_JKSE	Monthly	CCRC
Indian Stock Market Index	RT_SENSEX	Monthly	CCRC
Russian Stock Market Index	RT_RTSI	Monthly	CCRC
Australian Stock Market Index	RT_ASX	Monthly	CCRC

▪ CCARC and CCRC stand for Continuously Compounded Annual Rate of Change and Continuously Compounded Rate of Change, respectively.

For stock market returns, this study uses major indices of sample countries. All data are monthly closing prices. The US macroeconomic

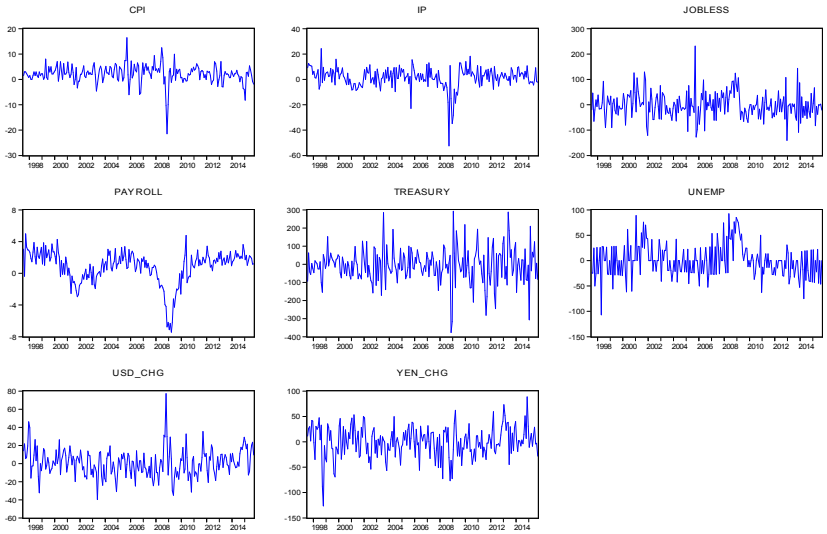
indicators are collected from Federal Reserve Bank of Saint Louis in the form of continuously compounded annual rate of change. Stock prices are obtained from the Yahoo finance database and monthly returns in stock markets under study, denoted R_t in the equation (1) below, are computed as a continuously compounding returns using the first difference in the natural logarithms:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

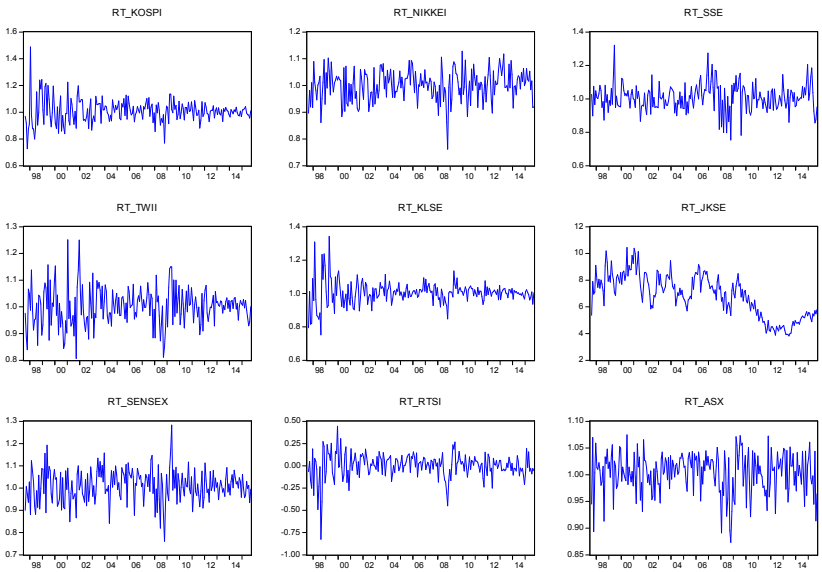
Where R_t is the returns in the stock market index for month t, and P_t and P_{t-1} are monthly closing data at time t and $t-1$, respectively.

<Figure 1> shows the movement of annual rates of change in eight macroeconomic variables for the sample period. During the global financial crisis of 2007-8, it is shown that there were substantial downfall in inflation rate, low level of industrial productivity, increase in initial jobless claims. Extremely sharp decline and rise in total nonfarm payrolls in the wake of the crisis are assumed to indicate that a large of number of employers were out of job due to the crisis and got employed again shortly, leading to sharp decline in jobless claims after the crisis. The value of Dollar index against other currencies is shown to become strong as the key currency during the global crisis. Stock returns in nine stock markets are displayed in <Figure 2>, showing high volatility during the 1997-98 Asian financial crisis and the 2007-08 global financial crisis.

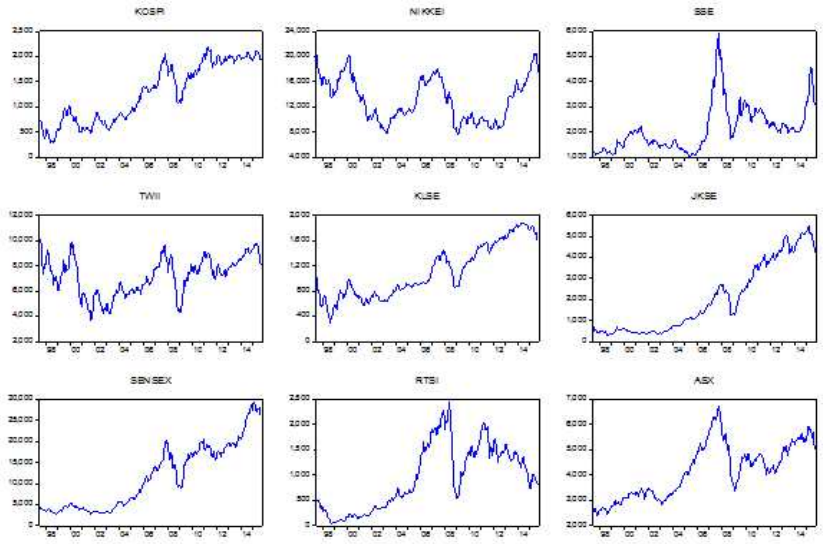
<Figure 1> Annual Rate of Change of Indicators



<Figure 2> Stock Price Returns



<Figure 3> Movement of Stock Indices



<Figure 3> demonstrates the trends of stock market indices of nine Asia-Pacific countries. Most of stock markets continued to be bullish after recovering from the global crisis shocks except for the Russian market, which has been sidelined in a rout of recent global stock market rally.

<Table 2> summarizes descriptive statistics for annual rate of change of the macroeconomic indicators. Mean values are all positive except for initial jobless claims and 10-year treasury maturity rate. 10-year treasury rate the biggest fluctuations at 96.2058 of standard deviation followed by jobless claims and civilian unemployment rate while total non-farm payrolls and consumer price index are least volatile. As for the stock market returns, Indonesian stock market shows best performance and highest volatility among sample stock markets. Overall stock returns variables are stable in comparison with US macroeconomic variables as indicated from the kurtosis and

standard deviation. All data used are not normally distributed as the p-value of the Jarque-Bera for all data rejects the null hypothesis of normal distribution.

<Table 2> Descriptive Statistics for Variables

	CPI	IP	JOBLESS	PAYROLL	TREASURY	UNEMP	USD_CHG	YEN_CHG
Mean	2.1590	1.4192	-1.0142	0.8095	-6.3048	0.1085	0.9024	0.2741
Median	2.1878	2.1938	-5.1702	1.2175	-4.5028	0	0.7266	0.5865
Maximum	16.4094	24.3071	230.917	4.9810	292.058	92.3532	77.0775	88.5507
Minimum	-21.4369	-52.3357	-140.590	-7.4423	-376.546	-106.737	-39.7233	-126.272
Std. Dev.	3.6146	8.1509	51.8620	2.0816	96.2058	32.3723	15.1101	30.2541
Skewness	-1.3551	-1.9686	0.5305	-1.4614	-0.1757	0.3454	0.6432	-0.4714
Kurtosis	12.4576	13.0612	4.6338	6.0725	5.0166	3.4417	5.5581	4.1705
Jarque-Bera	883.234	1065.16	34.629	164.096	38.237	6.1368	74.818	20.614
Probability	0	0	0	0	0	0.0465	0	0
Observations	219	219	219	219	219	219	219	219
	RT_KOSPI	RT_NIKKEI	RT_SSE	RT_TWII	RT_KLSE	RT_JKSE	RT_SENSEX	RT_RTSI	RT_ASX
Mean	1.0082	1.0009	1.0075	1.0015	1.0045	6.8359	1.0108	0.0020	1.0036
Median	1.0065	1.0041	1.0066	1.0038	1.0072	7.0443	1.0103	0.0103	1.0101
Maximum	1.4882	1.1285	1.3205	1.2513	1.3423	10.4523	1.2825	0.4445	1.0747
Minimum	0.7275	0.7617	0.7537	0.8065	0.7523	3.8266	0.7611	-0.8245	0.8734
Std. Dev.	0.0869	0.0572	0.0806	0.0703	0.0693	1.5771	0.0717	0.1387	0.0380
Skewness	0.7977	-0.4801	0.1897	0.1633	0.6164	-0.0929	-0.0817	-1.3303	-0.7219
Kurtosis	7.3475	3.5908	4.5411	3.9747	8.3370	2.1674	3.8485	9.2847	3.4501
Jarque-Bera	194.81	11.545	22.880	9.5986	272.537	6.6094	6.7824	423.065	20.779
Probability	0	0.0031	0	0.0082	0	0.0367	0.0336	0	0
Observations	218	218	218	218	218	218	218	218	218

<Table 3> shows the correlation coefficients between pairs of the variables under study. There exists no significant correlation among US macroeconomic variables except for the association between IP and Payroll. However, the correlation between them is not too strongly correlated to be removed, indicating all the variables can be used for analysis to explore the effect of macroeconomic information on stock

markets in Asia-Pacific. Among stock market performances, stock markets in the region are highly correlated while stock market returns in Indonesia and China are related with other markets in relatively low level.

<Table 3> Correlation Coefficients

	CPI	IP	JOB LESS	PAY ROLL	TREA SURY	UNEMP	USD_ CHG	YEN_ CHG
CPI	1							
IP	0.0609	1						
JOBLESS	0.0112	-0.3756	1					
PAYROLL	0.1903	0.5151	-0.2574	1				
TREASURY	0.2904	0.0059	-0.1466	0.0315	1			
UNEMP	-0.0948	-0.3638	0.1699	-0.4676	-0.0873	1		
USD_CHG	-0.3375	0.0063	0.0999	0.0282	-0.0702	0.0288	1	
YEN_CHG	0.0055	0.0183	-0.0558	0.1406	0.1939	0.0607	0.3802	1
	RT_ KOSPI	RT_ NIKKEI	RT_ SSE	RT_ TWII	RT_ KLSE	RT_ JKSE	RT_SE NSEX	RT_ RTSI	RT_ ASX
RT_KOSPI	1								
RT_NIKKEI	0.5112	1							
RT_SSE	0.1816	0.2646	1						
RT_TWII	0.5067	0.4714	0.3092	1					
RT_KLSE	0.4031	0.2694	0.2086	0.4761	1				
RT_JKSE	0.1939	0.0664	0.1628	0.1349	0.1617	1			
RT_SENSEX	0.3973	0.4746	0.2821	0.4710	0.3706	0.2299	1		
RT_RTSI	0.3780	0.4318	0.2296	0.5146	0.4230	0.2045	0.3738	1	
RT_ASX	0.5157	0.5823	0.2453	0.4825	0.3874	0.2333	0.5055	0.4744	1

IV. Methodology and Empirical Findings

The analysis using non-stationary variables causes problems in statistical inference involving time-series models. Hence, as a first step,

unit root tests are performed to check whether a series is stationary or not. The most well-known one is the Augmented Dickey and Fuller(ADF) (Dickey & Fuller. 1981, 1057-1072). The ADF test is applied in this study and <Table 4> shows results of the test for the existence of unit roots with the t-statistics, critical values and probability. The statistic values are less than the critical values so that the null hypothesis of a unit root in the series data can be rejected in all variables, meaning that all series are stationary. Only Indonesian stock market return time-series is found to be non-stationary.

<Table 4> ADF Unit Root Tests on Changes

	ADF t-Statistics	Critical Values			Probability
		1%	5%	10%	
CPI	-9.90086	-3.46031	-2.87462	-2.57382	0
IP	-3.87429	-3.46031	-2.87462	-2.57382	0.0026
JOBLESS	-16.7131	-3.46031	-2.87462	-2.57382	0
PAYROLL	-2.97419	-3.46031	-2.87462	-2.57382	0.039
TREASURY	-12.2509	-3.46031	-2.87462	-2.57382	0
UNEMP	-2.62611	-3.46031	-2.87462	-2.57382	0.0893
USD_CHG	-9.50497	-3.46031	-2.87462	-2.57382	0
YEN_CHG	-11.1916	-3.46031	-2.87462	-2.57382	0
RT_KOSPI	-12.8917	-3.46031	-2.87462	-2.57382	0
RT_NIKKEI	-12.9717	-3.46031	-2.87462	-2.57382	0
RT_SSE	-12.7903	-3.46031	-2.87462	-2.57382	0
RT_TWII	-8.56344	-3.46031	-2.87462	-2.57382	0
RT_KLSE	-12.7679	-3.46031	-2.87462	-2.57382	0
RT_JKSE	-2.10486	-3.46031	-2.87462	-2.57382	0.2431
RT_SENSEX	-14.0275	-3.46031	-2.87462	-2.57382	0
RT_RTSI	-11.8324	-3.46031	-2.87462	-2.57382	0
RT_ASX	-14.2761	-3.46031	-2.87462	-2.57382	0

Financial models such as autoregressive conditional heteroskedasticity (ARCH, Engle 1982, 987-1008) and generalized ARCH (GARCH, Bollerslev 1986, 307-327) are able to capture volatility clustering and predict the volatility. The ARCH model allows the conditional variance of a time series to change over time as a function of past squared errors by imposing an autoregressive structure on conditional variance and allowing volatility shocks to persist over time. Bollerslev (1986, 307-327) extends the ARCH process to GARCH for more flexibility in the lag structure. Empirical research has found evidence of large changes in stock prices followed by small changes of either signs. Therefore, the GARCH models, which take into account the volatility-clustering phenomenon of security prices, are more suitable in modelling volatility of financial assets and macroeconomics variables (Sariannidis et al. 2010, 135). The variables under study clearly exhibit volatility clustering phenomenon, shown in <Figure 1>, in which large changes tend to be followed by large changes and small changes tend to be followed by small changes. In order to investigate the effect of macroeconomic variables on stock market returns, the GARCH is estimated in this study. The estimation of a GARCH model involves the joint estimation of a mean and a conditional variance equation. The GARCH(1,1) model for time series Y_i is estimated in the following mean equation (2) and variance equation (3). The α and β in equation (3) are referred to as ARCH and GARCH parameters, respectively.

$$Y_t = \alpha + \beta_k \sum_{k=1}^{n} Y_{t-n} + \epsilon_t \tag{2}$$

$$\sigma_t^2 = \omega + \alpha \epsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{3}$$

To explore returns spillover effects of changes in indicators on stock market returns in Asia-Pacific, changes in eight variables are added to

the above mean equation. In order to investigate volatility spillover from macroeconomic indicators to stock markets, volatility of eight indicator changes is included as an exogenous variable in variance equation of the model as follows:

$$R_{iStock,t} = c_0 + c_k \sum_{k=1}^{8} R_{k,t-1} + \epsilon_t \quad (4)$$

$$\sigma^2_{iStock,t} = \omega + \alpha \epsilon^2_{i,t-1} + \beta \sigma^2_{i,t-1} + \gamma_k \sum_{k=1}^{8} \epsilon^2_{k,t-1} \quad (5)$$

Where $R_{iStock,t}$ is the monthly return for the stock market index of each country i in the Asia-Pacific, c_0 and c_k denote constant coefficient, coefficient of eight selected indicators, while $\sigma^2_{iStock,t}$ is conditional variance of the stock market returns of each country i, and ω, α, β, and γ_k represent constant coefficient, coefficients of the ARCH term (ϵ^2_{t-1}) and the GARCH term (σ^2_{t-1}), and shocks of eight indicators, respectively. Taking into account the fact that economic indicators are released on 10th to 15th of the next month, lagged (past period) indicator variables are applied as explanatory variables in equation (4) and (5) except for exchange rates.

The mean equation provides information about impacts of monthly changes in indicators on monthly market index returns. The variance equation is to predict this period's conditional variance of each market by forming a weighted average of a long-term average (the constant), information about volatility observed in the previous period (the ARCH term), the forecasted variance from last period (the GARCH term) and volatility of six indicators, respectively.

<Table 5> reports the result of the GARCH(1,1) estimation from equation (4) and (5). The top panel provides the coefficients of the mean equation and the middle panel contains the coefficients of the

variance equation. The results suggest that changes in the value of the trade-weighted US Dollar index have a negative impact in explaining stock market returns in all sample countries and Japanese Yen against Dollar is positively related to stock market returns in Japan, China, Taiwan and Russia. The US consumer price index negatively influences the market returns in Japan, China and Australia. Indian stock market returns are negatively affected by the US jobless claims and 10-year treasury maturity rate while Russian market performance is dependent on the US non-farm payrolls and unemployment rate. As shown in <Table 5>, however, the impact is very limited as the coefficients are extremely small. Among US eight macroeconomic indicators, industrial production index is not significant in explaining returns of any of Asia-Pacific stock markets.

As for the volatility impact, which is presented in the middle panel of <Table 5>, estimates of GARCH coefficients, expressed as β, are significantly positive in all stock market returns suggesting that current volatility in a stock market is severely affected by its own past volatility. Regarding volatility transmission from US macroeconomic indicators to stock markets in Asia-Pacific, the coefficient for the consumer price index is significantly negative in stock market returns in Korea, China, Taiwan, Malaysia and Indonesia indicating that the volatility is lower than normal for the release of the information while the coefficient is positive in Japanese market. Treasury maturity rate is positively related with the higher volatility in Indonesian market and unemployment has a positive effect on the volatility in Australia. Trade-weighted Dollar index has a positive impact on the Japanese and Russian market volatility while JPY/USD exchange rate has a negative impact on the Indian market volatility.

<Table 5> GARCH Model Estimation

coefficient	RT_KOSPI	RT_NIKKEI	RT_SSE	RT_TWII	RT_KLSE	RT_JKSE	RT_SENSEX	RT_RTSI	RT_ASX
Mean Equation									
c_0	1.01710***	1.00569***	1.00395	1.00998***	1.00943***	6.94768***	1.01273***	0.02127	1.00785***
$c_{cpi(-1)}$	-0.00302	-0.00305***	-0.00314*	-0.00243	-0.00087	0.01854	-0.00116	-0.00407	-0.00148*
$c_{ip(-1)}$	0.00042	0.00058	0.00065	0.00085	0.00069	0.00815	0.00037	-0.00025	0.0006
$c_{jobless(-1)}$	-0.00005	0.00004	0.00008	-0.00005	0.00007	0.00023	-0.00022***	-0.00023	-0.00001
$c_{payroll(-1)}$	0.00064	0.00379	0.00234	-0.00423	-0.00284	-0.05998	-0.00097	-0.01408***	-0.00038
$c_{treasury(-1)}$	-0.00005	-0.00002	-0.00005	-0.00006	-0.00005	0.00004	-0.00010**	-0.00005	-0.00001
$c_{unemp(-1)}$	0.00006	0.00000	-0.00026	-0.00018	-0.00026	0.0034	-0.00004	-0.00048*	0.00000
c_{usd_chg}	-0.00150**	-0.00136***	-0.00150***	-0.00163***	-0.00122**	-0.01423**	-0.00166***	-0.00210***	-0.00069***
c_{yen_chg}	0.00044	0.00081***	0.00050**	0.00061***	0.00022	0.00086	0.00021	0.00088***	0.00014
Variance Equation									
ω	0.00409***	0.00060**	0.00302***	0.00303**	0.00261***	1.23093*	0.00119*	0.00604***	0.00046**
α	0.15698	0.14908*	0.21048**	0.13878	0.15483	0.37002	0.10398	0.26995*	0.1209
β	0.54037***	0.59961***	0.49632***	0.56414***	0.55557***	0.20006	0.56967***	0.49278***	0.56644***

$\gamma_{cpi(-1)}$	-0.00056**	0.00010***	-0.00043***	-0.00026*	-0.00033***	-0.09467**	0.00009	-0.00053	-0.00002
$\gamma_{ip(-1)}$	-0.00002	-0.00003	0.00000	-0.00009	-0.00005	-0.00125	-0.00006	0.00008	0.00000
$\gamma_{jobless(-1)}$	0.00000	0.00000	0.00001	0.00001	0.00001	-0.0006	0.00000	0.00008**	0.00000
$\gamma_{payroll(-1)}$	-0.00006	-0.00012	-0.00001	-0.00034	-0.0002	0.12372	0.00006	-0.00003	0.00000
$\gamma_{treasury(-1)}$	0.00000	0.00000	0.00001	0.00000	0.00000	0.00387**	0.00000	0.00002	0.00000
$\gamma_{unemp(-1)}$	0.00002	0.00001	0.00003	0.00002	0.00000	-0.0047	0.00001	-0.00003	0.00001***
γ_{usd_chg}	0.00007	0.00004***	0.00000	0.00001	0.00002	-0.01022	0.00003	0.00021***	0.00001
γ_{yen_chg}	-0.00001	-0.00001	0.00000	0.00000	-0.00001	0.00161	-0.00003**	-0.00006*	0.00000
Residual Diagnostics									
F-statistic	0.64389	0.59895	1.53708	1.86167	0.21131	6.75466***	0.21276	0.44598	0.87961
Obs*R-squared	0.64794	0.60284	1.54037	1.86286	0.21306	6.60984**	0.21453	0.44920	0.88418
Q-statistic(12)	4.054	8.0757	17.282	17.484	30.509***	986.5***	11.23	7.9836	13.064

***, ** and * indicate 1%, 5% and 10% statistical significance, respectively. RESID(-1)^2 and GARCH(-1) mean the ARCH term(ϵ_{t-1}^2), the GARCH term(σ_{t-1}^2), respectively. F-statistics and Obs*R^2 represent the results of ARCH LM test. Q(12) describes the Q-statistic of the Ljung-Box test at one to twelve lags.

The bottom panel of <Table 5> reports the results of the ARCH LM test and the Ljung - Box test. The Lagrange multiplier (LM) test, proposed by Engle (1982, 987-1008), tests for autoregressive conditional heteroskedasticity (ARCH) in the residuals. The F-statistic is an omitted variable test for the joint significance of all lagged squared residuals. The Obs*R-squared statistic is Engle's LM test statistic, computed as the number of observations times the R^2 from the test regression. The test results show that there is no ARCH effect except for Indonesia, confirming that the variance equation is correctly specified overall (QMS 2010, 162-163). The Ljung-Box Q test is to test for remaining serial correlation in the mean equation and to check the specification of the mean equation. The test results at one to twelve lags show that all Q-statistics except for Malaysia and Indonesia are not significant, indicating that the mean equation is on the whole correctly specified.

Ⅴ. Conclusion

This study investigates how Asia-Pacific stock markets respond to the US macroeconomic indicators. Both domestic and foreign investors are interested in US economy because of its leading role in the world economy. Therefore, the US macroeconomic information is one of the main issues of interest for stock investors worldwide. The GARCH(1,1) model is estimated for the analysis with nine monthly important US macroeconomic data such as consumer price index, industrial production index, initial jobless claims, total nonfarm payrolls, 10-year treasury maturity rate, unemployment rate, trade-weighted US Dollar index and JPY/USD exchange rate over the period from July 1997 to September 2015 on nine Asia-Pacific stock markets. From the correlation analysis

where there exists no highly correlated pairs among indicator variables, nine selected macroeconomic data are allowed to be all used for the analysis because of the absence of multicollinearity problem.

The results of the study suggest that all US macroeconomic data selectively affect the stock market returns in Asia-Pacific countries with trade-weighted Dollar index being the most influential. As for the volatility impact of US macroeconomic indicators on stock markets in Asia-Pacific, the consumer price index has the most extensive impact on the volatility in Asia-Pacific stock markets. Treasury maturity rate, unemployment rate, trade-weighted Dollar index and JPY/USD exchange rate have selectively a significant impact on the stock market volatility. The GARCH model estimation employed is confirmed to be correctly specified overall as there is no ARCH effect following additional ARCH LM and Ljung - Box tests.

The findings of this study, on the whole, imply that the response of market to the US economic fundamentals is significant among the Asia-Pacific stock markets although the power of influence is very limited depending on the markets. This study can help investors to diversify their international portfolio for the risk management. However, particular care should be taken in picking these markets for investments because the diversification benefit is somewhat marginal as evidenced in this study.

| References |

Aijö, J. (2008). "Impact of US and UK Macroeconomic News Announcements on the Return Distribution Implied By FTSE-100 Index Options." *International Review of Financial Analysis.* Vol. 17, pp. 242-258.

Becker, K. G., J. E. Finnerty & J. Friedman (1995). "Economic News and Equity Market Linkage between the U.S. and U.K." *The Journal of Banking and Finance.* Vol. 19. No. 4, pp. 1191-1210.

Bollerslev, T. (1986). "Generalized Autoregressive Conditional Heteroscedasticity." *Journal of Econometrics.* Vol. 31. No. 3, pp. 307-327.

Chen, N. F., R. Roll & S. A. Ross (1986). "Economic Forces and the Stock Market." *Journal of Business.* Vol. 59, pp. 383-403.

Connolly, R. A. & F. A. Wang (2003). "International Equity Market Comovements: Economic Fundamentals or Contagion?" *Pacific-Basin Finance Journal.* Vol. 11. No. 1, pp. 67-69.

Dickey, D. A. & W. A. Fuller (1981). "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root." *Econometrica.* Vol. 49. No. 4, pp. 1057-1072.

Dimpfl, T. (2011). "The Impact of US News on the German Stock Market - An Event Study Analysis." *The Quarterly Review of Economics and Finance.* Vol. 51. No. 4, pp. 389-398.

Engle, R. F. (1982). "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of UK Inflation." *Econometrica.* Vol. 50. No. 4, pp. 987-1008.

Fama, E. F. (1970). "Efficient Capital Markets: A Review of Theory and Empirical Work." *Journal of Finance.* Vol. 25. No. 20, pp. 383-417.

Fama F. E. (1991). "Efficient Capital Market II." *Journal of Finance.* Vol. 46. No. 5, pp. 1575-1617.

Flannery, M. & A. Protopapadagis (2002). "Macroeconomic Factors Do Influence Aggregate Stock Returns." *Review of Financial Studies.* Vol. 15, pp. 751-782.

Gay, R. (2008). "Effect of Macroeconomic Variables on Stock Market Returns for Four Emerging Economies: Brazil, Russia, India, and China." *International Business and Economics Research.* Vol. 7. No. 3, pp. 1-8.

Hamao, Y. (1988). "An Empirical Investigation of the Arbitrage Pricing Theory." *Japan and the World Economy.* Vol. 1, pp. 45-61.

Hayo, B., A. M. Kutan & M. Neuenkirch (2010). "The Impact of U.S. Central Bank Communication on European and Pacific Equity Markets." *Economic Letters.* Vol. 108, pp. 172-174.

Kurihara, Yutaka & Eiji Nezu (2010). "Relationships between Japanese Stock Prices and Macroeconomic Variables during Quantitative Easing Period." *Briefing Notes in Economics.* Vol. 82, pp. 8-15.

Nikkinen, J., M. Omran, P. Sahlström & J. Aijö (2006). "Global Stock Market Reactions to Scheduled U.S. Macroeconomic News Announcements." *Global Finance Journal.* Vol. 17, pp. 92-104.

Nikkinen, J. & P. Sahlström (2004). "Scheduled Domestic and U.S. Macroeconomic News and Stock Valuation in Europe." *Journal of Multinational Financial Management.* Vol. 14. No. 3, pp. 201-215.

Poon, S. & S. J. Taylor (1991). "Macroeconomic Factors and the UK Stock Market." *Journal of Business and Accounting.* Vol. 18. No. 5, pp. 619-636.

QMS. (2010). *EViews 7 User's Guide II.* Irvine CA. USA: Quantitative Micro Software.

Ross, S. A. (1976). "The Arbitrage Theory of Capital Asset Pricing." *Journal of Economic Theory.* Vol. 13. No. 3, pp. 341-360.

Samuelson, P. (1965). "Proof That Property Anticipated Prices Fluctuate Randomly." *Industrial Management Review.* Spring 6, pp. 41-49.

Sariannidis, N., G. Giannarakis, N. Litinas & G. Konteos (2010). "A GARCH Examination of Macroeconomic Effects on U.S. Stock Market: A Distinction Between the Total Market Index and the Sustainability Index." *European Research Studies.* Vol. 13. No. 1, pp. 129-142.

Sharpe, W. F. (1964). "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk." *Journal of Finance.* Vol. 19. No. 3, pp. 425-442.

Singh, M., A. Nejadmalayerib & B. Lucey (2013). "Do U.S. Macroeconomic Surprises Influence Equity Returns? An Exploratory Analysis of Developed Economies." *The Quarterly Review of Economics and Finance.* Vol. 53. No. 4, pp. 476-485.

Vrugt, E. B. (2009). "U.S. and Japanese Macroeconomic News And Stock

Market Volatility in Asia-Pacific Pacific-Basin." *Finance Journal.* Vol. 17, pp. 611-627.

Wongbangpo, P. & S. C. Sharma (2002). "Stock Market and Macroeconomic Fundamental Dynamic Interactions: ASEAN-5 Countries." *Journal of Asian Economics.* Vol. 13, pp. 27-51.

Wongswan, J. (2006). "Transmission of Information Across International Equity Markets." *Review of Financial Studies.* Vol. 19. No. 4, pp. 1157-1189.

| **논문투고일** : 2015년 11월 10일 |
| **논문심사일** : 2015년 11월 28일 |
| **게재확정일** : 2015년 11월 30일 |

국문초록
아태연구 제22권 4호 (2015)

미국 거시경제 정보가 세계 주식시장 수익률에 미치는 영향에 관한 연구:
아태지역 국가의 사례 연구

윤일현
(동서대학교 경영학부)

본 연구는 세계 경제의 글로벌화 시대에 미국의 거시경제 정보가 외국의 주식시장에 미치는 영향력에 관하여 분석하고 있다. 분석을 위해 소비자물가지수, 산업생산성지수, 실업수당신청건수, 비농업고용지수, 10년 만기 재무성증권만기수익률, 실업률, 무역가중 달러화지수 및 일본엔화의 환율 등의 거시경제지표를 사용하였다. 이들 거시경제변수의 움직임이 아태지역국가의 주식시장 수익률에 어떤 영향을 미치는가를 살펴보기 위하여 1997년 7월부터 2015년 9월까지의 월간 시계열자료를 사용하여 GARCH 모형추정을 하였다. 분석결과, 분석대상의 모든 주식시장은 수익률이 미국의 몇몇 거시경제지표에 의하여 영향을 받고 있으며, 달러지수와 엔화의 환율이 가장 광범위한 영향을 미치고 있으며, 변동성 전이효과에 관해서는 미국의 소비자물가지수의 변동성이 아태지역의 주식시장의 변동성에 영향을 미치는 것으로 나타났다.

▪ 주제어: GARCH 모형, 거시경제지표, 단위근, 아태지역, 주식수익률