



The Study of the Spillover, Asymmetric-Volatility and Leverage Effects of Financial Exchange Traded Funds

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Abstract

The purpose of this research is to study of the spillover, asymmetric-volatility and leverage effects of financial exchange traded funds. This paper used the Generalized Autoregressive Conditional Heteroskedasticity-in-Mean-Autoregressive Moving Average (GARCH-M-ARMA) and the Exponentially Generalized Autoregressive Conditional Heteroskedasticity-in-Mean-Autoregressive Moving Average (EGARCH-M-ARMA) models. This research found that have two way relationship and unilateral for financial and non financial ETFs. Both ETFs have negative asymmetric volatility, the value of stock index and ETFs Converge. All financial and non financial ETFs have negative leverage effect against benchmark indexes. There are bilateral connections in terms of the spillover of returns from volatilities and leverage effects between financial and non-financial ETFs.

Keywords: *Spillover Effect, Asymmetric-Volatility, Leverage Effect, Financial ETFs*

I. INTRODUCTION

ETFs track an index, a commodity or a basket of assets like an index fund, while they trade like a stock on the stock exchange. ETFs experience price changes throughout the daily transaction. Unlike index funds, which are priced once after the end of each trading session, ETF prices change throughout the day because they're traded like shares. ETFs have lower fees than actively managed mutual funds and offer investors a wide range of sectors, geographies and strategies. This paper focuses on financial ETFs for the equities market, because there has been a little empirical research under as much scrutiny or controversy lately as the financial industry (Kennedy, 2012). From the current U.S. economy to foreign markets as well, financial giants have been hit hardly by foreclosure crises. For investor they must identify opportunity or risk and that's where financial ETFs can help. Finance ETFs can help investor to exposure whether it is an investor's strategy and to short the sector, hedge risk, cut losses, or look for upside



opportunity. Financial ETF can give these investors the associated advantages (including tax benefits) and make these investors to experience easier trading with less transactions and lower brokerage costs.

The purpose of this study is to contribute to the literature which will be dealing with financial and non financial ETFs categories based on returns and volatilities of their underlying stock indices. Financial ETFs include two U.S. financial ETFs and five international financial ETFs from Brazil, China, Canada, Europe, and emerging market. The aims of this are to implement the GARCH-M-ARMA and the EGARCH-M-ARMA models to examine the unilateral and bilateral effects caused by lagged ETF returns on stock index returns and vice versa. Asymmetric-volatility effects of ETFs against the stock indices being tracked are also highlighted.

The previous research found that it has a strong positive (negative) influence of lagged leverage (inverse leveraged) ETF returns on current stock index returns. Lagged stock index returns have negative (positive) effect on leveraged (inverse leveraged) ETF returns as a result of the addition (reduction) of total return swaps exposure. A negative bilateral relationship is evident in the spillover effects of returns. The new evidence found that return spillovers and asymmetric volatility creates bi-directional volatility feedback effect for cases in Canada and U.S. Industry ETFs (Krause and Tse, 2013). With GARMA-M-ARMA and EGARCH-M-ARMA models, the authors examined whether there are existing bilateral influences and asymmetric volatility effect of return and volatility transmissions between stock index and ETF returns for financial and non financial ETFs. This research finding could contribute to strengthening the investing strategies of fund managers, and give suggestion for better portfolio decision.

II. LITERATURE REVIEW

The global investment has witnessed an explosion of ETFs. Gao (2001) found that the key attributes are the diversification, convenience, simplicity, cost-effectiveness, transparency, flexibility, tax-efficiency, and diversity. ETFs, which are one set of instruments stands out as offering investors diverse and flexible options to invest in international equity markets (Schoenfeld, 2001). In the implementation of exposure to various asset classes, ETFs provide insights into the current use of liquid index trackers (Noël, 2009). Deborah (2009) examined rankings of ETF providers, index performance, industry growth, and applications.

Using EGARCH-M-ARMA, Chen and Diaz (2012) found that there is a strong positive (negative) influence of lagged leveraged (inversed leverage) ETFs return on

current stock index returns. With the same model, Chen and Huang (2010) examined the impact of the spillover and the leverage effects on returns and volatilities of stock index and ETFs for developed and emerging market. The result shows that the spillover effects of returns are excellent for Hong Kong, followed by Singapore. The study shows that spillover effects on stock index and ETF volatilities existed with bilateral influences. The study of Chen (2010) applied leverage effect of Ethical ETFs based on GARCH-ARMA and EGARCH ARMA models. The results found that there are no differences in terms of the spillover of returns from volatilities and leverage effects between ethical and non-ethical ETFs against benchmark indexes.

III. DATA AND METHODOLOGY

This paper used daily closing prices of financial ETFs with their underlying stock indices obtained from the Yahoo Finance website. The study period begins with varying ETFs inception dates until 12th of May 2012. The chosen, ETFs are limited only for financial ETFs from Broad Financial List, especially the insurance and financial service, from Brazil, China, Emerging Market, Canada, Europe, and USA. For comparative financial industry, this paper chosen from non financial ETFs, like industrial sector, consumer industrial, and material ETFs, form the same country. For benchmark Stock Indexes, NYSE Composite Index, S&PTX Composite Index Toronto, and NASDAQ Composite are included.

This study estimates the spillover and the leverage effects of ETFs and stock index returns and their volatilities. Returns are measured as the logarithm of relatives. For ETFs, difference between the logarithms of net assets value (NAV) at time $t-1$. For Stock index the difference between the logarithm of the index (I) at time t and logarithm of the index at time $t-1$. As stated at below equation:

$$R_{m,t} = \ln\left(\frac{I_t}{I_{t-1}}\right) * 100 \quad , \quad (1)$$

$$R_{i,t} = \ln\left(\frac{NAV_{i,t}}{NAV_{i,t-1}}\right) * 100 \quad , \quad (2)$$

where $R_{m,t}$ and $R_{i,t}$ represent the stock index returns and financial or non financial ETFs return.

To capture asymmetric volatility or leverage effect that released the non-negativity constraints in the linear GARCH model, this article also adopts the EGARCH model proposed by Nelson (1991) combined with ARMA specification for stock index and ETF returns. Specifically, each component of the mixture of both the GARCH (p, q)-ARMA (g, s) and EGARCH (p, q)-ARMA(g, s) models are shown as follows (Niarchos et al., 1999; Huang and Yang, 2002; Xu and Fung, 2005).

The spillover and leverage effects are illustrated as follows:

$$R_{i,t}^e = \alpha_0 + \sum_{i=1}^g \alpha_i R_{i,t-i}^e + w R_{i,t-1}^m + \varepsilon_{i,t}^e + \sum_{i=1}^s \theta_i \varepsilon_{i,t-i}^e + z \sqrt{h_{i,t}^e}, \quad (3)$$

$$\log(h_{i,t}^{e^2}) = a_0 + \sum_{i=1}^q \left(a_i \left| \frac{\varepsilon_{i,t-i}^e}{h_{i,t-i}^e} \right| + \delta_i \frac{\varepsilon_{i,t-i}^e}{h_{i,t-i}^e} \right) + \sum_{i=1}^p \psi_i \log(h_{i,t-i}^{e^2}) + v \varepsilon_{i,t-1}^{m^2}, \text{ for EGARCH M} \quad (4)$$

$$\varepsilon_{i,t}^e \mid \psi_{t-1} \sim N(0, h_{i,t}^e),$$

$$R_{i,t}^m = \beta_0 + \sum_{i=1}^g \beta_i R_{i,t-i}^m + d R_{i,t-1}^e + \varepsilon_{i,t}^m + \sum_{i=1}^s \gamma_i \varepsilon_{i,t-i}^m + k \sqrt{h_{i,t}^m}, \quad (5)$$

$$\log(h_{i,t}^{m^2}) = b_0 + \sum_{i=1}^q \left(b_i \left| \frac{\varepsilon_{i,t-i}^m}{h_{i,t-i}^m} \right| + \delta_i \frac{\varepsilon_{i,t-i}^m}{h_{i,t-i}^m} \right) + \sum_{i=1}^p \zeta_i \cdot \log(h_{i,t-i}^{m^2}) + l \varepsilon_{i,t-1}^{e^2}, \text{ for EGARCH M}, \quad (6)$$

$$\varepsilon_{i,t}^m \mid \psi_{t-1} \sim N(0, h_{i,t}^m),$$

where $R_{i,t}^e$, $R_{i,t}^m$ present financial (or non financial) ETFs returns at the period t; $h_{i,t}^{e^2}$ is conditional variance; $\sum_{i=1}^g \alpha_i R_{i,t-i}^e$ is the higher order of the autoregressive AR (g) for ETF returns. $\varepsilon_{i,t}^e$ stand for ETFs returns residual at the period t, while $\sum_{i=1}^s \theta_i \varepsilon_{i,t-i}^e$ is the higher order of the autoregressive MA(s) for ETF returns at the period t. $\sum_{i=1}^p \psi_i h_{i,t-i}^{e^2}$ is the p order conditional heteroskedasticity of GARCH term for ETF returns at the period t; $\sum_{i=1}^q a_i \varepsilon_{i,t-i}^e$ is

the q order of the ARCH term ETF returns at the period t ; δ_i is the leverage term; $t-1$ is all information set at period $t-1$; and θ_i is for unknown parameter. $\sum_{i=1}^p \psi_i \log(h_{i,t-i}^e)$ is the ETF returns associated with p order of conditional heteroscedasticity of GARCH term, at period t ; $\sum_{i=1}^p \zeta_i \cdot \log(h_{i,t-i}^m)$ is the stock index returns associated with p order of conditional heteroscedasticity of GARCH term, at period t ; $\sum_{i=1}^q \left(a_i \left| \frac{\varepsilon_{i,t-i}^e}{h_{i,t-i}^e} \right| + \delta_i \frac{\varepsilon_{i,t-i}^e}{h_{i,t-i}^e} \right)$ is the ETF returns associated with q order of conditional heteroscedasticity of ARCH term; $\sum_{i=1}^q \left(b_i \left| \frac{\varepsilon_{i,t-i}^m}{h_{i,t-i}^m} \right| + \delta_i \frac{\varepsilon_{i,t-i}^m}{h_{i,t-i}^m} \right)$ is the stock index returns associated with q order of conditional heteroscedasticity of ARCH term,. This investigation utilized the null hypothesis H_0 which states that the sequence has no spillover effects of volatility ($v=0$; $l=0$) against alternative hypothesis H_1 which states that the sequence has the spillover effects of volatility ($v \neq 0$; $l \neq 0$). If v is significantly higher than zero, it shows that the lagged stock index residual affects ETFs volatility. If l is significantly unequal to zero, it reveals that the lagged ETFs residual will influence stock index volatility. This article takes into account possible volatility spillover effects to shed light on cross-market dynamics for stock index and ETFs returns.

Thus, this study can identify the unilateral effects of lagged ETF returns on stock index returns, and vice versa, or the bilateral-return influence and asymmetric-volatility effects between the Financial ETFs and the stock indices being tracked. For the SD, risk and return relationships are denoted by the z and k coefficients, respectively, having positive relationship, which is in accordance with other previous studies that used the GARCH-M model (Chou, 1987, French, et al, 1987)..

This study used the null hypothesis H_0 which states that the sequence has no spillover effects of returns ($w = 0$; $d = 0$) against the alternative hypothesis H_1 which states that the sequence has the spillover effect of returns ($w \neq 0$; $d \neq 0$). Note that w and d assess the spillover effect from ETFs and stock index returns. If w is significantly different from zero, it shows that the lagged stock index returns affect ETF. If d is significantly unequal to zero, it indicates that the lagged ETFs returns affect the stock index returns. Using GARCH models that incorporate the possibility of spillover effects enables us to better understand whether ETFs returns and stock index returns in different markets are interdependent or whether they respond to domestic market shocks.

IV. GENERAL RESULT



Table 1 showed that the average returns for majority of the samples are positive, except BRAF, CHIX, and EUFN. For non financial ETFs, only CHII has negative average return. Both positive average returns indicated that financial and non financial ETFs have a good chance for investment. Moreover, standard deviations for both financial ETFs and non financial ETFs are relatively small. Both financial ETFs and non financial ETFs have negative skewness which means that the future data will be less than mean and for benchmark stock indexes it having a negative skewness.

The results kurtosis for both financial ETFs and non financial ETFs are leptokurtic. Investors who wish to avoid large and erratic swings in portfolio returns may structure their investments to produce a leptokurtic distribution. All Jarque-Bera statistics are significant for all samples showing that the assumption of normal distribution of the residual cannot be accepted.

Table 2 indicated that the results for ADF are all significant, showing that the observed time series for ETFs returns and stock indexes returns were stationary. This paper uses the minimum AIC for getting the best model from ARMA, GARCH, and EGARCH (Engle and Ng, 1991). Tests for serial correlation by applying the Breusch-Godfrey LM test have shown that the null hypothesis cannot be rejected for all of ETFs and stock Index returns, meaning no serial correlation. The use of The ARCH-LM test illustrated that the null hypothesis of no ARCH effect for all sample can be rejected. The results of the ARCH-LM test again show that the GARCH-ARMA and EGARCH-ARMA models have capability to eliminate ARCH errors in the residuals.

Table 1. The Sample Size and Period of financial and non financial ETFs and Stock Indexes

ETFs	Market	Index	Code	Type	Periode	Obs	Mean	SD	Skewness	Kurtosis	Jarque-Bera
Financial ETFs	BRAZIL	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2010/7/29- 2012/5/12	374	0.0007	0.0131	-0.5923	7.2367	301.5824***
		Global X Brazil Financials ETF (BRAJ)-NYSEArca	BRAF	ETF			-0.0002	0.0216	0.0622	6.9395	242.0859***
	CHINA	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2010/1/22- 2012/5/12	571	0.0002	0.0134	-0.3386	5.9442	217.1393***
		Global X China Financials ETF (CHIX)-NYSEArca	CHIX	ETF			-0.0001	0.0201	0.1976	6.7599	340.0556***
	EMERGING	S&PTX Composite index (Interi (^GSPTSE)Toronto	GSP	Stock	2001/3/30- 2012/5/12	2631	0.0003	0.0122	-0.4045	11.8979	8750.979***
		iShares S&PTX Capped Financials Index (XFN.TO)-Toronto	XFN	ETF			0.0003	0.0131	0.1799	13.1212	11244.05***
	CANADA	NASDAQ Composite (^IXIC)-Nasdaq	NAS	Stock	2010/2/11- 2012/5/12	421	0.0005	0.0141	-0.3373	6.0328	169.3353***
		iShares MSCI Emerg Mkts Financials Idx (EMFN)-NasdaqGM	EMFN	ETF			0.0002	0.0216	-0.1041	4.3703	33.69612***
	EUROPE	NASDAQ Composite (^IXIC)-Nasdaq	NAS	Stock	2010/2/3-2012/5/12	527	0.0005	0.0139	-0.3042	5.6715	164.8449***
		iShares MSCI Europe Financials Index (EUFN)-NasdaqGM	EUFN	ETF			-0.0004	0.0252	0.0922	5.3941	126.6089***
	USA	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2006/5/5-2012/5/12	1487	0.0001	0.0166	-0.1193	10.2111	3225.343***
		iShares Dow Jones US Insurance (IAK)-NYSEArca	IAK	ETF			0.0000	0.0232	0.2912	11.4268	4420.762***
Non Financial ETFs	BRAZIL	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2010/8/7-2012/5/12	457	0.0003	0.0131	-0.4561	6.4399	241.1686***
		Global X Brazil Consumer ETF (BRAQ)-NYSEArca	BRAQ	ETF			0.0004	0.0180	-0.3936	4.4738	53.16176***
	CHINA	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2009/12/1- 2012/5/12	587	0.0004	0.0132	-0.3669	6.1032	248.7059***
		Global X China Industrials ETF (CHII)-NYSEArca	CHII	ETF			-0.0005	0.0213	0.1621	5.2831	130.0615***
	CANADA	S&PTX Composite index (Interi (^GSPTSE)Toronto	GSP	Stock	2005/12/28- 2012/5/12	1554	0.0001	0.0141	-0.3906	10.5334	3714.202***
		iShares S&PTX Capped Materials Index (XMA.TO)-Toronto	XMA	ETF			0.0005	0.0229	0.0640	10.4114	3557.667***
	EMERGING	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2009/6/2-2012/5/12	724	0.0005	0.0132	-0.3673	5.5336	209.9230***
		EGShares Emerging Markets MetalsMining (EMT)-NYSEArca	EMT	ETF			0.0001	0.0217	-0.1739	4.5263	73.92136***
	EUROPE	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2005/3/10- 2012/5/12	1793	0.0001	0.0154	-0.1286	11.5443	5458.998***
		Vanguard MSCI Europe ETF (VGK)-NYSEArca	VGK	ETF			0.0001	0.0190	-0.0640	9.3334	2997.918***
	USA	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	2000/7/14- 2012/5/12	2909	0.0001	0.0138	-0.0876	11.7002	9178.403***
		iShares Dow Jones US Industrial (IYJ)-NYSEArca	IYJ	ETF			0.0002	0.0154	-0.1567	7.2521	2203.371***
	USA	NYSE COMPOSITE INDEX (NEW METHO (^NYA)-NYSE	NYA	Stock	1998/12/22- 2012/5/12	3322	0.0002	0.0134	-0.0867	11.5870	10210.57***
		Industrial Select Sector SPDR (XLI)-NYSEArca	XLI	ETF			0.0002	0.0148	-0.0665	7.6938	3052.015***

Source: Yahoo Finance, various years, Finance.yahoo.com

Table 2. Summary statistics of Unit Root, of financial and non financial ETFs and Stock Indexes

ETFs	Market	Code	Type	ADF	ARMA	AIC	LM	ARCH-LM	GARCH	AIC	ARMA-LM	EGARCH	AIC	ARCH-LM
Financial ETFs	BRAZIL	NYA	Stock	-18.52947***	(3,3)	-5.85103	0.392378	88.42099***	(3,1)	-6.14351	0.721793	(2,1)	-6.18656	2.233857
		BRAF	ETF	-18.2365***	(1,2)	-4.83276	0.271766	10.02258***	(2,1)	-5.05595	0.745138	(2,2)	-5.05176	0.587294
	CHINA	NYA	Stock	-25.47335***	(1,1)	-5.787	3.492346	48.64357***	(3,3)	-6.06384	1.135995	(2,2)	-6.11212	0.442331
		CHIX	ETF	-22.80675***	(2,2)	-4.98769	1.809881	35.31964***	(3,2)	-5.19963	2.24449	(3,2)	-5.22231	1.939162
	CANADA	GSP	Stock	-52.78048***	(2,2)	-5.98993	0.609496	425.3316***	(3,3)	-6.46349	0.602996	(1,3)	-6.48245	0.390255
		XFN	ETF	-38.42727***	(1,2)	-5.82943	2.324613	328.1506***	(2,3)	-6.4347	0.330587	(2,1)	-6.44335	2.392271
	EMERGING	NAS	Stock	-21.48991***	(0,3)	-5.68905	0.280867	67.76544***	(3,2)	-5.97187	0.721957	(1,2)	-6.02137	1.024274
		EMFN	ETF	-21.78522***	(1,1)	-4.83096	0.24668	9.535063***	(3,2)	-4.9287	0.809598	(3,0)	-4.98157	0.619439
	EUROPE	NAS	Stock	-23.18567***	(3,3)	-5.7267	2.282274	67.566***	(3,3)	-5.969	0.688401	(3,3)	-6.04875	0.37422
		EUFN	ETF	-23.24754***	(3,0)	-4.53337	0.732424	29.7358***	(3,3)	-4.6916	0.709845	(2,3)	-4.72582	3.771284
	USA	NYA	Stock	-30.85679***	(3,3)	-5.37634	1.748621	296.6376***	(3,2)	-5.92272	1.406844	(3,3)	-5.96547	0.648446
		IAK	ETF	-42.23498***	(1,1)	-4.69421	0.125665	294.3146***	(1,3)	-5.503	0.234532	(3,2)	-5.52589	0.369259
	USA	NYA	Stock	-42.20152***	(3,3)	-5.75704	1.629325	569.9392***	(3,2)	-6.27823	0.585653	(2,3)	-6.31303	0.104483
		IYG	ETF	-59.03104***	(3,2)	-4.79147	4.761163	336.8734***	(3,3)	-5.57392	0.299306	(3,3)	-5.60106	5.240743
Non Financial ETFs	BRAZIL	NYA	Stock	-23.01554***	(3,3)	-5.853	1.273048	49.73634***	(2,3)	-6.11722	1.677443	(2,2)	-6.17557	0.018237
		BRAQ	ETF	-20.20459***	(2,2)	-5.22877	0.706158	42.92104***	(1,1)	-5.35986	2.601781	(1,3)	-5.38868	0.104729
	CHINA	NYA	Stock	-25.70534***	(2,2)	-5.8219	1.260128	51.54688***	(1,2)	-6.08075	0.522611	(2,3)	-6.14378	0.930775
		CHII	ETF	-22.10892***	(2,2)	-4.87467	3.706748	51.54042***	(2,2)	-5.0861	2.064972	(1,1)	-5.08448	2.305538
	CANADA	GSP	Stock	-41.77709***	(3,3)	-5.68918	0.303054	235.6174***	(3,1)	-6.18378	1.157064	(2,2)	-6.20851	1.06806
		XMA	ETF	-39.93016***	(3,3)	-4.72068	1.831338	99.48559***	(3,3)	-5.06539	0.684703	(1,1)	-5.08043	1.032161
	EMERGING	NYA	Stock	-28.06256***	(3,3)	-5.81764	0.022082	71.56236***	(3,3)	-6.04486	2.101293	(2,2)	-6.08588	0.964887
		EMT	ETF	-25.06849***	(2,2)	-4.84192	0.261437	26.12898***	(1,3)	-4.93944	0.253758	(1,2)	-4.96603	2.901401
	EUROPE	NYA	Stock	-33.81221***	(3,3)	-5.53294	1.503028	355.307***	(1,3)	-6.13594	0.390621	(2,3)	-6.17935	0.451548
		VGK	ETF	-47.9706***	(3,3)	-5.10999	2.245145	290.7812***	(2,2)	-5.57214	0.084768	(1,2)	-5.5889	0.486516
	USA	NYA	Stock	-41.91756***	(3,3)	-5.74249	1.619961	564.3177***	(1,2)	-6.25997	0.722239	(3,3)	-6.29658	0.188596
		IYJ	ETF	-56.39291***	(3,3)	-5.52221	1.096556	297.3291***	(1,2)	-5.93099	1.039519	(3,3)	-5.96546	2.447795
	USA	NYA	Stock	-44.92324***	(3,3)	-5.79756	0.503587	610.1103***	(3,2)	-6.25816	0.128789	(1,2)	-6.29287	0.493061
		XLI	ETF	-58.98298***	(2,1)	-5.58413	0.125382	359.8646***	(1,3)	-5.92905	0.091648	(1,2)	-5.95687	0.615964

Note: ADF is the t-statistic for the Augmented Dickey-Fuller test with a constant and trend at the level. LM is Breusch-Godfrey serial correlation test and we use Lag (4) to be the best lag periode. AIC is Akaike Info Criterion. *, **, and *** denote significance at 10%, 5%, and 1% or less, respectively. The *p*-Values are shown in brackets.

Table 3. Spillover effects of return and volatilities for stock and ETF returns

ETFs & Indices	Code	Spillover Effects of Returns	Spillover Effects of Volatilities	Risk	Leverage Effect
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		EGARCH -M-ARMA		EGARCH -M-ARMA		EGARCH -M-ARMA		EGARCH ARMA	
		Stock	ETF	Stock	ETF	Stock	ETF	Stock	ETF
		d	w	l	v	k	z	δ	δ
		1	2	3	4	5	6	7	8
Financial ETFs	BRAF/NYA	-0.0292 0.2528	-0.1227 0.2600	17.1671 0.0732*	297.4769 0.0008***	0.2062 0.0046***	0.1305 0.3708	-0.2534 0.0000***	-0.0634 0.0206**
	CHIX/NYA	0.0409 0.0711*	-0.0291 0.6595	149.4629 0.1580	84.5085 0.0988*	-0.0627 0.5626	0.0634 0.6906	-0.3058 0.0000***	-0.0685 0.0002***
	XFN/GSP	-0.0117 0.5722	0.1425 0.1775	49.9493 0.0021**	33.9985 0.0117**	-0.0630 0.2482	-0.0668 0.1425	-0.0977 0.0000***	-0.0844 0.0000***
	EMFN/NAS	0.0631 0.051**	0.0486 0.5388	99.7996 0.3320	91.1683 0.0155**	-0.2471 0.0412***	1.3321 0.003***	-0.1980 0.0000***	-0.2094 0.0000***
	EUFN/NAS	0.0263 0.2342	-0.1277 0.0714*	78.4270 0.1517	103.9032 0.1687	0.1957 0.3707	-0.17186 0.1432	-0.3562 0.0000***	-0.0550 0.0317**
	IAK/NYA	-0.0325 0.2259	0.0145 0.7281	-47.5472 0.0005***	2.2577 0.9063	-0.0569 0.3296	-0.0574 0.2225	-0.2363 0.0000***	-0.1509 0.0000***
	IYG/NYA	-0.0358 0.0037***	0.0048 0.9054	38.1808 0.0135**	-0.4723 0.9709	-0.0621 0.1681	-0.0568 0.0011***	-0.1605 0.0000***	-0.1505 0.0000***
Non Financial ETFs	BRAQ/NYA	0.0591 0.0149**	-0.2136 0.0198**	279.6760 0.0116**	106.6712 0.1599	-0.0645 0.5750	-0.1575 0.4083	-0.2871 0.0000***	-0.0867 0.0008***
	CHII/NYA	0.0530 0.0238**	-0.0539 0.5256	122.5610 0.2679	51.1103 0.4375	-0.0755 0.4839	0.0440 0.7805	-0.3265 0.0000***	-0.0947 0.0001***
	XMA/GSP	0.0085 0.5735	0.0267 0.5946	62.5759 0.004***	82.7419 0.0000***	0.0730 0.3615	0.1084 0.1951	-0.0958 0.0000***	-0.0843 0.0000***
	EMT/NYA	0.0538 0.047**	-0.0305 0.6914	141.6400 0.1567	31.8580 0.1441	0.0307 0.7674	0.7755 0.0000***	-0.3183 0.0000***	-0.1451 0.0000***
	VGK/NYA	0.0465 0.1978	-0.0984 0.1576	33.3022 0.0803*	24.4141 0.0156**	-0.0630 0.2210	-0.2064 0.0000***	-0.1865 0.0000***	-0.1100 0.0000***
	IYJ/NYA	-0.0220 0.1505	0.0189 0.6282	-42.0896 0.0016***	23.1923 0.0911*	-0.0717 0.0935*	-0.0037 0.9338	-0.1618 0.0000***	-0.5280 0.082*
	XLI/NYA	0.0284 0.1815	0.0030 0.9280	32.7370 0.0038***	17.6898 0.051*	-0.0269 0.5490	-0.0303 0.4652	-0.1235 0.0000***	-0.0913 0.0000***

Note: *, **, and *** are significance at 10%, 5%, 1% levels, respectively. The p-Values are shown in brackets.

Table 4. GARCH-M-ARMA of financial and non financial ETFs return

ETFs	Code	Model	Mean Equation							Conditional Variance Equation						
				α_0	α_1	α_2	α_3	θ_1	θ_2	θ_3	a0	a1	a2	a3	ψ_1	ψ_2
Financial ETFs	BRAF	GARCH (2,1) ARMA (1,2)		-0.0036 0.2542	-0.7759 0.4884			0.8340 0.4551	0.0547 0.4031		0.0000 0.056*	-0.0050 0.9166	0.8562 0.0000***		0.1204 0.0000***	
	CHIX	GARCH(3,2) ARMA (2,2)		-0.0012 0.6386	-0.8549 0.0000***	-0.9607 0.0000***		0.8902 0.0000***	0.9895 0.0000***		0.0000 0.0384**	1.3090 0.0000***	-1.2758 0.0000***	0.8492 0.0000***	0.0832 0.0006***	0.0163 0.5428
	XFN	GARCH (2,3) ARMA (1,2)		0.0006 0.1937	0.7845 0.0000***			-0.7523 0.0000***	-0.0708 0.0023***		0.0000 0.0003***	1.7427 0.0000***	-0.7524 0.0000***		0.1092 0.0000***	-0.0917 0.0356**
	EMFN	GARCH (3,2) ARMA (1,1)		-0.0046 0.0548*	-0.2637 0.4305			0.1486 0.6691			0.0000 0.1387	0.2651 0.0000***	-0.3543 0.0000***	0.9420 0.0000***	0.0896 0.0000***	0.0351 0.0686*
	EUFN	GARCH (3,3) ARMA (3,0)		0.0017 0.5347	0.0083 0.8324	-0.0649 0.1438	-0.0627 0.1373				0.0000 0.0063***	-0.5938 0.0000***	0.7594 0.0000***	0.5071 0.0000***	-0.0191 0.4638	0.0837 0.0006**
	IAK	GARCH (1,3) ARMA (1,1)		0.0004 0.5353	0.7427 0.0000***			-0.8017 0.0000***			0.0000 0.0001***	0.1518 0.0000***	-0.0755 0.007***	0.8926 0.0000***	0.0293 0.1174	
	IYG	GARCH (3,3) ARMA (3,2)		-0.0001 0.8496	0.2828 0.7149	0.4210 0.4716	-0.0030 0.9009	-0.3385 0.6620	-0.4324 0.4938		0.0000 0.0249**	1.2979 0.0000***	0.0559 0.8046	-0.3641 0.0013***	0.0268 0.0561*	0.1342 0.0000**
	BRAQ	GARCH (1,1) ARMA (2,2)		0.0011 0.7440	-1.6811 0.0000***	-0.9369 0.0000***		1.7250 0.0000***	0.9869 0.0000***		0.0000 0.0309**		0.8755 0.0000***		0.0961 0.0000***	
	CHII	GARCH (2,2) ARMA (2,2)		-0.0026 0.3431	-1.1512 0.0000***	-0.5832 0.0237**		1.2288 0.0000***	0.6490 0.0067***		0.0000 0.0129**	0.2845 0.4843	0.5313 0.1542		0.0276 0.3955	0.1184 0.0017**
	XMA	GARCH (3,3) ARMA (3,3)		-0.0004 0.8007	1.8661 0.0000***	-1.5823 0.0000***	0.6504 0.0000***	-1.8656 0.0000***	1.5762 0.0000***	-0.6676 0.0000***	0.0000 0.0000***	1.3936 0.0000***	-1.3734 0.0000***	0.8595 0.0000***	0.0495 0.0013***	-0.0306 0.0921*
	EMT	GARCH (1,3) ARMA (2,2)		-0.0048 0.1256	0.0242 0.8719	0.7629 0.0000***		0.0280 0.8481	-0.8197 0.0000***		0.0000 0.092*	0.9438 0.0000***			-0.0302 0.0702*	0.2063 0.0000**
	VGK	GARCH (2,2) ARMA (3,3)		0.0005 0.5287	1.3070 0.0000***	-0.1737 0.5624	-0.2508 0.1158	-1.4160 0.0000***	0.3082 0.3246	0.1996 0.2420	0.0000 0.0000***	0.5458 0.0066***	0.3089 0.0986*		-0.0077 0.6498	0.1416 0.0000**
	IYJ	GARCH (1,2) ARMA (3,3)		0.0001 0.8633	-1.1812 0.0002***	-1.2809 0.0000***	-0.4814 0.1070	1.1681 0.0003***	1.2596 0.0000***	0.4582 0.1267	0.0000 0.0000***	0.8906 0.0000***			0.0091 0.5319	0.0910 0.0000**
	XLI	GARCH (1,3) ARMA (2,1)		-0.0001 0.9036	-0.2767 0.5029	-0.0395 0.0413**		0.2597 0.5295			0.0000 0.0000***	0.9153 0.0000***			0.0485 0.0004***	0.0982 0.0000**

Note:*, **, and *** are significance at 10%, 5%, 1% levels, respectively. The p-Values are shown in brackets.

Table 5. GARCH-M-ARMA of financial and non financial Stock index return

ETFs	STOCK	Model	Mean Equation							Conditional Variance Equation						
			β_0	β_1	β_2	β_3	γ_1	γ_2	γ_3	b0	b1	b2	b3	ζ_1	ζ_2	ζ_3
Financial ETFs	NYA/BRAF	GARCH (3,1)	0.0034 0.0047***	-0.5791 0.0000***	-0.7557 0.0000***	-0.7296 0.0000***	0.6488 0.0000***	0.7824 0.0000***	0.8806 0.0000***	0.0000 0.0014***	1.7104 0.0000***	-1.6905 0.0000***	0.8700 0.0000***	0.0699 0.0000***		
	NYA/CHIX	GARCH (3,3)	0.0011 0.3989	0.8048 0.0000***	-0.8628 0.0000***					0.0000 0.0152**	-0.6251 0.0000***	0.5694 0.0000***	0.5443 0.0000***	-0.0259 0.2986	0.2314 0.0000***	0.2624 0.0000***
	GSP/XFN	GARCH (3,3)	0.0005 0.2886	-1.1776 0.0000***	-0.8125 0.0000***		1.2053 0.0000***	0.8420 0.0000***		0.0000 0.0001***	0.5176 0.0000***	-0.6253 0.0000***	0.8631 0.0000***	0.0755 0.0000***	0.0474 0.0000***	0.0891 0.0000***
	NAS/EMFN	GARCH (3,2)	0.0015 0.3277				-0.0123 0.8031	-0.0364 0.5246	-0.0340 0.5403	0.0000 0.0072***	1.0276 0.0001***	-0.6743 0.0254**	0.3984 0.0015***	0.0037 0.9310	0.1971 0.0012***	
	NAS/EUFN	GARCH (3,3)	0.0040 0.0424**	-0.0553 0.0045***	0.0686 0.0001***	0.9149 0.0000***	0.0487 0.0000***	-0.0449 0.0000***	-0.9909 0.0000***	0.0000*** 0.7997	0.4903 0.9019	0.1050 0.9550	0.1792 0.9229	0.0965 0.0114**	0.0792 0.8403	0.0108 0.9771
	NYA/IAK	GARCH (3,2)	0.0008 0.2733	-0.0367 0.9748	0.0427 0.9351	0.0399 0.9364	-0.0427 0.9707	-0.0943 0.8611	-0.0775 0.8898	0.0000 0.0000***	0.5667 0.0001***	0.2088 0.2083	0.0463 0.7337	-0.0253 0.0000***	0.1876 0.0000***	
	NYA/IYG	GARCH (3,2)	0.0004 0.3526	0.3437 0.7030	0.2374 0.8324	0.1250 0.7746	-0.3907 0.6649	-0.2521 0.8283	-0.1182 0.7973	0.0000 0.0000***	0.7797 0.0000***	0.1456 0.5170	-0.0637 0.6120	-0.0204 0.0401**	0.1415 0.0000***	
Non Financial ETFs	NYA/BRAQ	GARCH (2,3)	0.0008 0.5885	-0.7150 0.0000***	0.3131 0.1821	0.7594 0.0000***	0.6786 0.0000***	-0.3758 0.0600	-0.8509 0.0000***	0.0000 0.1263	0.3223 0.3619	0.4510 0.0997*		0.0132 0.6962	0.2261 0.0000***	-0.0458 0.6788
	NYACHII	GARCH (1,2)	0.0013 0.3717	0.0414 0.8899	0.7463 0.001***		-0.0926 0.7613	-0.7571 0.002***		0.0000 0.0028***	0.7960 0.0000***			-0.0545 0.0087***	0.2292 0.0000***	
	GSP/XMA	GARCH (3,1)	-0.0004 0.6539	0.1722 0.8341	0.4826 0.2436	0.1147 0.8241	-0.1800 0.8260	-0.5134 0.2249	-0.1497 0.7814	0.0000 0.0138**	2.0214 0.0000***	-1.4316 0.0276**	0.3713 0.1901	0.0322 0.0084***		
	NYA/EMT	GARCH (3,3)	0.0008 0.4816	-0.0573 0.4863	-0.1690 0.0258**	0.8552 0.0000***	0.0163 0.8167	0.1431 0.0247**	-0.9024 0.0000***	0.0000 0.0062***	-0.6049 0.0000***	0.4597 0.0000***	0.6208 0.0000***	-0.0070 0.7257	0.2656 0.0000***	0.2180 0.0000***
	NYA/VGK	GARCH (1,3)	0.0010 0.0606*	0.0382 0.9624	0.1672 0.7685	0.3580 0.3096	-0.1050 0.8970	-0.2115 0.7292	-0.3883 0.2951	0.0000 0.0000***	0.8465 0.0000***			-0.0214 0.0000***	0.1717 0.0000***	-0.0111 0.7063
	NYA/IYJ	GARCH (1,2)	-0.0006 0.1620	-0.7117 0.0000***	-0.2277 0.1423	0.4584 0.0000***	0.6475 0.0000***	0.1742 0.2320	-0.5057 0.0000***	0.0000 0.0000***	0.8641 0.0000***			-0.0229 0.0000***	0.1334 0.0000***	
	NYA/XLI	GARCH (3,2)	0.0000 0.9197	0.0360 0.7281	-0.3456 0.0000***	0.7469 0.0000***	-0.0596 0.5360	0.2973 0.0000***	-0.7789 0.0000***	0.0000 0.0000***	1.3295 0.0000***	-1.0825 0.0000***	0.6275 0.0000***	0.0366 0.0001***	0.0743 0.0000***	

Note: *, **, and *** are significance at 10%, 5%, 1% levels, respectively. The p-Values are shown in brackets.

The leverage effect is verified through EGARCH-ARMA estimations, by checking significant autocorrelation and by examining the volatility of stock index and ETFs returns revealing conditional heteroskedasticity (Chen and Diaz, 2010). Consistent with Chen (2004), Balaban (2005), Li (2007), and Chen and Huang (2010), the results of EGARCH-ARMA for leverage effect (δ) indicated that all ETFs (financial and non financial ETFs) and stock indexes returns are all significant as showed in Table 3. All ETFs have negative asymmetric volatility effects, while two financial instruments were converged in their values.

The empirical result of EGARCH-M-ARMA for ETFs Risk (z) showed that based on ARCH-M the expected risk and return on ETF are positive for EMFN and EMT which are negative related for IYG and VGK. The result for the expected risk and return for stock indexes risk (k) related to the expected risk and return of stock index are positive for BRAF/NYA and negative for EMFN/NAS and IYJ/NYA. For spillover effect of return (w) related to lagged stock index returns has a negative effect of the financial ETFs for EUFN and non financial ETFs for BRAQ. According to EGARCH-M-ARMA, for spillover effect of returns (d) has positive effect on returns of stock index for CHIX/NYA, EMFN/NAS, BRAQ/NYA, CHII/NYA and EMT/NYA, and has negative effects on returns of stock index for IYG/NYA. Note that spillover effects of volatilities with EGARCH-M-ARMA (l, v) showing that there are six ETFs and stock indexes which have positive effects for lagged stock index volatility on the volatility of the ETFs and vice versa. There are bilateral connection such as BRAF/NYA, XFN/GSP, XMA/GSP, VGK/NYA, IYJ/NYA, and XLI/NYA. This paper found that lagged stock index volatility for EMFN/NYA and CHIX/NYA has positive effect on the ETF. Meanwhile, lagged ETF volatility for IYG/NYA and BRAQ/NYA have positive effect on the volatility of stock index, while lagged ETF volatility for IAK/NYA has negative effect on the volatility of stock index. The lagged stock index volatility for CHIX and EMFN has significant and positive effect on the volatilities of the ETFs.

Tables 4 and 5 showed that the results of GARCH-M-ARMA model examined the stable convergence of GARCH. The sums of all coefficient α_i , ψ_i , β_i and ζ_i are constrained to equal one or less, consistent with the result of Baillie and DeGennaro (1990). The most of estimated value ψ_i and ζ_i are unequal with α_i and β_i for volatility financial and non financial ETFs, this suggesting evidence of the existence of the volatility clustering phenomenon as shown at Figure 1. The empirical evidences show that the previous unexpected return (θ_i) for XFN and IAK have significant and greater negative impact on Financial ETFs return comparing to those of non financial returns for XMA and VGK presented in Table 4. In the mean equation (ζ_i) at Table 5 showing that there is a



significantly positive effect on stock index returns associated with financial ETFs for GSP/XFN and NAS/EUFN and for non financial ETFs NYA/BRAQ and NYA/IYJ.

V. CONCLUSIONS

This research documents the results of the GARCH-M-ARMA and EGARCH-M-ARMA models to analyze the spillover of returns and volatilities and the leverage effects of financial and non financial ETFs.

Finding showed that there is the bilateral connection financial and non financial ETFs affecting benchmarked indexes. At the same time we found a strong positive spillover effect of volatilities ETFs to stock for non financial, but some have negative effect of stock to non financial ETFs. We also found that the Spillover effects of return ETFs have positive effect to stock index. Testing with EGARCH-ARMA all ETFs (financial and non financial ETFs) and Stock Indexes return all significant have strong negative for leverage effect (δ).

The most important in this study is that, it can help fund manager and investor to make better strategies for portfolio investment especially for financial ETFs from international finance market.

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