WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Impact of Stock Index Futures Trading on Spot Price Volatility: Evidence from Mature and Emerging Markets

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ABSTRACT :

This study evaluates how spot price volatility affects the trading of stock index futures in developed and developing markets. Using a comprehensive dataset obtained from four countries, namely Japan and the US (mature markets) and Mexico and South Korea (emerging markets), we explore the links between futures trading and spot market volatility. A range of econometric techniques, including the usage of a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, are used to model volatility in financial time-series data. Careful unit root analysis is also employed in the study to assess stationarity in the time series data. Our findings provide valuable information to investors and market regulators and aid in the clarification of how derivative products operate in the financial markets.

Keywords: GARCH model, futures trading, volatility of spot prices, established markets, developing markets, futures of stock indices, unit root analysis.

1.Introduction:

The topic of this study is the effect of futures trading on the volatility of spot prices in developed and developing markets. For many years, there has been a heated argument about whether futures trading makes spot prices more stable or less stable. Futures trading may help to stabilize spot prices, according to some studies, while others claim that it actually increases price volatility.

The research reviewed in this paper examines a number of studies that offer contradictory results about the link between futures trading and market volatility. For instance, some research suggest that futures trading raises volatility before or after specific events, while others claim it lowers volatility. Depending on the particular market and circumstances, the effect of futures trading on spot price volatility seems to change over time.

In order to add to the ongoing discussion, this study will look at how futures trading affects spot price volatility in both developed and developing markets. The researchers want to know if futures trading stabilizes or destabilizes spot prices and if there are any differences between the two kinds of markets.

The relationship between spot price volatility and stock index futures trading will be examined in the study using sophisticated econometric approaches. Policymakers, investors, and regulators will benefit from this study's findings since they can offer information about market stability, risk management, and financial regulation. Making informed decisions in both developed and developing economies requires an understanding of how futures trading affects spot price volatility.

2. REVIEW OF LITERATURE :

Kalantzis and Milonas (2017) investigated the impact of futures trading on spot price volatility in the spot electricity market in France and Germany and found that spot price volatility had decreased. In their 2017 study, Gao and Sun saw a decrease in stock market volatility in China following the introduction of index futures.

Chou et al. (2017) investigated the market liquidity and volatility of the Taiwan Index Futures Market and found a significant influence. Kumar (2017) investigated and concluded that futures trading has a positive impact on spot market volatility in Indian commodities derivatives markets.

Chetchatree (2019) discovered a positive association between futures trading activity and index price volatility in the research of the SET50 index future. Li and Wang (2019) looked at the relationship between daily institutional transactions and stock price volatility in a developing market dominated by individual investors and found a significant positive influence.

3. DATA METHODOLOGY:

The section provides the data and econometric analysis used to determine the outcomes.

3.1. Data Description:

To display the stock of each country independently, this study primarily takes into account indexes for Mexico, South Korea, and South Korea as Emerging Markets and Japan, the US, and Mature Markets. The cash market's daily closing prices are sourced from yahoo finance. The entire sample is separated into two primary sections: pre year data and post year data, which are used to examine the volatility in returns and market efficiency for each country. The description of the data period is shown in the table.

TABLE: Listing Dates of Future Indices

Country (underlying index)	Pre-data period	Introduction date of index Future	Post-data period	Whole period
Japan(Nikkei 225)- mature market	1984-1986	Sep 1986	1986-1990	1984-1990
US(Nasdaq)- mature Market	1997-1999	June 1999	1999-2003	1997-2003
Mexico (IPC Mexico)- emerging market	2015-2017	June 2017	2017-2020	2015-2020
South Korea (KS11) - emerging market	2005-2007	April 2007	2007-2010	2005-2010

Data Preprocessing: To manage any missing values, outliers, and other data concerns, the acquired data will be cleaned and preprocessed. Before beginning the GARCH analysis, it is crucial to make sure the data is accurate and consistent.

3.2 METHODOLOGY:

This comparative study aims to assess how spot price volatility affects the trading of stock index futures in both developed and developing markets. Information on trade volumes, open interest, daily closing prices of stock index futures, and financial databases like Yahoo Finance will be gathered from secondary sources. The data will be individually investigated for each market using GARCH models appropriate for financial time series data, unit root analysis, and descriptive statistics.

4. Result and Discussion:

TABLE 2: Results of the ADF test for the daily returns of Emerging and Mature market

UNIT ROOT ANALYSIS									
SL. NO	Stocks	Period	ADF	Tau			phi		
			T-Statistic	1%	5%	10%	1%	5%	10%
1	Nikkei225 (Japan)	Pre	-8.2209	-3.43	-2.86	-2.57	6.43	4.59	3.78
		Post	-11.3162	-3.43	-2.86	-2.57	6.43	4.59	3.78
2	Nasdaq (US)	Pre	-0.7948	-3.44	-2.87	-2.57	6.47	4.61	3.79
		Post	-0.9558	-3.43	-2.86	-2.57	6.43	4.59	3.78
3	IPC Mexico	Pre	-1.8126	-3.43	-2.86	-2.57	6.43	4.59	3.78
		Post	-1.2873	-3.43	-2.86	-2.57	6.43	4.59	3.78
4	KSII (South-Korea)	Pre	-7.9835	-3.44	-2.87	-2.57	6.47	4.61	3.79
		Post	-6.6299	-3.43	-2.86	-2.57	6.43	4.59	3.78

Descriptive statistics: include mean, median, standard deviation, minimum, maximum, skewness, and ADF test statistics that are significantly negative.

Investors and decision-makers should carefully assess the ramifications of these findings. Forecasting future stock price movements is challenging because the presence of unit roots and non-stationarity in stock market indices suggests that prices may be influenced by long-term trends and may not revert to their mean over time. and Kurtosis will be calculated to offer an overview of the data and to discover any early patterns or trends.

TABLE 3: Descriptive Analysis of Mature and Emerging Markets Pre and Post data

Index	Period	Mean	Median	Min	Max	Std.Dev	Skewness	Kurtosis
Nikkie 225	Pre	12583	12642.9	9703.35	18936.24	3467.72	-1.61	8.24
	Post	26319.3	27412.3	15819.55	38915.87	8498.89	-1.48	5.71
Nasdaq	Pre	1883.42	1785.64	1419.12	2652.05	330.045	0.84	2.41
	Post	2407.78	2034.84	1114.11	5048.62	998.829	0.72	2.33
IPC Mexico	Pre	45328.4	45316	32964.22	51713.38	3567.97	-0.76	3.85
	Post	45114.3	44956.7	32964.22	51713.38	4234.52	-0.63	2.94
KS11	Pre	1286.19	1333.18	970.88	1470.03	182.497	-4.01	27.49
	Post	1565.44	1623.06	938.75	2064.85	297.579	-1.83	9.81

Table 3 compares the performance of the Nikkei 225, Nasdaq, IPC Mexico, and KS11 stock market indexes in developed and emerging markets before and after a specific time period. Their mean, median, lowest and highest values, as well as their standard deviation, skewness, and kurtosis, are displayed. In comparison to the pre-period, the indices had higher mean values, broader ranges, and higher volatility in the post-period. Certain indices showed less severe skewness and kurtosis in the post-period.

The Nikkei 225 index had a higher mean and median, as well as a wider range and increased volatility, in the post-period. Its distribution was negatively skewed at both times, however the kurtosis was lower in the post-period, indicating fewer outliers.

In the post-period, the Nasdaq index had higher mean and median values, a far broader range, and more volatility. The distributions of both eras were positively skewed, while the post-period's kurtosis was slightly smaller.

In the post-period, the Nikkei 225 index had a larger range, a higher mean and median, and more volatility. Despite the fact that the post-period's

Kurtosis was lower and would have indicated fewer outliers in both times, but its distribution was negatively skewed.

The Nasdaq index had greater mean and median values, a significantly wider range, and more volatility in the post-period. Although the post-period's kurtosis was slightly lower, both periods' distributions were positively skewed.

The IPC Mexico index has a comparable mean and median with a fairly limited range in both pre- and post-periods. In the post-period, the distribution remained negatively skewed but with substantially less skewness, and volatility increased. Kurtosis decreased, indicating a distribution with fewer outliers.

The KS11 index had a higher mean and median in the post-period, as well as a broader range and greater volatility. It featured an unusually long tail, a severely skewed distribution, and multiple outliers in both time periods. Even if the kurtosis was decreasing in the post-period, it remained quite high.

GARCH Analysis: It is usual to compare volatility levels before and after the introduction of stock index futures to examine the influence of futures introduction on volatility. Previous research has frequently used the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model for assessing stock market data. The GARCH model allows for exact volatility specification as well as controls for other factors that can influence volatility.

The following is the key hypothesis in this study:

H0: The volatility of the stock index has changed after the introduction of index futures.

H1: Volatility has not changed with the introduction of index futures.

Garch's Model: t = + t1 + t12 where:

σt is the volatility at time t α is the constant term

β is the autoregressive coefficient

γ is the conditional variance coefficient

TABLE 4: Spot Volatility of Pre-Mature & Emerging Markets by using GARCH Model

Index	Spot Volatility	Constant(c)	RESID(-1)^2	GARCH(-1)	Z-statistic	Probability
Nikkie 225	0.884379	0.000821	0.183957	0.699601	3.141	0.0017
Nasdaq	0.968063	0.001752	0.303309	0.663002	3.062	0.0022
IPC Mexico	0.696361	0.000021	0.143724	0.552616	2.114	0.0345
KSll	0.937678	0.001281	0.101737	0.83466	2.736	0.0062

TABLE 5: Spot Volatility of Post Mature & Emerging Markets by using GARCH Model

Index	Spot Volatility	Constant(c)	RESID(-1)^2	GARCH(-1)	Z-statistic	Probability
Nikkie 225	0.953809	0.001245	0.434611	0.517953	5.032	0.00
Nasdaq	0.981469	0.000769	0.082504	0.898196	4.524	0.00
IPC Mexico	0.976311	0.000042	0.194471	0.781798	8.016	0.00
KSll	0.984755	0.000838	0.101099	0.882818	7.153	0.00

The spot volatility of the Nikkei 225, which stands in for Japan in the mature market sector, was 0.884379 before the introduction of index futures and 0.953809 after. According to this, there is moderate to significant market volatility in the established Japanese market. The increase in spot volatility after the introduction of index futures indicates that market volatility increased, presumably as a result of increased trading activity and changes to the market's characteristics.

The spot volatility on the Nasdaq, which reflects the US market, was 0.968063 before the introduction of index futures; afterward, it was 0.981469. These figures demonstrate the relatively high level of volatility seen in the developed US market. Following the introduction, there was a little increase in spot volatility, which is likely due to a number of factors that are specific to the established US market.

Prior to the introduction of index futures, the IPC Mexico displayed spot volatility of 0.696361, while after the inclusion in the developing market category, it displayed spot volatility of 0.976311. This shows that since index futures were introduced in the expanding Mexican market, volatility has greatly increased. The higher spot volatility, which index futures use to impact trade dynamics and market participation,

Last but not least, the spot volatility of the KS11, which stands in for the South Korean market, was 0.937678 before the introduction of index futures and 0.984755 after. These figures indicate a moderate to high level of market volatility in the emerging South Korean economy. As indicated by the increase in spot volatility after the introduction, the market may have grown more volatile as a result of features particular to the context of emerging markets. According to the spot volatility research, there are varying degrees of volatility in both developed and developing markets. Because of their innate volatility and trading dynamics, mature markets like the Nasdaq and Nikkei 225 exhibit spot volatility that is noticeably higher than other markets. While less extreme, spot volatility is nevertheless prevalent in South Korea's KS11 and Mexico's IPC Mexico developing markets. Spot volatility and its levels appear to have increased dramatically after index futures were introduced in these emerging economies.

5. CONCLUSION:

A GARCH model was used in the study to analyze how spot price volatility affected the trading of stock index futures in Japan, the US, Mexico, and South Korea. Both developed and emerging market volatility are affected differently by the introduction of index futures.

based on the findings. One of the practical repercussions is that market participants and regulators must adapt their risk management and decision-making processes to account for greater volatility. Future studies should look at long-term effects, market dynamics, and the influence of stock index futures on other market components in order to properly understand the role of financial derivatives in markets.

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